Way (a Class III bikeway) intersects with Sand Hill Road, Stanford is planning to construct a direct extension to Welch Road (with bicycle lanes), providing an important connection from Menlo Park over San Francisquito Creek into campus. This connection will greatly reduce travel times and increase legibility for pedestrians and bicyclists who are currently forced out of direction toward Pasteur Drive and/or Vineyard Lane. Community feedback and field inspection also indicate the need for better bike lane and shared use pathway connections where the Sand Hill Road trail intersects with El Camino Real, the Caltrain tracks, and Alma Street toward Palo Alto Avenue and downtown.

Future Durand Way road and bicycle lane connector at Sand Hill Road. *Pedestrians and bicyclists crossing over San Francisquito Creek into Palo Alto will have a much more direct and legible connection into campus when Durand Way and Welch Road are connected at Sand Hill Road as part of the improvement plans for the Stanford Medical Center expansion.*

Recommended Treatments and Locations

- Across Barrier Connections
  - California Avenue Caltrain undercrossing: Redesign to provide ADA access and a separated bicycle connection.
- Trails
  - Jogging path along Stanford Avenue: Connect and complete the path in front of Escondido School to enhance the Bay to Ridge Trail.

- **Churchill Road Sidepath/Embarcadero Trail Extension**: Link the Embarcadero Path and Churchill Mall Path in the Stanford athletic fields via a widened sidewalk and reconfigured El Camino Real intersection.

- **Bike Lane/Sharrow Roadway Striping**
  - El Camino Real: Provide intersection through-markings (sharrows) across all bikeway connections.
  - Palo Alto Medical Foundation campus: Provide wayfinding and sharrow markings from the Homer Avenue undercrossing, with potential Stanford University connections along El Camino Real to Galvez Road and along the existing low-volume Lasuen Street into the heart of campus.
  - Sand Hill Road: Replace deteriorated bike lane markings with enhanced bikeway treatments, including signal actuation.

- **Bicycle Boulevards**
  - Park Boulevard: Sign and mark bicycle boulevard from Churchill Street to Lambert Avenue because major traffic calming treatments are already in place and pursue additional improvements south as future phase projects.
  - Matadero Avenue: Pursue focused traffic calming treatments at Josina Avenue and Laguna Avenue and sign/mark bicycle boulevard.

- **Intersection Spot Improvements**
  - Palo Alto High to the Castilleja-Park Bicycle Boulevard: Improve the unsignalized crossing at Churchill and connection to the Caltrain bike path along Embarcadero Road.

- **Pedestrian Improvements**
  - El Camino Real: Improve and widen sidewalks along El Camino Real in conjunction with ongoing construction and maintenance activities. Provide pedestrian crossing improvements as the area densifies over time, including bus stop and sidewalk upgrades by California Avenue (a top pedestrian collision location) as part of the El Camino BRT project.

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Chapter 7 Implementation and Funding

This Plan outlines a set of programmatic and infrastructure improvements that will encourage walking and bicycling for everyday trips in Palo Alto. This chapter addresses how the City can implement the proposed projects, from guidelines for designing high-quality pedestrian and bicycle infrastructure, to prioritizing projects to identify the order in which the City should pursue implementation. This chapter also identifies hoe Palo Alto has traditionally funded pedestrian and bicycle improvements and proposes a strategy for identifying money for future implementation.

7.1 Design Guidelines

Appendix A: Design Guidelines presents innovative bicycle and pedestrian facilities that can complement existing standards and guidelines. Despite the experimental nature of some of the recommended treatments, all include U.S. examples and many have been adopted by the National Association of City Transportation Officials (NACTO). The design guidelines are intended to be a toolkit that allows the City flexibility for implementing all future projects. It incorporates the latest thinking from NACTO (which has been endorsed by the FHWA) and reflects recent State policies such as Complete Streets.

7.2 Project Prioritization

This section summarizes the process and criteria used to prioritize and strategically rank bicycle and pedestrian recommendations in the *Bicycle and Pedestrian Transportation Plan* (BPTP).

7.2.1 2003 Bicycle Transportation Plan Criteria and Rankings

Three criteria used to prioritize projects are essentially carried over from the 2003 Bicycle Transportation Plan, which helps promote continuity between planning processes and highlight many of the previously identified priority projects not yet implemented. These criteria are safety, connectivity, and a "special" category that denotes previous commitments and/or public support. While similar, each has been updated and/or simplified from the 2003 Plan to reflect new conditions, available data, and revised public input from the project planning process.

Safety

High: Project location has a significant crash history AND is located on the identified School Commute Corridors Network

Medium: Project has a significant crash history, OR is located on the identified School Commute Corridors Network, OR addresses common safety concerns identified through the Plan development process

Low: Project addresses a perceived or low risk safety concern identified by the community

Connectivity

High: Project closes a gap between two Class I trail segments OR creates a new significant new connection to an activity center or across a major circulation barrier such as a freeway, creek, or arterial intersection

Medium: Project closes a gap between two on-street bikeways OR extends a Class I trail segment OR enhances an existing arterial crossing or access to an activity center

Low: Project improves circulation within the existing bikeway network or extends an on-street bikeway without addressing barriers or providing new activity center connections

Special

This criterion refers to special circumstances – such as current/past planning and funding commitments and/or public support identified through the plan outreach process – that contribute to the project's status as a high priority. Scoring range is based on a qualitative assessment of these factors.

7.2.2 Five I's Evaluation Framework

In addition to the three criteria above, the priority project list was developed and further refined according to the 'Five I's' strategic evaluation framework established in **Chapter 2** of this Plan and promoted throughout the planning process. Unless otherwise noted, each project has been given a High, Medium or Low 'score', and its rank has been adjusted based on a qualitative assessment of the following criteria. It should be noted that not all 'I's are given equal weight in developing and ranking projects, and that in some cases (particularly with Innovation) the criteria are most valuable as guiding principles during design and implementation, not to select projects.

Integration

This criterion rates the potential to integrate the project with another identified city priority or project, and/or incorporate integrated design features to achieve multiple benefits and reduced waste/public impacts.

Inclusion

This criterion asks, "How important is the project for attracting "interested but concerned" bicycle riders and/or improving universal accessibility for vulnerable users and people with disabilities?"

Innovation

This criterion notes the project's dependence on, and/or potential incorporation of, innovative design features to overcome barriers to implementation. This criterion generally does not influence the project ranking, but is included to help identify where innovative projects may require additional education and outreach to build public support or ensure proper usage of the facility. *Note: Due to the impracticality of determining levels of innovation for each project at this stage, this category simply denotes the potential absence or presence of innovative features and is given a "Yes or "No" score.*

Investment

This criterion reflects the expected benefit-to-cost ratio in general terms, including the project's potential competitiveness for outside grant funding.

Institutional Partnerships

This criterion identifies the project's potential and/or need for mutual coordination and cost sharing between various agencies, jurisdictions, and private/public partnerships. *Note: A "high" score in this category denotes the potential for improved feasibility (due to cost sharing), but it also indicates an increased project risk associated with garnering widespread support or approvals.*

7.2.3 Project Categories

To identify priorities among similar projects, project recommendations for the BPTP are organized into nine distinct categories:

- Across Barrier Connections
- Trails
- Bike Lane/Sharrow Roadway Striping
- Bicycle Boulevards
- Intersection Spot Improvements
- Programmatic (Infrastructure)
- System Rehabilitation/ Maintenance
- Design, Feasibility, and Planning
- Non-Infrastructure (Education, Encouragement)

The high priority projects, and perhaps the overall system and segments themselves, may change over time because of changing bicycling and walking patterns, land use patterns, implementation constraints and opportunities, and the development of other transportation system facilities. The City of Palo Alto should review the project list and project ranking at regular intervals to ensure it reflects the most current priorities, needs, and opportunities for implementing the bicycle network in a logical and efficient manner.

Table 7-1 shows the results of this prioritization and includes a project description and list of related projects. Planning level cost estimates are also provided, which include previous cost estimates (where available), new estimates based on high-level cost assumptions (excludes right-of-way, design and staff time), and programmatic funding recommendations for annual and one-time expenditures.

Table 7-1. Top Recommended Projects by Category

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
Across Barrier Connections		
ABC-1	**Adobe Creek Highway 101 Overcrossing**	**$5-9 million**
Project Description:	Construct year-round pedestrian and bicycle overpass of Highway 101 between Adobe Creek/Bay Trail/Baylands Nature Preserve and W. Bayshore Rd near the existing Benjamin Lefkowitz seasonal undercrossing.	
Related Projects/Plans:	Adobe Creek Reach Trail; Fabian Way Enhanced Bikeway; Embarcadero Rd Highway 101 Overpass Access Improvements; Sterling Canal Trail; Barron Creek connector; *Comprehensive Plan Transportation Element* Goals T-1 and T-3, Land Use & Design Element Policy L-42, and Community Services Element Goal C-5	
Rankings:	Safety: *Medium* / Connectivity: *High* / Special: *High* Integration: *High* / Inclusion: *High* / Innovation: *Yes* Investment: *Medium* / Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
ABC-2	Caltrain/Alma Barrier Crossing at Matadero Creek	$5 million

Project Description: Construct a grade-separated pedestrian and bicycle crossing of Caltrain/Alma Street in the vicinity of Matadero Creek/Park Boulevard or between Margarita and Loma Verde Avenues. This project closes a 1.3 mile gap between existing crossings at California Avenue and Meadow Street, greatly improving east-west connectivity in conjunction with other improvements.

Related Projects/Plans: Matadero Creek Trail Feasibility Study; Matadero/Margarita Bicycle Boulevard; Bol Park Pathway Improvements, El Camino Real spot improvements

Rankings:

Safety: *Medium*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *No*
Investment: *Medium/Low*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
ABC-3	Palo Alto Transit Center/University Avenue Undercrossings	$2-5 million

Project Description: Widen and improve the existing sidewalk undercrossings along University Avenue at the Palo Alto Transit Center. This project will improve bicycle and pedestrian access to transit and between downtown Palo Alto and Stanford University's main entrance, and should include lighting, wayfinding and public art enhancements.

Related Projects/Plans: Alma Street Enhanced Bikeway; University Avenue and High Street spot improvement; downtown shared bikeways; proposed Safe Routes to Transit and VTA/Caltrain Public Bicycle Share programs

Rankings:

Safety: *Medium*	Connectivity: *High*	Special: *High*
Integration: *Medium*	Inclusion: *Medium*	Innovation: *No*
Investment: *Medium/High*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
ABC-4	California Avenue Caltrain/Alma Undercrossing	$2-5 million

Project Description: Modify or reconstruct the California Avenue Caltrain/Alma Street undercrossing to improve access and reduce user conflicts. At minimum this project should provide rampways that meet pedestrian accessibility best practices. Pending additional feasibility analysis and budget, other project goals include a widened tunnel with separate pathways for pedestrians and bicyclists and better integration with improved on-street bikeways.

Related Projects/Plans: California Avenue Enhanced Bikeway, Castilleja-Park-Wilkie Bicycle Boulevard; California Avenue Streetscape Improvements; VTA/Caltrain Public Bicycle Share program; Alma St/Oregon Expressway bridge replacement (future County project)

Rankings:

Safety: *Medium*	Connectivity: *Medium*	Special: *Medium*
Integration: *High*	Inclusion: *High*	Innovation: *No*
Investment: *Medium*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
ABC-5	Matadero Creek / Highway 101 Seasonal Undercrossing	$1.1 million

Project Description: Upgrade the existing Santa Clara Valley Water District (SCVWD) maintenance road underneath Highway 101 to a Class I trail facility. This project would improve east-west mobility across a major barrier (Highway 101) and connect to an existing trail/fire road within the Baylands Nature Preserve, although it may require development of additional Class I trail segments to the west along Matadero Creek before it is warranted. Similar to the existing Benjamin Lefkowitz undercrossing at Adobe Creek, this crossing would be subject to seasonal flooding and closed approximately six months of the year in the winter season.

Related Projects/Plans: Matadero Creek Trail & Feasibility Study; Amarillo-Moreno Bicycle Boulevard; Sterling Canal Trail

Rankings:

Safety: *Medium/Low*	Connectivity: *High*	Special: *Medium*
Integration: *High*	Inclusion: *High*	Innovation: *No*
Investment: *Medium*	Institutional Partnerships: *Medium/High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
ABC-6	Newell Road Bridge Crossing at San Francisquito Creek	$500,000

Project Description: Provide enhanced (dedicated) bicycle and pedestrian facilities and planning as part of the Newell Road Bridge replacement project, an identified high priority for the City due to the bridge's "obsolete" classification by Caltrans. Funding represents a planning-level estimate of non-motorized enhancements over-and-above what would be minimally required.

Related Projects/Plans: Newell Road Bridge Replacement Project (Public Works); Newell Road Enhanced Bikeway; East Palo Alto Highway 101 Barrier Crossing

Rankings:

Safety: *Low*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *Medium*	Innovation: *No*
Investment: *High/Medium*	Institutional Partnerships: Medium	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
ABC-7	Middlefield Road Undercrossing at San Francisquito Creek	$1 million

Project Description: Construct year-round pedestrian or share-use pathway under Middlefield Road along San Francisquito Creek as part of a multi-jurisdictional creek trail development effort.

Related Projects/Plans: San Franciquito Creek Joint Powers Authority Creek Trail Project; future replacement of the Middlefield Road/San Francisquito bridge crossing

Rankings:

Safety: *Low*	Connectivity: *High*	Special: *Medium*
Integration: *High*	Inclusion: *High*	Innovation: *Varies*
Investment: *Medium/Low*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE

Trails and Shared Use Pathways

TR-1 Embarcadero Road / Rinconada Park Sidepath — $200,000

Project Description: Widen existing sidewalk between Middlefield Road and Newell Road along the north side of Embarcadero Road to provide a Class I path to/from Rinconada Park and Walter Hays Elementary School. This off-street "sidepath" would close an important gap between the Churchill/Coleridge Avenue, Rinconada Park, and Newell Road bikeways and improve the School Commute Corridor Network without significant impact to traffic operations along Embarcadero Road.

Related Projects/Plans: Newell Road Enhanced Bikeway; Coleridge/Churchill Avenue Enhanced Bikeway; Safe Routes to School; Rinconada Park Improvements

Rankings:

Safety: *High/Medium*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *High*	

TR-2 Adobe Creek Reach Trail — $100,000

Project Description: Upgrade the existing Santa Clara Valley Water District (SCVWD) maintenance road to a Class I trail facility from W. Bayshore Road at Adobe Creek to E. Meadow Drive. This trail would help connect the existing Benjamin Lefkowitz underpass and future potential overcrossing.

Related Projects/Plans: **Adobe Creek/Highway 101 Overcrossing; Meadow Drive Enhanced Bikeway; ; Sterling Canal Trail; Fabian Way Enhanced Bikeway**

Rankings:

Safety: *Medium/Low*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *No*
Investment: *High/Medium*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
TR-3	Existing Trail Access Improvements	$500,000

Project Description: Enhance on-street intersections along the existing trail network and key existing bridge/overpass approaches to improve ADA access, bikeway connectivity, and convenience for all users.

Priority upgrades include: modifying or replacing substandard safety corrals with bollards and associated striping/signage; installing accessible curb ramps and re-grading poor transitions; pedestrian-scaled lighting; installing high visibility crosswalks at key locations; and landscaping maintenance/removal. Priority locations include, but are not limited to, the following:

- Bol Park Path at Matadero Avenue
- Highway 101/Embarcadero Road overcross approaches
- Gunn HS path at Georgia Avenue, Miranda Avenue/Arastradero Road
- Adobe Creek Highway101 underpass approaches at W. Bayshore Road
- Matadero Creek ped/bike bridge along the Bryant Street Bike Boulevard
- Adobe Creek ped/bike bridge approaches at Duncan Place and Creekside Drive
-Benjamin Lefkowitz underpass lighting improvements

Related Projects/Plans: Adobe Creek/Highway 101 Overcrossing; Meadow Drive Enhanced Bikeway; Fabian Way Enhanced Bikeway

Rankings:

Safety: *Varies*	Connectivity: High	Special: *High*
Integration: *Medium*	Inclusion: *High*	Innovation: *No*
Investment: *High/Medium*	Institutional Partnerships: *Low*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
TR-4	Bol Park / Gunn HS / Los Altos Path Lighting & Upgrades	$550,000

Project Description: Install pathway or pedestrian-scaled lighting in conjunction with trail maintenance and access upgrades along this popular school commute trail to improve early morning and evening visibility and safety. As part of this project, explore ADA access improvements to the existing VA Medical Center "back connection" to provide an attractive bypass of the steep bicycle lanes on Hillview Street for the outer Stanford Research Park area, and a sidepath along Arastradero Road between Foothill Expressway and the existing pedestrian crossing at the Gunn High School entrance.

Related Projects/Plans: Existing Trail Access Improvements; Safe Routes to School; Bol Park Path Research Park extension; Hetch Hetchy/Los Altos Path extension or Arastradero Road Sidepath; Arastradero Road Enhanced Bikeway

Rankings:

Safety: *Medium/High*	Connectivity: *Medium/High*	Special: *High*
Integration: *Medium*	Inclusion: *High*	Innovation: *No*
Investment: *Medium*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
TR-5	Churchill Road Sidepath/Embarcadero Trail Extension	$150,000

Project Description: Extend existing Class I trail (Caltrain path) along north side of Churchill Road to Stanford University trailhead at El Camino Real by widening existing sidewalk adjacent to Palo Alto High School and PAUSD office.

Related Projects/Plans: Castilleja-Park-Wilkie Bike Boulevard and intersection crossing improvement at Churchill Avenue; Southgate neighborhood priority paving (Public Works)

Rankings:

Safety: *High/Medium*	Connectivity: *High*	Special: *Medium*
Integration: *Medium*	Inclusion: *High*	Innovation: *Yes*
Investment: *High/Medium*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
TR-6	Geng Road and Embarcadero Road (Bay Trail) Maintenance	$100,000

Project Description: Repaving and upgrades to the Bay Trail segment along Geng Road, and potential upgrade/extension of existing pathway along Embarcadero Road adjacent to the Palo Alto Municipal Golf Course and Santa Clara County Airport.

Related Projects/Plans: Baylands Trail extension from E. Bayshore Road; Existing Trail Acccess Improvements; Baylands Athletic Center Improvements Project (Parks & Recreation)

Rankings:

Safety: *Low*	Connectivity: *Medium*	Special: *Medium/High*
Integration: *Medium/High*	Inclusion: *High*	Innovation: *No*
Investment: *High/Medium*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE

Bicycle Boulevards

BB-1 Castilleja-Park-Wilkie Bicycle Boulevard — $210,000

Project Description: Comprehensive improvements, including signage, striping, and capital spot improvements from Churchill Road past Charleston Road to the southern city limits at Del Medio Avenue. Provide wayfinding at jog along California Avenues. Cost estimate does not include repaving.

Related Projects/Plans: Churchill Road Sidepath and Enhanced Bikeway; Southgate Stormwater Improvements and Green Street (Public Works); Southgate Neighborhood Priority Paving (Public Works); California Avenue Streetscape Improvements; Safe Routes to School

Rankings:

Safety: *Medium/High*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium*	

BB-2 Matadero - Margarita Bicycle Boulevard — $290,000

Project Description: Corridor enhancements to consider include:
- Wayfinding signs and pavement markings
- Matadero Avenue chicanes with pass-through,
- ADA/safety upgrades at El Camino Real approach
- El Camino Real: crosswalk realignment, signal detection upgrades, potential center median refuge and partial traffic diversion at Margarita Avenue
- Consider traffic diversion at Margarita Avenue

Related Projects/Plans: Matadero Creek Caltrain/Alma Barrier Crossing; Matadero Creek Trail Feasibility Study; Castilleja-Park-Wilkie Bicycle Boulevard; Bol Park Path Lighting and Upgrades; Portage Avenue/Hansen Way Enhanced Bikeways; El Camino Real Bicycle Lanes Study and Intersection Through-Markings; Safe Routes to School

Rankings:

Safety: *Medium*	Connectivity: *High*	Special: *High*
Integration: *High/Medium*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium/High*	

BB-3 Bryant Street Bicycle Boulevard — $80,000

Project Description: Wayfinding signs and pavement markings south of Bryant Street. Spot improvements for additional safety and comfort, including Churchill/Coleridge Avenue spot improvement and arterial crossing enhancements at University Avenue, Meadow Drive (consider beacon or signal), Charleston Road, and San Antonio Road at Nita Drive into Mountain View.

Related Projects/Plans: Everett Avenue Bicycle Boulevard; Churchill/Coleridge Enhanced Bikeway, Charleston Road and Meadow Drive Enhanced Bikeways; Existing Trail Access Spot Improvements (Adobe Creek bridge); Safe Routes to School

Rankings:

Safety: *Medium/High*	Connectivity: *Medium*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High/Medium*	Institutional Partnerships: *Low*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
BB-4	Ross/Louis Road Bicycle Boulevard	$150,000

Project Description: Spot improvements throughout corridor, including wayfinding signs and pavement markings. Priority locations and treatments to consider include:
- Traffic circles at Moreno Avenue, Ames Road, and Mayview Avenue
- Chicanes with bicycle pass-through at Louis Road
- Revised center median at Charleston Road, Montrose Avenue/Middlefield Avenue at Cubberly Community Center entrance.

Cost estimate excludes committed funds for Oregon Expressway bicycle signal. Longer-term opportunities to explore with PAUSD include trail connections through the Cubberly campus to Nelson Drive and through the Jordan Middle School campus to Newell Road, although the latter connection presents significant barriers to implementation.

Related Projects/Plans: Newell Road Enhanced Bikeway; Amarillo/Moreno Bicycle Boulevard

Rankings:

Safety: *Medium*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *Medium/Low*	Institutional Partnerships: *High*	

BB-5	Webster Street Bicycle Boulevard	$190,000

Project Description: This project will further develop Webster Street into an attractive bike route (and alternative to Middlefield Road) for school-related travel and trips between north and south Palo Alto. Wayfinding signs and pavement markings should be placed along the corridor. Pending the results of a traffic warrant study and/or an Embarcadero Road corridor analysis, this project should include implementation of an actuated beacon crossing or bicycle priority signal at Embarcadero Road, which is currently unsignalized. Additional improvements may include stop sign reversals, traffic circles, and pavement resurfacing from Everett Avenue to N California Avenue (pavement improvements not included in cost estimate).

Related Projects/Plans: Embarcadero Road Class III Shared Arterial/Corridor Study; Safe Routes to School; Street Maintenance program (Public Works); Kingsley Avenue and Guinda-Chaucer Bicycle Boulevards

Rankings:

Safety: *High/Medium*	Connectivity: *High*	Special: *Medium*
Integration: *Medium*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Low*	

BB-6	Amarillo- Moreno Bicycle Boulevard	$70,000

Project Description: Wayfinding signs and pavement markings from Middlefield Road to West Bayshore Road. Consider offset intersection treatments such as signs and pavement markings to assist with wayfinding at Louis Road where the route jogs. Consider traffic circle at Ross Road (included in Ross cost estimate) and/or Greer Road.

Related Projects/Plans: Middlefield Road Bicycle Lanes (study); Ross Road and Greer Road Bicycle Boulevards; Safe Routes to School; Matadero Creek /101 Seasonal Undercrossing

Rankings:

Safety: *Medium*	Connectivity: *Medium/High*	Special: *Medium*
Integration: *Medium*	Inclusion: *High*	Innovation: *Yes*
Investment: *Medium/High*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE

Bike Lanes/Sharrows/Enhanced Bikeways

BK-1 Charleston/Arastradero Road Enhanced Bikeway — $1.5 million

Project Description: Phase 2 follow-up to the approved Charleston Road re-striping and pending trial study of Arastradero Road re-striping. Project to include: enhanced bike lane striping (green lanes, intersection through-markings, and bike boxes as appropriate); installation of permanent median islands; improved ped/bike crossings at key north-south bikeway connections; and select spot improvements (e.g., at El Camino Real and Middlefield Road).

Related Projects/Plans: Arastradero Road Trial Striping; Middlefield Road/Charleston Road Spot Improvement; Bol Park/Hetch Hetchy/Terman Park Path; numerous bicycle boulevards; Safe Routes to School; Fabian Way Enhanced Bikeway; City of Palo Alto 2012-2016 CIP

Rankings:

Safety: *High*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *Medium/High*	Institutional Partnerships: *Medium*	

BK-2 California Avenue Enhanced Bikeway — $200,000

Project Description: Potential cycletrack or enhanced striping and signage of existing substandard (time restricted) bike lanes, and enhanced signage and markings coordinated with the California Avenue streetscape improvements project, to improve safety and access to the business district, Caltrain, Jordan Middle School and Escondido/Nixon Elementary Schools; and to improve mobility and attractiveness along the Bay to Ridge Trail. Part of the "Civic Loop" urban trail concept.

Related Projects/Plans: California Avenue Streetscape Project; California Avenue Caltrain/Alma Barrier Connection Improvements; Castilleja-Park-Wilkie, Greer Road and Webster Street Bicycle Boulevards; Safe Routes to School; El Camino Real BRT and Intersection Through-Markings

Rankings:

Safety: *High*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *High*	

BK-3 Channing Avenue Enhanced Bikeway — $25,000

Project Description: Provide enhanced bicycle markings in the short term between Homer Avenue and Greer Road in conjunction with roadway resurfacing. Longer term, consider potential for separation of bicycles and automobile traffic through design of a two-way cycletrack facility that connects to the Newell Road and Channing/Homer Enhanced Bikeways as part of the "Civic Loop" concept that includes the existing Embarcadero/Caltrain trail, the Castilleja- Park-Wilkie Bicycle Boulevard, and the California Avenue Enhanced Bikeway.

Related Projects/Plans: Street Maintenance Program (Public Works); Enhanced Bikeway/Cycletrack Study; California Avenue, Channing/Homer Avenue, and Newell Road Enhanced Bikeways

Rankings:

Safety: *Medium*	Connectivity: *Medium/Low*	Special: *High*
Integration: *High*	Inclusion: *Medium*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
BK-4	Lytton Avenue / Alma Street / Sand Hill Road Enhanced Bikeway	$400,000

Project Description: Replacement of substandard bicycle lanes and incorporation of enhanced bicycle markings (super sharrows and lead-in bike lanes/boxes), pedestrian countdown displays, ADA curb ramps, and select curb extensions on Lytton Avenue as part of the upcoming repaving project. Enhance existing Class II bike lanes on Alma Street and Sand Hill Road; consider cycletrack or new Class I trail along the Caltrain/El Camino Park frontage as part of the park improvement project and Stanford Medical Center Expansion mitigation. This enhanced bikeway may be considered as an alternative to the Everett Avenue Across Barrier Connection concept identified in the 2003 *Bicycle Transportation Plan* and Stanford Medical Center Expansion EIS.

Related Projects/Plans: Street Maintenance Program (Public Works); Pedestrian Countdown Signals & Crossings Program; University Avenue Enhanced Bikeway; Everett Avenue Bicycle Boulevard; El Camino Park improvement project; Safe Routes to Transit Program

Rankings:

Safety: *Medium*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *Medium/High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
BK-5	Homer/Channing Avenue Enhanced Bikeway	$85,000

Project Description: Provide dedicated or enhanced shared bike facility(ies) from the Homer Avenue Underpass to Guinda Street in order to improve connections to the Homer Street underpass and develop the "Civic Loop" bikeways concept. At minimum, provide contra-flow bike lane on Homer Avenue from Alma to High Street, and convert High Street to two-way flow to Forest or Hamilton Avenue (for downtown access). East of Emerson Street this enhanced bikeway corridor can be established through shared lane markings and signage, conversion of a vehicle traffic lane into a Class II bicycle lane, or conversion of either Homer or Channing Avenue into a two-way cycletrack.

Related Projects/Plans: Channing/Newell Road Enhanced Bikeway; Emerson and Ramona Street Class III shared lane markings; Downtown and Professorville Parking Upgrades; private development at Alma Street/Homer Avenue; Enhanced Bikeway/Cycletrack Study

Rankings:

Safety: *Medium*	Connectivity: *High*	Special: *High*
Integration: *Low*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium/High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
BK-6	Citywide Sharrow Markings & Wayfinding Signage	$140,000

Project Description: Mark all existing and proposed Class III facilities that meet minimum pavement condition and placement standards with sharrows. Wayfinding signage improvements at strategic locations within the bikeway network, with emphasis on improving navigability of community centers, parks and school grounds and coordinated signage with adjacent jurisdictions.
As an interim measure, sign and mark appropriate segments of the future bicycle boulevard network streets (Map 6-2 on page 6-11) as Class III Bike Routes. Use California standard Bike Route signs (CAMUTCD Sign D11-1).

Related Projects/Plans: Citywide projects

Rankings:

Safety: *Varies*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *Medium*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
BK-7	Meadow St / El Camino Way / Los Robles Enhanced Bikeway	$300,000

Project Description: Potential cycletrack redesign or enhanced striping and signage of existing bike lanes between La Donna and Meadow Street along Los Robles/El Camino Way; Enhanced striping and signage, including intersection through-markings, for existing Meadow Street bike lanes from El Camino Way to Fabian Way.

Related Projects/Plans: Bay to Ridge Trail (revised additional alignment); Shared Lane Marking projects in the Barron Park neighborhood; Park -Wilkie, Maybell, and Ross/Louis Road Bicycle Boulevards; intersection improvements at Hansen Way/El Camino Real, Los Robles Ave/El Camino Real, Alma St/Meadow Drive

Rankings:

Safety: *High/Medium*	Connectivity: *Medium*	Special: *High/Medium*
Integration: *Medium/Low*	Inclusion: *High*	Innovation: *Yes*
Investment: *High/Medium*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
BK-8	Newell Road Enhanced Bikeway	$80,000

Project Description: Provide enhanced bicycle markings in the short term between Homer/Channing Avenues and Jordan Middle School/ California Avenue. Longer-term, or as part of the Newell Road Bridge Crossing Replacement Project or Cycletrack Study, consider further separation and permanent parking prohibitions on one side of the street.

Related Projects/Plans: Channing and California Avenue Enhanced Bikeway; Ross/Louis Road Bicycle Boulevard; Newell Road Bridge Replacement (Public Works); East Palo Alto Highway 101 Barrier Connection

Rankings:

Safety: *Medium*	Connectivity: *Medium/Low*	Special: *Low*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
BK-9	Fabian Way Enhanced Bikeway	$65,000

Project Description: Potential cycletrack or enhanced striping and signage of existing substandard (time restricted) bike lanes to improve safety and access to Adobe Creek Highway 101 crossing, Charleston bike lanes to San Antonio Road.

Related Projects/Plans: Charleston and Meadow Enhanced Bikeways; Adobe Creek Reach Trail; Adobe Creek Highway 101 Overcrossing

Rankings:

Safety: *Medium*	Connectivity: *Medium*	Special: *Low*
Integration: *Medium/Low*	Inclusion: *High*	Innovation: *Yes*
Investment: *Medium*	Institutional Partnerships: *Medium*	

Intersection Spot Improvements

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
INT-1	El Camino Real Intersection Through-Markings	$125,000

Project Description: Consistent intersection through-markings at major existing east-west crossings of El Camino Real to improve visual connectivity and demarcate the bicycle path of travel across this major arterial barrier. This project, which must be explored with Caltrans, should be coordinated as a single project (if proven feasible) to maximize implementation opportunities. Priority locations include:

- Sand Hill Way Trail/Alma Street Bike Lanes
- Quarry Road to El Camino Park / Palo Alto Transit Center
- PAMF crossing to Stanford U.
- Churchill Road to Stanford trail
- Park Boulevard/Serra Street
- Stanford Avenue - California Avenue
- Los Robles Avenue/El Camino Way
- Maybell Avenue/El Camino Way
- Charleston/Arastradero Road

Related Projects/Plans: Numerous enhanced bikeways; El Camino Real Bus Rapid Transit; El Camino Real Bicycle Lanes Study

Rankings:

Safety: *High*	Connectivity: *High*	Special: *High*
Integration: *High*	Inclusion: *Medium*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
INT-2	Charleston Road at Middlefield Road Bicycle Through-Lanes	$25,000

Project Description: (Top Collision Location): Re-channelize Charleston Rd approaches to Middlefield Rd to improve bike lane positioning and reduce right-turn conflicts with vehicles. Consider a right-turn only lane for vehicles with a dedicated through-bike lane, intersection through-markings, and related signal enhancements as needed. May be studied as part of the *Middlefield Road Plan Line Study*.

Related Projects/Plans: Charleston/Arastradero Enhanced Bikeway; *Middlfield Road Plan Line Study*; Safe Routes to School

Rankings:

Safety: *High*	Connectivity: *Medium*	Special: *High*
Integration: *High*	Inclusion: *Medium/High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Low*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
INT-3	High Street at University Avenue	$50,000

Project Description: (Top Collision location); New curb extension(s) and ramps on the west side of High Street; enhanced crosswalk striping and signage.

Related Projects/Plans: University Avenue/Palo Alto Transit Center Undercrossings; Homer Avenue Enhanced Bikeway

Rankings:

Safety: *High*	Connectivity: *Medium/Low*	Special: *High*
Integration: *Low/Medium*	Inclusion: *High*	Innovation: *No*
Investment: *High*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
INT-4	Hanover Street at Page Mill Road	$50,000

Project Description: (Top Collision Location): Reconfigure number and width of vehicular travel lanes to connect existing bike lanes. Include intersection through-markings and striping of two-step turn for access to Hanover Street sidepath.

Related Projects/Plans: Hanover Street Sidepath Upgrades; Safe Routes to School; Page Mill Road Sidepath; Bol Park Path Lighting and Upgrades

Rankings:

Safety: *High*	Connectivity: *High/Medium*	Special: *High*
Integration: *Low*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
INT-5	El Camino Real at Embarcadero Road	$900,000

Project Description: (Top Collision Location): Removal of "pork chop" islands and relocation/replacement of signals (as necessary); installation of new curb ramps, enhanced crosswalks, and sidewalk improvements similar to those constructed at Stanford Avenue and El Camino Real. Additional attention should be paid to improving the bicycle connection from the Town & Country Shopping Center to/from the existing Caltrain Class I pathway.

Related Projects/Plans: Stanford University El Camino Real Class I Frontage Trail; Kinglsey Bicycle Boulevard and Spot Improvement at Embarcadero Road/Emerson Street; Churchill Road Enhanced Bikeway and Sidepath

Rankings:

Safety: *High*	Connectivity: *High*	Special: *High*
Integration: *Medium/High*	Inclusion: *Medium*	Innovation: *No*
Investment: *Medium*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
INT-6	Churchill Avenue at El Camino Real	$100,000

Project Description: Removal of "pork chop" island and relocation of existing signal; new curb ramp, sidewalk improvements, and bicycle signage and striping (bike box, intersection-through markings) to facilitate access to/from Churchill Road and Stanford University path across El Camino Real. Suggested implementation with Project TR-5, although may be a stand-alone project if planned in phases.

Related Projects/Plans: Churchill Road Sidepath (TR-5), El Camino Real Shared Lane Markings; Castilleja-Park-Wilkie Bicycle Boulevard; Southgate Stormwater Improvements and Green Street Project (Public Works); Churchill/Coleridge Enhanced Bikeway

Rankings:

Safety: *High*	Connectivity: *High*	Special: *Medium*
Integration: *Medium/High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High/Medium*	Institutional Partnerships: *High*	

Programs (Infrastructure)

PR-1	Safe Routes to School	$500,000

Project Description: Comprehensive access and safety improvements along the School Commute Corridor Network to be determined through detailed school site assessments and outreach as part of the VTA VERBS grant-funded project. Common elements likely to include: crosswalk striping and signage; flashing beacons and/or hybrid pedestrian signals; trail and bicycle boulevard spot improvements; targeted striping and signage for enhanced bikeway development. Funding targeted from outside grants (SRTS/SR2S), existing CIP Program, and other sources.

Related Projects/Plans: Complements the bicycle boulevard, enhanced bikeway, and trail spot improvement projects; Street Maintenance Program (Public Works)

Rankings:

Safety: *High*	Connectivity: *Varies*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Varies*
Investment: *High*	Institutional Partnerships: *High*	

PR-2	Bicycle Parking Corral / Rack Installation Program	$75,000

Project Description: Dedicated funding to implement on-street bike corrals, "mini-corrals" along sidewalks, and both standard and custom public art racks at strategic locations and on a request basis. Note: This budget includes up to ten bicycle corral installations and several public art racks that are planned for installation in Downtown for 2011/2012.

Related Projects/Plans: *Comprehensive Plan Transportation Element* Policy T-19; VTA Public Bicycle Share Program

Rankings:

Safety: *N/A*	Connectivity: *N/A*	Special: *High*
Integration: *High*	Inclusion: *N/A*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium/High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
PR-3	Pedestrian Countdown Signals & Crossings Program	$50,000 annual

Project Description: Develop a new program for high visibility and/or raised crosswalks, curb bulbs, and pedestrian signals (countdown signals, HAWK, Rapid Flashing Beacons) for non-school areas throughout the City.

Related Projects/Plans: Safe Routes to School; Street Maintenance Program (Public Works); Thermoplastic Striping and Markings Program (Public Works)

Rankings:

Safety: *Varies*	Connectivity: *N/A*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium/Low*	

PR-4	Trail Spot Repair and Maintenance Program	$125,000 annual

Project Description: Increased dedicated funding for spot repairs and striping and markings for existing Class I trails.

Related Projects/Plans: Numerous sidepath and trail extension projects; Geng Road Trail Repaving; Existing Trail Access Improvements; Bol Park Path Lighting & Upgrades

Rankings:

Safety: *Varies*	Connectivity: *Varies*	Special: *High*
Integration: *Medium*	Inclusion: *High*	Innovation: *Varies*
Investment: *Medium/High*	Institutional Partnerships: *Medium/High*	

PR-5	Bicycle Share Program	Initial outlay funded; future expansions TBD

Project Description: VTA-led, multi-city program to include initial outlay of 100 bicycles at 7-12 locations in Palo Alto, focused around the Caltrain stations. This program, which may be folded into existing Transportation Demand Management efforts and staffing, should monitor, promote, and expand the public bike share system assuming initial success.

Related Projects/Plans: Bicycle Parking Program, existing Transportation Demand Management efforts

Rankings:

Safety: *N/A*	Connectivity: *N/A*	Special: *High*
Integration: *High/Medium*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *High*	

PR-6	Safe Routes to Transit Program	$500,000

Project Description: ADA pedestrian access and stop enhancements for Palo Alto shuttle, local VTA (including Route 35), and El Camino Bus Rapid Transit (BRT) services. Funding anticipated to come from outside grant sources.

Related Projects/Plans: Palo Alto Transit Center/University Avenue Undercrossings; Lytton/Alma/Sand Hill Road Enhanced Bikeway; Safe Routes to School; El Camino Bus Rapid Transit; Palo Alto Free Shuttle; *Middlefield Road* and *Embarcadero Road Plan Line Studies*

Rankings:

Safety: *Medium/High*	Connectivity: *Varies*	Special: *Medium*
Integration: *High*	Inclusion: *High*	Innovation: *No*
Investment: *Varies*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
PR-7	Safe Routes to Parks / Palo Alto Greenways Program	TBD

Project Description: Park access and greenway network development improvements, to be determined through future study and/or coordination with Palo Alto Parks & Recreation.

Related Projects/Plans: *Comprehensive Plan Transportation Element* Policy T-22; Land Use & Design Element Policies L-15 and L-17; Bay Trail and Bay to Ridge Trail; Safe Routes to School; Bicycle Boulevard network; Creek Trail projects

Rankings:

Safety: *N/A*	Connectivity: *Medium/High*	Special: *Medium*
Integration: *High*	Inclusion: *High*	Innovation: *Varies*
Investment: *High/Medium*	Institutional Partnerships: *High*	

PR-7	Trail Barrier Removal Program	TBD

Project Description: Remove rigid bollards and inappropriate fences from entrances to bicycle paths and bridges. If blocking access to vehicles is a priority at a particular location, a mechanism that is not hazardous to bicyclists should be used. The Draft Highway Design Manual, Chapter 1000, Index 1003.1(16) provides guidance and alternatives.

Related Projects/Plans: Trail Spot Repair and Maintenance Program

Rankings:

Safety: *High*	Connectivity: *Low*	Special: *Low*
Integration: *Medium*	Inclusion: *High*	Innovation: *Low*
Investment: *High*	Institutional Partnerships: *Low*	

System Rehabilitation/Maintenance

The following projects are identified as priority bikeway maintenance projects based on the most recent available Pavement Maintenance Management System (PMMS) roadway scores from Public Works. This list does not include existing scheduled paving projects (such as for Alma Street and Oregon Expressway/Oregon Avenue) except where to highlight the need for potential scope enhancements.

R-1	Castilleja Street - Park Boulevard	$100,000

Project Description: Paving repair as part of the development of the Castilleja-Park-Wilkie Bicycle Boulevard. Include signage and wayfinding upgrades in coordination with Project BB-1.

Related Projects/Plans: Street Maintenance Program (Public Works); Southgate Stormwater Improvements and Green Street Project (Public Works); California Avenue Streetscape Project; Charleston/Arastradero Enhanced Bikeway

R-2	Lytton Avenue	$200,000

Project Description: Mill and overlay of Lytton Ave from Alma Street to Florence Avenue. Scheduled for 2012. Project should consider enhancements to existing bikeway and crosswalk striping, additional pedestrian countdown signals where none currently exist; and pedestrian curb extensions where feasible as part of required curb ramp installation. (See BK-4 for more details.)

Related Projects/Plans: Street Maintenance Program (Public Works); Lytton / Alma / Sand Hill Enhanced Bikeway; Pedestrian Countdown Signals & Crossings Program; Safe Routes to Transit

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
R-3	Emerson and Ramona Streets	$200,000 - $1 million

Project Description: At minimum, pavement and signage/marking upgrades along proposed Class III bikeways through downtown between Palo Alto Avenue and the proposed Homer/Channing Enhanced Bikeway with prioritization of mid-block and plaza/park pedestrian connections. With Project F-5, explore signature downtown or "festival street" design that integrates roadway resurfacing activities with parking lot and/or alley upgrades.

Related Projects/Plans: Street Maintenance Program (Public Works); Bike Palo Alto!/Sunday Streets Program (proposed); Homer/Channing and Lytton/Alma/Sand Hill Enhanced Bikeways; California Avenue Streetscape Improvements; *Comprehensive Plan Transportation Element* Policies T-20 through T-23

R-4	Middlefield Road	TBD

Project Description: Enhanced striping/markings, and other pedestrian- and bicycle-oriented improvements, as part of repaving needs near Walter Hayes and Addison Elementary Shools and at the approaches to Oregon Expressway from Midtown and Jordan Middle School.

Related Projects/Plans: Webster Street Bicycle Boulevard; Middlefield Road Shared Lane Markings; *Middlefield Road "Complete Street" Plan Line Study*; Safe Routes to Transit; Safe Routes to School

R-5	Everett, Webster, Kingsley Avenue Bicycle Boulevards	$150,000

Project Description: Significant pavement repair along key stretches of the Everett Bicycle Boulevard, Webster Street Bicycle Boulevard, and Kingsley Bicycle Boulevard.

Related Projects/Plans: Intersection Spot Improvements at Embarcadero Road and Kingsley Avenue, and at Embarcadero Road and Webster Street; Safe Routes to School

Design, Feasibility, and Planning

F-1	Middlefield Road "Complete Street" Plan Line Study	$60,000

Project Description: Develop design alternatives for, and study the feasibility of, a potential lane reduction to provide Class II bike lanes and improve the Middlefield Road/Colorado Avenue area (a top collision location) for improved access to the Midtown Shopping Center district.

Related Projects/Plans: *Comprehensive Plan Transportation Element* Policy T-31 and Land Use & Design Element Program L-40; Proposed Class II Bike Lanes on Middlefield Road; Safe Routes to Transit Program; Amarillo-Moreno Bicycle Boulevard; Charleston Road Enhanced Bikeway

Rankings:

Safety: *High*	Connectivity: *High*	Special: *Medium*
Integration: *High*	Inclusion: *High*	Innovation: *No*
Investment: *High*	Institutional Partnerships: *Medium/Low*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
F-2	El Camino Real Bicycle Lanes	$100,000

Project Description: Feasibility and design study of Class II bike lanes from Page Mill Rd to Maybell Ave/Charleston Ave, which is the segment identified for further study/implementation as part of the 2003 El Camino Real Master Schematic Design Study. Analysis would ideally occur under/be coordinated with the upcoming environmental impact assessment for the El Camino Real Bus Rapid Transit (BRT) project.

Related Projects/Plans: VTA El Camino Real Bus Rapid Transit; *Comprehensive Plan Land Use & Design Element* policy L-35 and Program L-33

Rankings:

Safety: *High*	Connectivity: *High*	Special: *High*
Integration: *Medium*	Inclusion: *Medium/Low*	Innovation: *No*
Investment: *Medium/High*	Institutional Partnerships: Medium/*High*	

F-3	Matadero Creek Trail & Crossings Feasibility Study	$150,000

Project Description: Feasibility/design study to determine the preferred alignment, design elements, and potential phasing approach for the development of a Class I trail along the existing Matadero Creek maintenance road (or parallel street segments) from Park Boulevard to E. Bayshore Road.

Related Projects/Plans: Bay to Ridge Trail (additional revised alignment); Matadero Creek Class I Trail; Matadero Creek / Highway 101 Seasonal Undercrossing; Caltrain/Alma Barrier Crossing at Matadero Creek; Safe Routes to Parks/Palo Alto Greenways Program (proposed); Safe Routes to School; *Comprehensive Plan Land Use & Design Element* Program L-41.

Rankings:

Safety: *Medium*	Connectivity: *High*	Special: *High*
Integration: *Medium*	Inclusion: *High*	Innovation: *No*
Investment: *Medium*	Institutional Partnerships: *High*	

F-4	Embarcadero Road Plan Line Study	$60,000

Project Description: Feasibility and design study to identify appropriate bicycle and pedestrian treatments along and across this important residential arterial. Analysis should include the feasibility/warrant establishment of a marked crossing at Webster Street for the Webster Street Bicycle Boulevard, reconfiguration of the Emerson Street/Kingsley Avenue and Coleridge Avenue intersections, and improved connections under Caltrain/Alma Street.

Related Projects/Plans: Embarcadero Road / Walter Hays Sidepath; Coleridge/Churchill Enhanced Bikeways; Webster Street and Kingsley Avenue Bicycle Boulevards; Embarcadero Road Class III Arterial (or Future Study Needed); Safe Routes to School

Rankings:

Safety: *Medium*	Connectivity: *High*	Special: *High*
Integration: *Medium/High*	Inclusion: *Medium/High*	Innovation: *Varies*
Investment: *Medium/High*	Institutional Partnerships: *Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
F-5	Emerson/ Ramona Street Festival or Shared Street(s)	$50,000

Project Description: Feasibility/design study of potential shared space and/or festival street along Emerson Street and/or Ramona Street between Lytton Avenue and Hamilton Avenue. Includes assessment of connections and design opportunities of adjacent existing public parking lots, alleyways, and plazas. See Project R-3 for more details.

Related Projects/Plans: Street Maintenance Program (Public Works); Homer Avenue contra-flow bike lane; Homer/Channing Avenue Enhanced Bikeways

Rankings:

Safety: *Medium/Low*	Connectivity: *Medium/High*	Special: *Medium*
Integration: *High*	Inclusion: *High/Medium*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *Medium*	

F-6	Bol Park Path / Stanford Research Park Extension	$30,000

Project Description: Feasibility and design analysis of future potential trail connection through the Stanford Research Park between Hansen Way and the existing Bol Park Path near Matadero Avenue.

Related Projects/Plans: Existing Trail Access Improvements; Hansen Way/Portage Avenue Enhanced Bikeway; Bol Park Path Lighting and Upgrades; Matadero-Margarita Bicycle Boulevard

Rankings:

Safety: *Medium/Low*	Connectivity: *High*	Special: *Medium/High*
Integration: *Medium*	Inclusion: *High/Medium*	Innovation: *No*
Investment: *Medium*	Institutional Partnerships: *High*	

F-7	Enhanced Bikeway / Cycletrack Study	$30,000

Project Description: Feasibility/design study to assess potential for cycletrack design in Palo Alto.

Related Projects/Plans: Enhanced Bikeways, including the Homer Avenue contra-flow bike lane; Innovative Bicycle Facility Education and Outreach; numerous sidepath recommendations

Rankings:

Safety: *TBD*	Connectivity: *High*	Special: *Low*
Integration: *Medium*	Inclusion: *High*	Innovation: *Yes*
Investment: *TBD*	Institutional Partnerships: *Low*	

Non-Infrastructure (Education, Encouragement)

E-1	Safe Routes to School	$500,000

Project Description: See VERBS grant program RFP/work plan for more details. Includes comprehensive education, encouragement, and enforcement activities at all PAUSD schools.

Related Projects/Plans: Safe Routes to School (Infrastructure); *Palo Alto Bicycle and Pedestrian Transportation Plan*

Rankings:

Safety: *High*	Connectivity: *N/A*	Special: *High*
Integration: *High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
E-2	Citywide Traffic Counts and Data Collection	.10 FTE or equivalent

Project Description: Conduct regular pedestrian and bicycle counts at high-use locations and locations identified for additional study. Provide an annual report outlining trends analysis and progress toward *Bicycle and Pedestrian Transportation Plan* benchmarks, where applicable. Citywide counts should be consistent with National Pedestrian and Bicycle Documentation Project guidelines.

Related Projects/Plans: This program is related to all projects and recommendations within this plan and is highly consistent with/critical to policies and programs under *Comprehensive Plan Transportation Element* Goal T-4: An Efficient Roadway Network for All Users

Rankings:

Safety: *N/A*	Connectivity: *N/A*	Special: *High*
Integration: *High*	Inclusion: *N/A*	Innovation: *Varies*
Investment: *High*	Institutional Partnerships: *High/Medium*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
E-3	Bike Palo Alto! / Palo Alto Sunday Streets	$50,000 (proposed)

Project Description: "Cyclovia" style program that encourages walking and biking through recurring street closure events and programming during the late spring/summer/early fall.

Related Projects/Plans: Existing Downtown events programming; Safe Routes to School; proposed bicycle boulevards; Stanford University Wellness program (potential)

Rankings:

Safety: *N/A*	Connectivity: *N/A*	Special: *Medium*
Integration: *Medium/High*	Inclusion: *High*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships:: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
E-4	City Employee TDM Program	TBD

Project Description: Increase walking/biking (and transit) incentives for City employees and continued support for the annual Bike to Work Day.

Related Projects/Plans: VTA Public Bicycle Share Program; 2007 *Palo Alto Climate Action Plan*; *Comprehensive Plan Transportation Element* Programs T-5 and T-8

Rankings:

Safety: *NA*	Connectivity: *Low*	Special: *High*
Integration: *High*	Inclusion: *High/Medium*	Innovation: *Yes*
Investment: *High*	Institutional Partnerships: *High*	

ID	PROJECT NAME	PLANNING LEVEL COST ESTIMATE
E-5	Adult Bicycle Safety Education and On-Street Skills Training	$30,000

Project Description: Continue and expand opportunities to educate and encourage youth and adults to walk and bicycle safely. Funds to be identified through the Safe Routes to School VERBS grant, existing CIP programs, and on a per project basis. Additional emphasis within this program could be to encourage and promote knowledge of and training for new innovative bicycle facilities and the forthcoming public bicycle share program.

Related Projects/Plans: Safe Routes to School; VTA Public Bicycle Share Program

Rankings:

Safety: *High*	Connectivity: *Low*	Special: *High*
Integration: *Medium*	Inclusion: *High*	Innovation: *No*
Investment: *Medium*	Institutional Partnerships: *Medium*	

7.2.4 Cost Estimate Assumptions

Cost estimates for bikeway facilities are based on cost opinions provided by the City of Palo Alto and experience with neighboring cities. **Table 7-2** provides a detailed summary of the planning-level estimate costs of different bikeway facility types. **Table 7-3** lists typical costs of additional bicycle and pedestrian facilities and amenities.

Table 7-2. Cost Estimate Assumptions for Bikeway Facilities

Item	Quantity	Units	Unit Cost	Total
Class I Shared Use Path - 10' paved, 2' shoulders				
Wayfinding	4	EA	$300	$1,200
Clear and Grub	73,920	SF	$1.00	$73,920
Asphalt Concrete Pavement	52,800	SF	$8.00	$422,400
Decomposed Granite Shoulders	21,120	SF	$5.00	$105,600
Striping*	15,840	LF	$2.50	$39,600
Total Cost Per Typical Mile	$642,720			
Class 2 Bike Lanes				
Bike Lane Sign/Wayfinding	10	EA	$300	$3,000
Striping Removal	10,560	LF	$1.25	$13,200
Striping and Stenciling	10,560	LF	$2.50	$26,400
Total Cost Per Typical Mile	$42,600			
Enhanced Bike Lanes				
Bike Lane Sign/Wayfinding	10	EA	$300	$3,000
Striping Removal	10,560	LF	$1.25	$13,200
Striping and Stenciling	10,560	LF	$2.50	$26,400
Green bike lane (thermoplastic)	5,000	SF	$7.00	$35,000
Intersection markings	150	EA	$250.00	$37,500
Total Cost Per Typical Mile	$115,100			
Class 3 Bike Route - Urban - Per Mile				
Bike Route Sign/Wayfinding†	10	EA	$300	$3,000
Shared Lane Marking‡	20	EA	$250	$5,000
Total Cost Per Typical Mile	$8,000			
Bicycle Boulevard§				
Pavement Markings	20	EA	$100.00	$2,000
Signing**	10	EA	$300.00	$3,000
Total Cost Per Typical Mile	$5,000 + costs for traffic calming, crossing treatments, and other improvements			

* Includes center stripe and striping along path edges.
† Assumes five signs per mile in each direction.
‡ Assumes shared lane marking are placed every 265 feet.
§ Treatments will vary based on operational characteristics along the route; cost for planning purposes only.
** Assumes ten signs per mile in each direction.

Table 7-3. Typical Cost Estimates for Bicycle and Pedestrian Facilities and Amenities

Item	Unit	Planning-Level Cost Estimate
Intersections		
Pedestrian Scramble Signal	EA	$50,000.00
Hybrid Pedestrian Signal Crossing (HAWK)	EA	$50.000
Pedestrian Countdown Signal Heads	EA	$800.00
High Visibility Crosswalk	WA	$1,200.00
Pedestrian Refuge Island	EA	$25,000.00
Rectangular rapid flashing beacons	EA	$12,500.00
Sidewalks		
Sidewalk, Widening (includes curb and gutter)	SF	$25.00
Curb Ramps (perpendicular)	EA, per corner	$5,000.00
Traffic Calming		
Bulb Out	EA	$15,000 - $25,000
Chicane	EA	$15,000 - $35,000
Speed Bump	EA	$3,000 - $4,500
Traffic Calming Circle	EA	$8,000 - $12,000
Bicycle Paths and Lanes		
Bicycle Loop Detector	EA	$1,000.00
Colored bike lane, paint	SF	$2.00
Colored bike lane, thermoplastic	SF	$5.00 to $7.00
Bike Box, no coloration	EA	$1,900.00
Bike Box, thermoplastic (10' by 12')	EA	$2,300.00
Bike Box, thermoplastic (16' by 14' with lead-in and egress)	EA	$5,600.00

7.3 Key Potential Funding Sources

The long list of improvement concepts in **Chapter 6** and priority projects described in this chapter will require substantial funding to complete, and represents a commitment of $7.5 - $10 million in local funding over the next five to ten years (or more). However, the prioritization outlined in the previous section provides a strategy for Palo Alto to begin implementing projects in the Plan that will provide the most benefit to the community. In addition, a variety of funding sources can be leveraged with existing funding in order to reduce the City's burden. Key sources are addressed below, with a complete list provided in **Appendix F**.

7.3.1 Private Development Impact Fees and Mitigation

The **Palo Alto Municipal Code** regulates the standard of developments and use of city streets and supports non-motorized travel and improvements. Recent best practice revisions to the code include Transportation Impact Fees for mitigating congestion in certain areas, strong requirements for bicycle parking with new projects, and urban design guidelines that foster pedestrian-friendly streetscapes.

The largest and most obvious source related to private development is the recently approved **Stanford Medical Center expansion**, which includes a mitigation and public benefit package that will provide valuable funding for many new projects. The traffic mitigation and public benefits approved in May 2011 identifies $5.5 million in direct pedestrian and bicycle-related improvements, and additional funding for non-motorized transportation may be available through a separate Sustainability Fund created as part of this package.

7.3.2 Palo Alto CIP and Regional Funding

Table 7-4 summarizes the analysis and approach for the three principal funding sources for pedestrian, bicycle, and other related transportation improvements. It shows that direct, identified funding and need for bicycle and pedestrian projects is nearly $65 million under current planning (2011-2035), which could increase by approximately 40% if "routine accommodation" and coordination opportunities are successfully leveraged. City staff will continue to refine and confirm these funding sources to help constrain and focus project development priorities.

Table 7-4: Palo Alto Bicycle and Pedestrian Summary of Potential Funding

	CIP 2011-2015	Stanford Hospital Expansion 2011-2020	Regional Projects and Grants (VTP 2035)	Total
Direct Funding (assumes 100%)	$13,450,000	$5,550,000	$45,700,000	$64,700,000
Partial and Accommodation (assumes 10% share of related projects and programs)	$2,237,300	$1,613,000	$1,960,000.0	$5,810,300
Potential Coordination	$1,192,480 (assumes 1% value share of utility and other non-direct capital investment within City right-of-way)		$14,600,000.00 (5% leverage assumed from El Camino Real BRT and Palo Alto Transit Center programmed funds)	$15,792,480
Total	$16,879,780	$7,163,000	$47,660,000	$86,302,780

7.3.3 State, Federal, and Regional Grants and Partnerships

Federal FHWA/HUD Partnership

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

The Partnership is not a formal agency with a regular annual grant program. Nevertheless, it is an important effort that has already led to some new grant opportunities (including both TIGER I and TIGER II grants). The City of Palo Alto should track Partnership communications and be prepared to respond proactively to announcements of new grant programs. Initiatives that speak to multiple livability goals (such as partnerships with Caltrain or with affordable housing groups) are more likely to score well than initiatives that are narrowly limited in scope to bicycle and pedestrian efforts.

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

Safe Routes to School

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

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

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

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

Safe Routes to Transit

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

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

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

Bicycle Transportation Account

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

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

7.3.4 Bicycle Facilities Program

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

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

7.4 CEQA Environmental Analysis

This BPTP has completed an Initial Study/Negative Declaration (IS/ND) environmental assessment. All projects requiring lane reductions and off-street facilities within this Plan will require a separate review under Section 15152 of the California Environmental Quality Act (CEQA) Guidelines. Parking removal does not trigger CEQA review. Future projects or activities in Palo Alto will be evaluated for consistency with the IS/ND to determine if they would have effects not examined in this document. If individual projects or activities in Palo Alto would have no effects beyond those examined in this IS/ND, no further CEQA compliance would be required. The final plan report will include the IS/ND as an appendix, which will likely determine that a Mitigated Negative Declaration is appropriate for the proposed BPTP.

Appendix A. Design Guidelines and Standards

This section presents innovative bicycle and pedestrian facilities that build upon and improve Palo Alto's existing non-motorized network. All of the facilities presented have been implemented in the United States. However, not all are approved for use by Caltrans or the Association of American State Highway Transportation Officials (AASHTO).

Many of the bicycle facilities are from the National Association of City Transportation Officials (NACTO) Urban Bikeways Design Guide, which has developed design guidelines for innovative bicycle facilities and is the most up-to-date source for information and guidance for on-street bicycle facilities. The Design Guide is meant to complement, not supersede, guidance from AASHTO and MUTCD, and was recently endorsed by the U.S. Secretary of Transportation. NACTO is an association of major urban cities, who among other initiatives, have banded together to form Cities for Cycling. Local guidelines for bicycle and pedestrian facilities include the Valley Transportation Authority (VTA) bicycle and pedestrian guidelines.

It should be noted that some treatments may be unsuitable for locations in Palo Alto, particularly treatments that were designed for large urban environments with few driveways or unsignalized intersections. Established facility types are recommended where feasible and appropriate to the roadway conditions, while innovation may be considered when such treatments may be safer and more effective than standard solutions. Palo Alto should collect data to identify whether innovative facilities are appropriate in the suburban setting. Before and after data about motor vehicle and bicyclist volume and roadway position, crashes, compliance, conflicts, delay, or other variables should be collected as appropriate on experimental treatments.

The design guidelines are a toolbox for implementing key plan recommendations and for providing innovative, attractive, economical, and high-quality bicycle and pedestrian facilities. Each design sheet discusses an innovative facility, presenting the most currently available design standards, recommended facility applications, and examples of implementation. Where possible, these descriptions include a discussion of issues and dimensions specific to Palo Alto conditions, as well as references to the VTA *Pedestrian Technical Guidelines* (2003) and the *County Expressway Bicycle Design Guidelines* (2003). When implementing new facility designs, the City should work with engineers, the Palo Alto Bicycle Advisory Committee (PABAC), and other stakeholders, consider trial and pilot projects, and provide information to the public about expected use of and behavior around new facilities.

Bikeway Facility Classifications

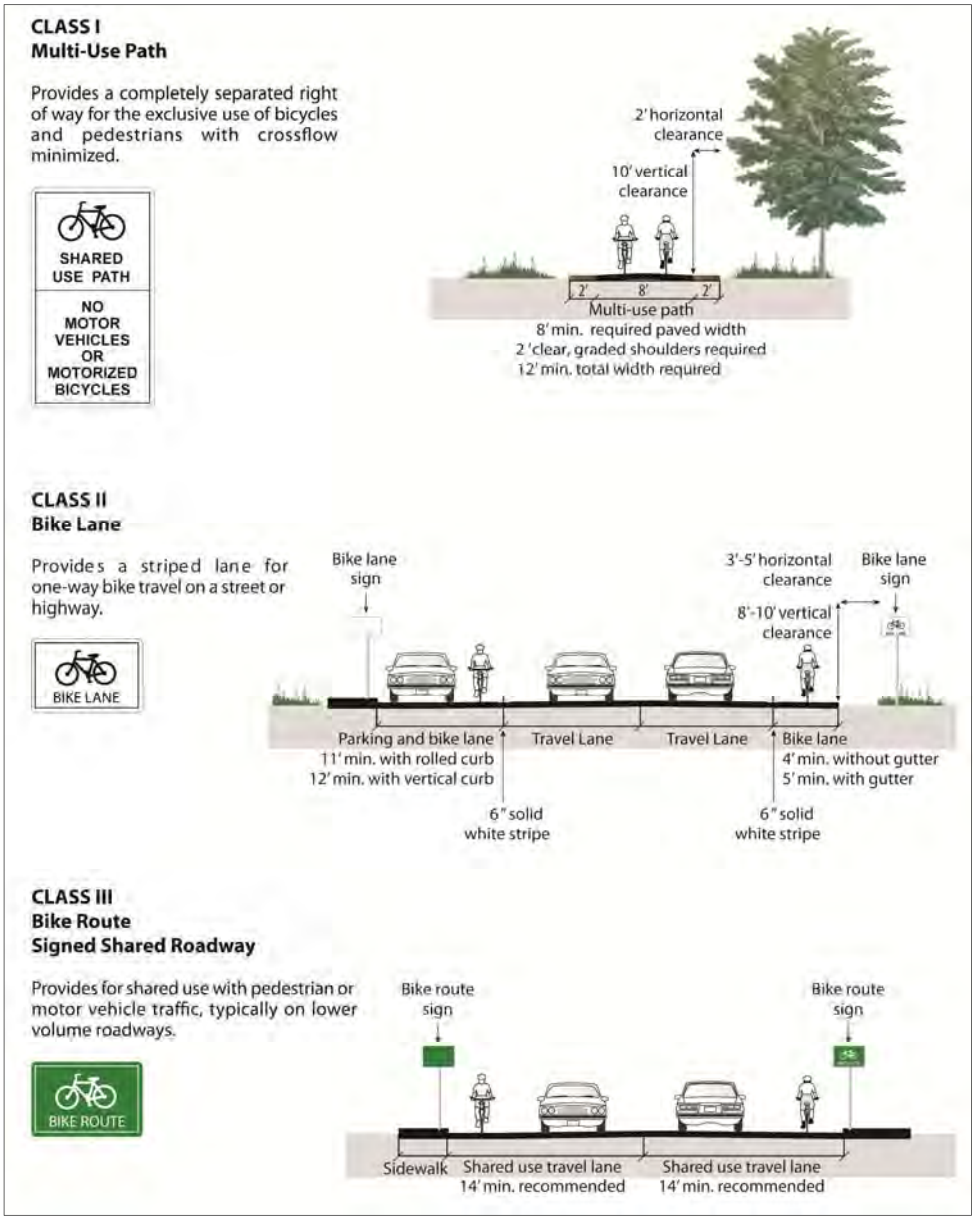
Description

Bikeways provide access for bicyclists. Travel area widths for bicycles are measured exclusive of gutters, because the longitudinal joint may not always be smooth, and may be difficult to ride along, and the gutter is not a suitable surface for bicycle travel.

Application

- 6' bike lanes preferred (Santa Clara County guidelines)

Design



Design References

Santa Clara County, *County Expressway Bicycle Accommodation Guidelines* (2003)

Caltrans Highway Design Manual, Chapter 1000

CA-MUTCD

Sharrows

Description

Shared lane markings, or "sharrows," help position and guide bicyclists on shared roadways, and remind/alert motorists to the presence of bicyclists and their right of travel. Sharrows are commonly used to delineate bikeways where Class II bike lanes are not feasible and/or along lower volume roadways where extensive striping and signage are inappropriate. Innovative use of sharrows include angled chevrons for wayfinding at decision-points, a combined uphill bike lane/downhill sharrow for steep inclines, and "super sharrows" that include an underlying green paint or slurry treatment to emphasize the bicyclist right-of-way on busy commercial streets. Super sharrows can be considered an enhanced bikeway option in some circumstances.

Application

- Sharrows should not be placed on roadways with a speed limit at or above 40 mph.
- Sharrows should be placed 13 feet from the curb where parallel parking exists (12 feet minimum can be acceptable pending detailed consideration by the City and PABAC).
- Sharrows may be placed in the middle of the outside travel lane if there are two or more travel lanes per direction, or if the outside lane is less than 14 feet, where parking turnover is high or where bicyclists may need positioning guidance.
- Sharrows should be installed before and after intersections, with additional markings spaced every 150 to 500 ft along school commute routes or for more complex or longer stretches (as determined by city traffic engineer).
- Sharrows may also be installed through key intersections to delineate the path of travel and increase the visual continuity and conspicuity of the bicycle facility
- Sharrows may be combined with other treatments such as green paint or slurry treatments (also known as "super sharrows").

Design References

California MUTCD, Section 9C.103 (2010) specifies that sharrows only be used on roadways with parallel parking, but the forthcoming 2011 edition will give local engineers greater discretion with sharrow placement on roadways with or without parking.

FHWA Publication No.: FHWA-HRT-10-044: Evaluation of Shared Lane Markings.

VTA Bicycle Technical Guidelines

Materials Cost Estimate

$275 per stencil

Design

Sharrows delineate bicyclists' path of travel away from potential open car doors and improve wayfinding.

This sharrow in Long Beach, CA uses an underlying green color treatment to help improve visibility and alert motorists

Enhanced Bikeway Option - Buffered Bike Lanes

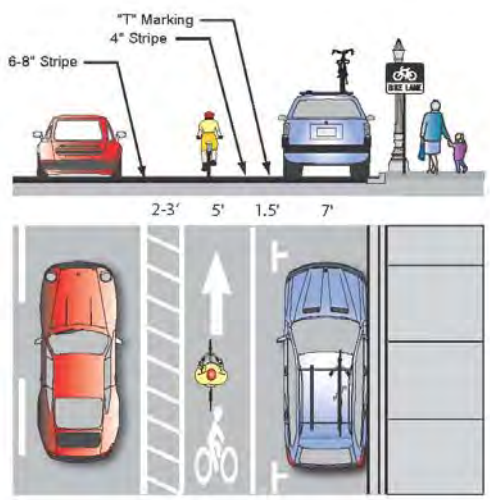
Description

A buffered bike lane is further separated from a travel or parking lane by a striped "shy zone." The buffered zone can be demarcated with hatched striping and/or soft hit posts.

Application

- Buffers may be installed between bike lanes and travel lanes or adjacent to parking lanes to provide additional shy distance from vehicles.
- Where extra buffer room is available and it is necessary to keep motor vehicles out of the bikeway, soft hit posts may be used to create additional separation, provided design minimizes potential hazard to bicyclists and drivers. The Palo Alto Bicycle Advisory Committee (PABAC) should review potential installation locations.
- The buffer shall be marked with two solid white lines with diagonal hatching. Double white lines indicate lanes where crossing is discouraged, though not prohibited. For clarity, consider dashing the inside buffer boundary where cars are expected to cross.
- Not appropriate for roadways with a high density of vehicle curb cuts/driveways.
- May be combined with time-restricted bike lanes and colored bikeway treatments.

Design



Design References

VTA Bicycle Technical Guidelines recommend eight-foot wide bike lanes on roadways with posted speeds of 45 mph or more (buffered bike lanes are not referenced).

National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide: http://nacto.org/cities-for-cycling/design-guide/

Photo

Fairfax, CA: Buffered bike lanes installed as part of a Safe Routes to School project on Sir Francis Drake Blvd (arterial).

Materials Cost Estimate

Varies depending on existing roadway cross section; comparable to bicycle lane costs where existing lanes can be narrowed

Enhanced Bikeway Option - Cycletracks

Description

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

Intersection conflicts should be addressed by providing adequate signage, pavement markings, and visibility of bicyclists in the facility.

Application

- Most appropriate on roadways with high bicycle demand, infrequent cross streets, and infrequent/low volume curb cuts.
- On streets where conflicts at intersections can be effectively mitigated using parking lane setbacks, bicycle markings through the intersection, and other signalized intersection treatments.
- Reduces risk of 'dooring' compared to a bike lane, and is attractive to a wider variety of bicyclists of all ages and abilities.
- Low implementation cost when making use of existing pavement and drainage and using parking lane or other barrier for protection from traffic.
- Ten-foot minimum for two-way facility, with 12 feet desired.
- On one-way streets, reduces out-of-direction travel by providing contra-flow movement.

Design

A "DO NOT ENTER" sign (MUTCD R5-1) with "EXCEPT BIKES" plaque shall be posted along the facility to only permit use by bicycles.

If configured on a one-way street, a "ONE WAY" sign (MUTCD R6-1, R6-2) with "EXCEPT BIKES" plaque shall be posted along the facility and at intersecting streets, alleys, and driveways informing motorists to expect two-way traffic.

Design References

National Association of City Transportation Officials (NACTO) Bikeway Design Guide

League of American Bicyclists (LAB) Sidepath Suitability Index: www.bikelib.org/roads/blos/sidepathform.htm

Materials Cost

Varies dramatically by available right of way width and design used. Can be comparable to buffered bike lane costs per mile when existing signals and pavement are utilized.

Cycle Tracks at Driveways and Minor Street Crossings

Description

At driveways and crossings of minor streets, the majority of traffic will continue through intersections, while a small number of automobiles will cross the cycletrack. At these locations, bicyclist visibility is important, as a buffer of parked cars or vegetation can reduce the visibility of a bicyclist traveling in the cycletrack. Biyclists should not be expected to stop at these minor intersections if the major street does not stop, and markings and signage should be used to indicate that drivers should watch for bicyclists.

Access management should be used to reduce the number of crossings of driveways on a cycle track.

Application

- If raised, maintain the height of the cycletrack, requiring automobiles to cross over.
- Remove parking 16 feet prior to the intersection.
- Use colored pavement markings and/or shared lane markings through the conflict area.
- Place warning signage to identify the crossing.

Design References

National Association of City Transportation Officials (NACTO) Bikeway Design Guide

CROW Design Manual for Bicycle Traffic.

Alta Planning + Design. (2009). Cycle Tracks: Lessons Learned.

Design

Colored pavement informs bicyclists and drivers of a potential conflict area.

Bicycle markings at a driveway crossing

Materials Cost

Varies dramatically by available right of way width and design used. Can be comparable to buffered bike lane costs per mile when existing signals and pavement are utilized.

Cycle Tracks at Driveways and Minor Street Crossings

Description

- Stripe stop line, remove parking, and consider dropping cycle track to a bike lane 16 feet back from the intersection for visibility.
- Use bike box treatments to move bicyclists in front of traffic and to facilitate right turns.
- Use colored pavement markings and/or shared lane markings through the conflict area.
- Provide left-turning movements with 'Copenhagen lefts' (a two-stage crossing, described below).

Application

The "Copenhagen Left" facilitates safe left-turn movements from cycletracks. Bicyclists approaching an intersection can make a right into the intersecting street from the cycle track, to position themselves in front of cars. Bicyclists can go straight across the road they were on during next signal phase. All movements in this process are guided by separate traffic signals – motorists are not allowed to make right turns on red signals. In addition, motorists have an exclusive left-turn phase, in order to make their movements distinct from the bicyclists'.

To increase visibility of bicyclists, several treatments can be applied at intersections:

- **Protected Phases at Signals**. With this treatment, left and right turning movements are separated from conflicting through movements. The use of a bicycle signal head is required in this treatment to ensure all users know which signals to follow. Demand-only bicycle signals can be implemented to reduce vehicle delay to prevent an empty signal phase from regularly occurring. If heavy bicyclist left turns are expected, these movements should be given its own signal phase and push button.

Design

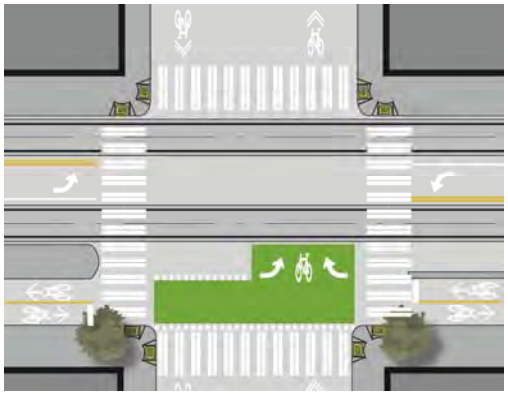


Diagram of a 'Copenhagen Left' at an intersection of a two-way cycle track and street with shared lane markings.

Bike box positions bicyclists to make a left turn from a cycle track in Portland, OR.

- **Advanced Signal Phases**. Signalization utilizing a bicycle signal head can also be set to provide cycletrack users a green phase in advance of vehicle phases. The amount of time will depend on the width of the intersection.
- **Unsignalized Treatments** . At non-signalized intersections the same conflicts exist. Warning signs, special markings and the removal of on-street parking (if present) in advance of the intersection can all raise visibility and awareness for bicyclists.

Design References

National Association of City Transportation Officials (NACTO) Bikeway Design Guide

Materials Cost

Varies dramatically by available right of way width and design used. Can be comparable to buffered bike lane costs per mile when existing signals and pavement are utilized.

Cycletracks Continued

Additional Disscussion

Separation

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

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

Placement

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

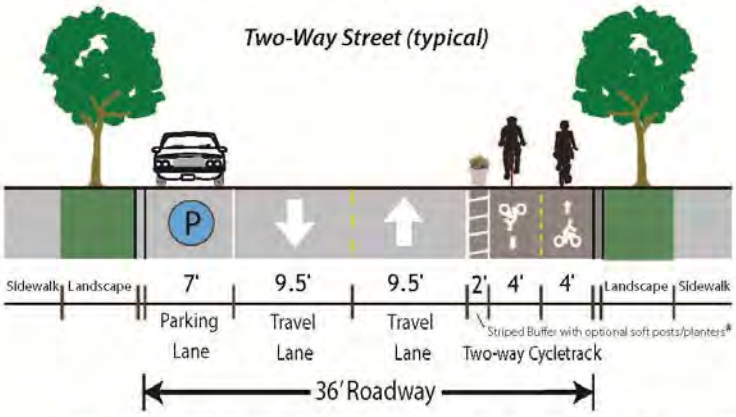
Cycletracks should only be constructed along corridors with adequate right-of-way. Sidewalks or other pedestrian facilities should not be narrowed to accommodate the cycletrack as pedestrians will likely walk on the cycletrack if sidewalk capacity is reduced. Visual and physical cues should be present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

Access Management.

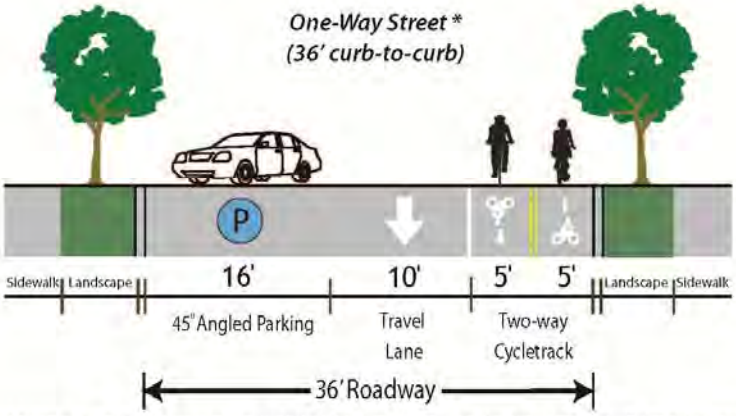
The reduction in the number of potential conflict points can also benefit a cycletrack corridor. Medians, driveway consolidations, or restricted movements reduce the potential for conflict.

Retrofitting Streets for Two-Way Cycletracks

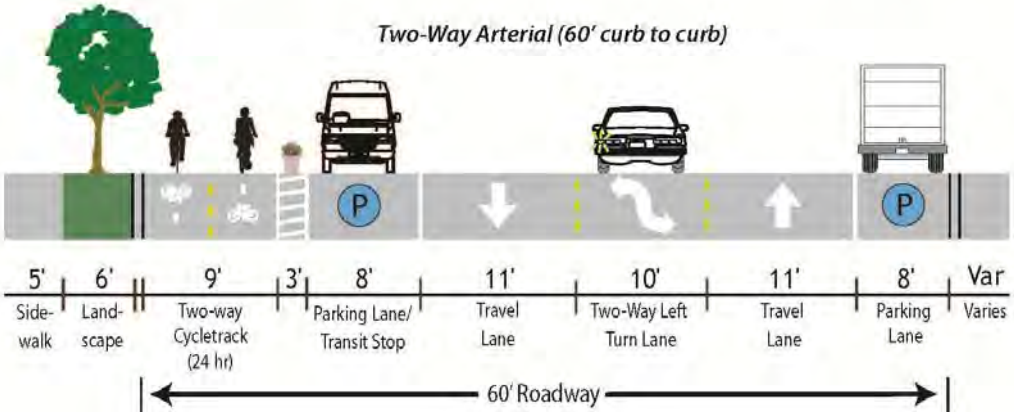
Sample Cross-Sections (Proposed)



If implemented as part of a repaving project, consider a 2" rolled curb/raised cycletrack or different surface treatment/color for added separation



* Proposed design can be considered a combination Class II left-side bike lane/ contraflow bike lane for the purpose of sufficient angled parking stall width



Enhanced Bikeway Option - Floating Bicycle Lanes

Description

Floating bicycle lanes are an on-street bicycle facility that accommodates peak hour traffic with an additional traffic lane by restricting parking and permitting bicyclists to use the parking lane. Floating bike lanes require an additional stripe within the parking lane to delineate the peak hour bike lane. Signage is needed to display restricted parking times and when bicyclists may use the peak hour lane delineation.

Application

Off-peak traffic does not warrant outside travel lane.

Peak hour parking demand does not warrant parking lane.

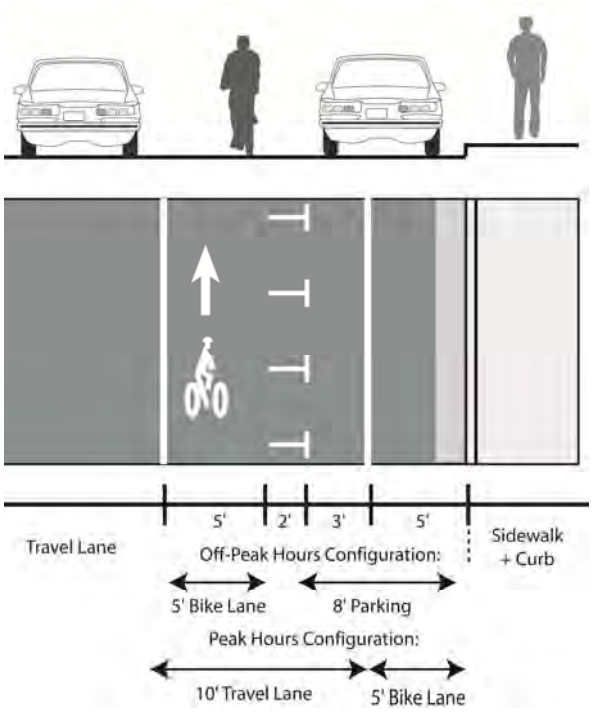
Design Reference

City of San Francisco, CA

Materials Cost Estimate

$25,000-$35,000 per mile (if retrofitting street as separate project)

Design



Example

San Francisco has installed floating bike lanes on The Embarcadero.

Enhanced Bikeway Option - Restricted Hours Bicycle Lanes

Description

California Vehicle Code permits automobile parking within a Class II bicycle lane unless otherwise signed. CAMUTD defines a Class II bicycle lane as permitting automobile parking. Restricted hours bike lanes restrict parking within bike lanes at designated hours. This design is different from floating bike lanes in that bicyclists lose the bike lane to parking during designated hours and must share the travel lane with motorists. Palo Alto has installed restricted hours bike lanes on several streets, including Channing Ave, Newell Rd, N California Ave, Loma Verde Ave, and Fabian Way.

Application

Existing streets with time-restricted bike lanes on (primarily) residential streets.

For 36-foot curb-to-curb roadways conditions, time-restricted lane should be five feet wide to allow for a 12-foot shared parking/bike lane on the opposite side and two 9.5-foot travel lanes.

Can be upgraded to full-time bike lanes where weekend bicycle connections are a high priority and/or where evening/weekend parking utilization rates are low.

Signage

Design References

CAMUTD Section 9C.04

City of Palo Alto 2003 Bicycle Transportation Plan

Photo

Palo Alto prohibits parking within the Loma Verde bike lane from 7 am to 7 pm on weekdays.

Materials Cost Estimate

Varies depending on existing conditions.

Enhanced Bikeway Option -Contaflow Bike Lanes

Description

A contraflow bike lane provides a dedicated bicycle lane against one-way traffic flow.

Application

One-way roadways where bicycle traffic is prioritized over on-street parking and automobile traffic.

Bicycle demand warrants increased bicyclist accessibility and connectivity.

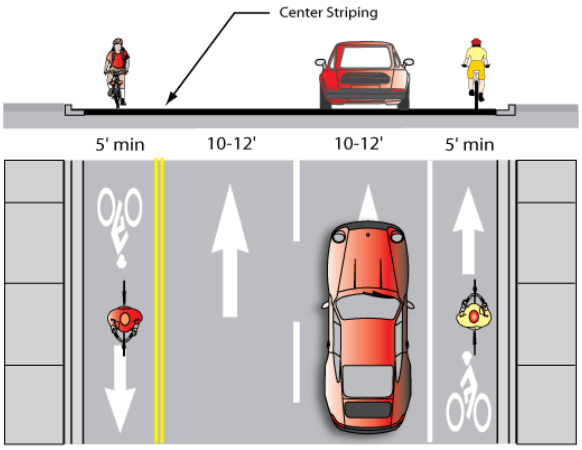
Contraflow bike lanes should be separated by a double yellow line at minumum.

Pavement markings and signage should indicate contraflow bike lane is exclusively for bicycle use.

Consider colorizing bike lane and/or physical separation between bike and travel lanes, such as soft hit posts.

Signalized intersections must be modified to accommodate bicyclists.

Design



Design Reference

CROW Design Manual (Netherlands) recommends five- to 6.5-foot bike lane widths

NACTO Bikeway Design Guide

Example

The City of San Francisco installed a contra flow bike lane on Lyell St. Photo Credit: Eric Fischer

Materials Cost Estimate

Varies by roadway (grinding and adding stripes is relatively low cost, but higher costs may be incurred for additional traffic control)

Enhanced Bikeway Option - Green Bike Lanes through Conflict Areas

Description

Colored bike lanes alert roadway users to the presence of bicyclists and are clear in assigning right-of-way to bicyclists. Motorists are expected to yield to bicyclists in these areas.

Two materials are typically used to color bike lanes. Painting bike lanes is the least expensive option but is slippery when wet. Colored and textured sheets of acrylic epoxy coating is moderate in cost and durability and maintains grip when wet. Colored asphalt is most durable and maintains grip when wet at the highest cost.

Application

Apply color selectively to highlight potential conflict zones or mark all facilities exclusively for bicycle use in high volume traffic situations.

May be used in combination with physical separation devices, e.g. hatched buffers, soft hit posts, where motorists do not merge over bike lane.

Normal white bike lane lines shall be provided along the edges of the colored lane to provide consistency with other facilities and to enhance nighttime visibility.

Color may be solid or dashed through potential conflict zones, including intersections.

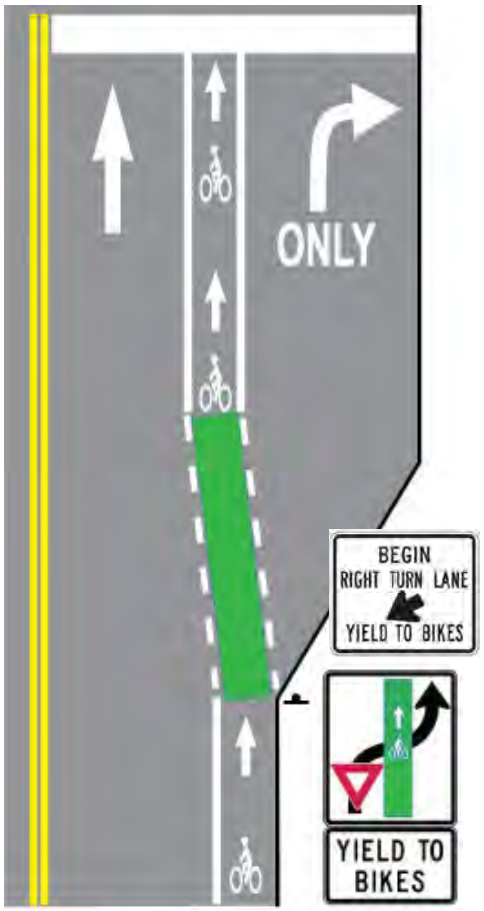
Green color may also be used in conjunction with other markings, such as the sharrow, to further identify and contrast bicycle facilities.

Design References

NACTO Urban Bikeway Design Guide

FHA April 2011 Memorandum – MUTCD Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes (1A-14)

Design



Colorized bike lanes can be used in high-conflict areas, where motorists cross bicyclists' path. The City of Portland uses a graphic sign in advance of the lane, while MUTCD standard sign displays text.

Material Cost Estimate

Varies dramatically by materials used, i.e. thermoplastic, acrylic epoxy or colorized asphalt

Enhanced Bikeway Option - Intersection Crossing Markings

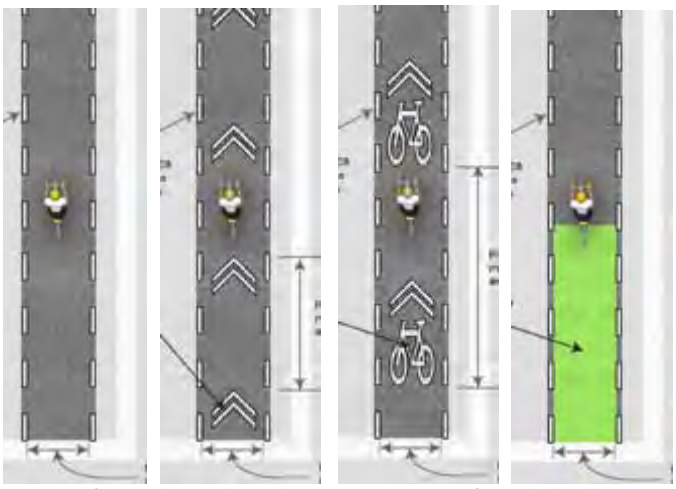
Description

Bicycle pavement markings delineate bicyclists' path of travel through intersections. Cities throughout the United States and Canada have used a variety of intersection crossing markings. The National Association of City Transportation Officials (NACTO) is a coalition of cities working to standardize innovative bicycle treatments not yet approved by the Federal MUTCD and AASHTO, including intersection crossing markings. NACTO developed the following design guidelines based on international best practices. In California, approvals are not required to use these markings on local roadways.

Intersection markings increase awareness for both bicyclists and motorists of potential conflicts and reinforce that bicyclists have priority over turning vehicles. They can facilitate the use of complicated intersections and delineate where and how bicyclists should cross. Indicating intersection crossings with dashed lines results in lower maintenance costs then colored markings.

Design Example

Dashed lines and chevrons delineate bicyclist path of travel through an intersection on the 9th Avenue cycletrack in New York City.



Options for markings through intersections vary from dashed lines to shared lane markings, or can use green paint. (Source: NACTO)

NACTO Design Guidelines

Required

Dotted lines shall bind the crossing space.

Crossing striping shall be at least six inches adjacent to motor vehicle travel lanes.

Recommended

Dashed lines should be two-foot lines spaced two to six feet apart.

Striping should be white, reflective and non-skid.

Crossing lane width should match the leading bicycle lane.

Optional

Chevrons, shared lane markings, or colored bike lanes may be used to increase visibility within conflict areas or across entire intersections.

Application

Wide, complex intersections.

Locations where motorists commonly encroach on bicyclists' space.

Mark across driveways or on-ramps with prevailing motorist speeds low enough for yielding to bicyclists.

Wayfinding Signage and Markings

Signs and/or pavement markings will be posted on designated roadways and trails to direct bicyclists to major destinations throughout Palo Alto. Customized signs and markings will be used on designated bicycle boulevards and integrated into the citywide system, where appropriate. Signs and markings should follow Manual on Uniform Traffic Control Devices (MUTCD) standards for installation, such as minimum height of signs above ground and horizontal placement from edge of the roadway or trail.

Identification / Confirmation Signs

Bicycle boulevard confirmation sign

Confirmation signs should be placed at the beginning of designated bikeways and repeated at appropriate locations, such as the far side of an intersection where two bikeways meet or every one-third to one-half mile depending on length segment, sight distance, and need for confirmation. Destination "blade" signs may be used in conjunction with confirmation signs to provide additional information.

For bicycle boulevards, identification signs shall be customized with Pantone Violet C coloring, the approved "Bike Palo Alto" logo, and the specific corridor or roadway name(s).

Standard confirmation sign with blades

Street Signs

Proposed street sign standard for designated bicycle boulevards

Along designated bicycle boulevards, additional route confirmation and wayfinding will be achieved through integrated street name signs that carry the bicycle boulevard marker symbol and color. Installation can occur as part of the city's non-conforming street sign upgrade program, or in conjunction with other bikeway or roadway maintenance projects.

Non-conforming street signs (existing)

Destination / Route Blade Signs

Bicycle boulevard destination blade signs (proposed)

"Blade" signs provide route or destination information at major decision points along or near a designated bikeway. Closest destinations should be listed on top, and no more than three blade signs should be used for any one location/pole. Destinations can include common neighborhood names, major parks, schools/universities, important roads/bikeways, general commercial areas, and adjacent communities.

If a sign is located on or directing to a bicycle boulevard, it shall be differentiated by its [violet] color. When not accompanied by a confirmation sign, blade signs should include a bicycle symbol. Use of established symbols/graphics for trails and destinations is encouraged, as are mileage indicators for longer destinations.

Existing (standard) blade signs

Route Guidance Pavement Markings

Custom Palo Alto bicycle boulevard roadway marking

Along bicycle boulevards, a customized pavement marker (left) may be used in addition to or in lieu of repeated confirmation signage. These markers can be used with arrows to provide route guidance through jogs or roadways changes, and at off-route locations leading toward a bicycle boulevard. In general, the custom markings should be placed in the center of the travel lane to denote bicycle priority. Through higher-traffic areas of bicycle boulevards, or wherever lane positioning and route confirmation are desirable on Class III facilities, shared lane markings (right) may also be used. Additional guidance on "sharrow" placement is provided separately in Appendix A.

Sharrows help confirm routes and guide cyclists on Class III facilities

Bike Boxes

Description

A bike box is a priority bicycle zone at the head of a signalized intersection. The bike box allows bicyclists to position themselves in front of the traffic queue on a red light and proceed first when that signal turns green. On a two-lane roadway, the bike box can facilitate left turning movements for bicyclists. Motor vehicles must stop behind the white stop line at the rear of the bike box. Bike boxes are also appropriate at signalized intersections along Class III (shared) bikeways where a lead-in bike lane can be provided (often accomplished by removing one or more parking spaces).

Application

- Use at signalized intersections with pedestrian countdown displays only.
- Right turns on red should be prohibited unless a dedicated right turn lane is provided to the right.
- Stop lines and optional lettering indicate where motor vehicles must stop.
- Dashed lines and coloration can extend into the intersection.

Design References

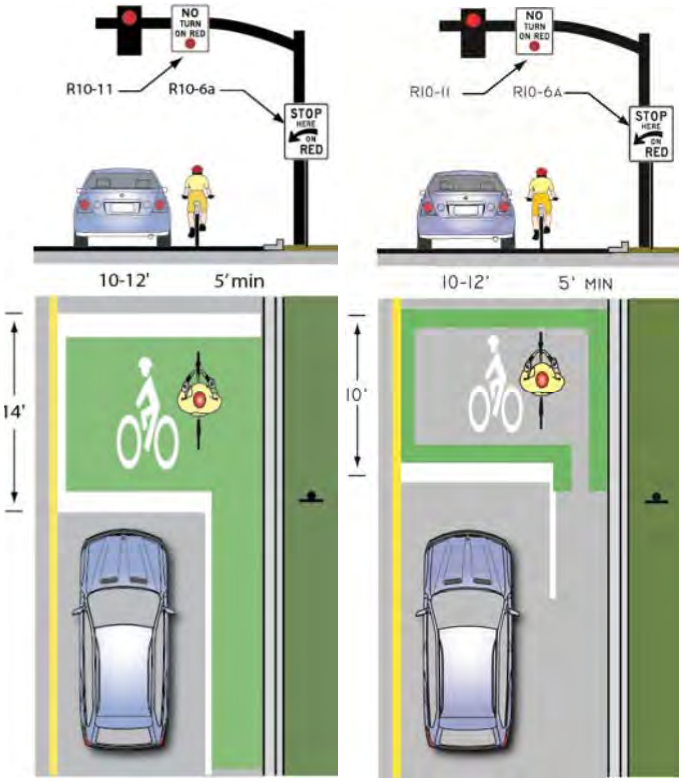
- NACTO *Urban Bikeway Guide*
- City of *Portland Bikeway Design Best Practices*
- CROW *Design Manual* (Netherlands)

Material Cost Estimate

$5 to $7 sf for thermoplastic, $250 for pavement markings, $300 for signing, assumes boxes on both sides of the street.

- Outlined bike box: $1,900
- 10’ by 12’ with coloration: $2,300
- 16’ by 12’ with coloration and access/egress lanes: $5,600

Design



San Luis Obispo uses a simpler version of a bike box. Source: Caltrans.

Caltrans installed a bike box in San Luis Obispo in 2010.

Crosswalk Design

Description

Crosswalks should be marked at unsignalized intersections when they help show pedestrians the shortest route across traffic with the least exposure to vehicular traffic and traffic conflicts, or help position pedestrians where they can best be seen by oncoming traffic. While yield lines are not required by the CA MUTCD, the National MUTCD requires them and "Yield Here to Pedestrians" signs at all uncontrolled crossings of a multi-lane roadway.

VTA *Pedestrian Technical Guidelines* state that, "curb radii at intersections within pedestrian areas should be 10 to 15 feet where curb bulbouts are not used." This practice reduces the crossing area.

Crosswalks can be improved with the following treatments to increase visibility.

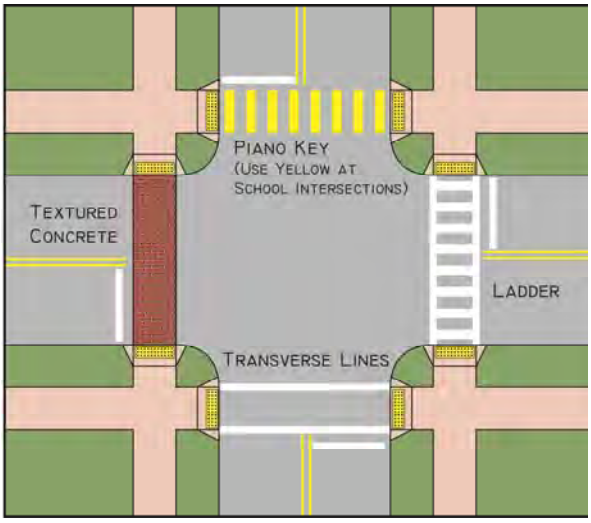
Advance Stop Bars are solid lines painted a minimum of 4 feet in advance of signalized crosswalks (on a multi-lane road with three or more lanes, an advance stop line is recommended at a point no further than 30 feet [20 feet preferred] per VTA standards) . A second stop bar for bicyclists placed closer to the centerline of the cross street than the drivers' stop bar increases the visibility of bicyclists waiting to cross a street. This treatment is typically used with other crossing treatments (i.e. curb extension) to encourage bicyclists to take full advantage of crossing design.

Yield teeth are triangles pointed downstream in a traffic lane, reminding and guiding motorists where to yield to pedestrians using an unsignalized crosswalk (such as a mid-block crossing or through a channelized right-turn lane). They should be accompanied by a sign indicating where motorists are expected to yield.

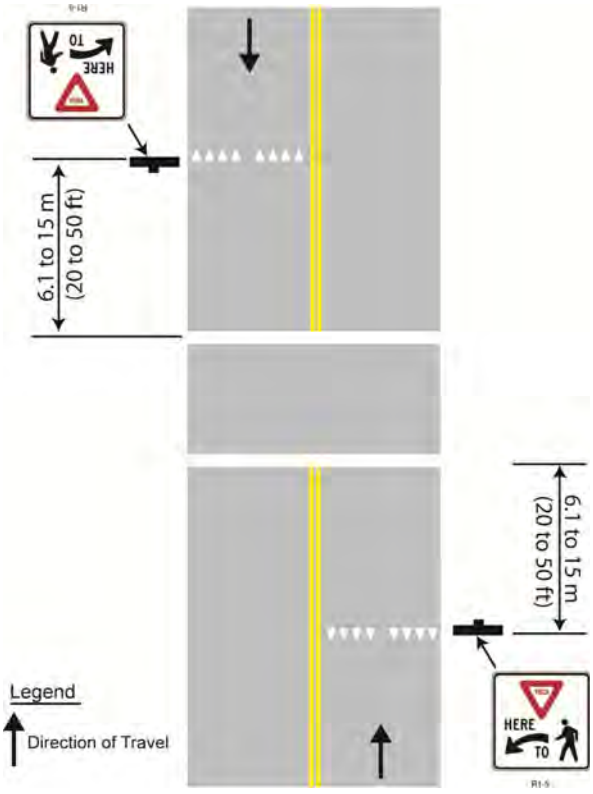
Yield to Pedestrians (R1-6) signs should be used to remind users of laws regarding the right of way at an unsignalized pedestrian crossing. Paddles are installed at the center stripe of the roadway on the leading edge of the crosswalk to warn approaching motorists to yield to crossing pedestrians. VTA recommends that overhead pedestrian crossing signs be used on streets with four or more lanes, two or three lane roads with widths greater than 50 feet at crossings where pedestrian crossing activity is more than 50 to 100 crossing per hour, and where sight distance of the driver may not allow view of roadside signs.

Beacons can be used to improve yielding and increase visibility. See following sheets for information.

Examples



Types of crosswalks.



Yield lines at m,idbloclk crosswalk. (MUTCD-CA, Figure 3B-15)

Crosswalk Design

Application

Use yield teeth at locations where motorists frequently disobey pedestrian right-of-way. Use with "YIELD HERE TO PEDESTRIANS" sign and place 20 to 50 feet in advance of uncontrolled crosswalk.

Bicycle stop bas are a recommended standard for all marked crosswalk locations, except where fewer than 25 percent of motorists make a right turn movement.

See VTA *Pedestrian Technical Guidelines* for crossing enhancement selection (Table 3.1)

Design References

VTA *Pedestrian Technical Guidelines* Section 3.1C Striping and 3.2A Marked Crosswalks.

CAMUTCD - Chapters 2, 7 and 9

AASHTO Guide for the Development of Pedestrian Facilities (p. 110)

VTA *Pedestrian Technical Guidelines* Section 3.1

Materials Cost Estimate

- Crosswalk, Thermoplastic: $5 to $7 per sf
- Crosswalk, Transverse: $320-$550 each
- Crosswalk, Permeable Pavement (brick, includes demo of existing): $14 per sf
- Crosswalk, Scored Concrete (includes demolition of existing): $9-$14 each
- Signs, High-Visibility: $430 each
- Signs, In-Pavement Yield Paddles: $220 each

Yield teeth encourage drivers to slow down and watch for pedestrians in a crosswalk.

Bicycle forward stop bars increase bicyclists' visibility at intersections.

In-street yield to pedestrians paddles.

Pedestrian Crossing Beacons/Actuated Signals

Description

These signals or flashing beacons are user- activated devices for use by pedestrian and/or bicycles only (as opposed to regularly timed or permanent blinking traffic signals). Often engaged by using a pedestrian push-button, loop and other detectors may also help detect bicycles.. A Florida study found that rapid flashing beacons had a compliance rate of 82%, compared to the base rate of 2 %. See other sheets for information related to crosswalk design and visibility enhancements at actuated crossings.

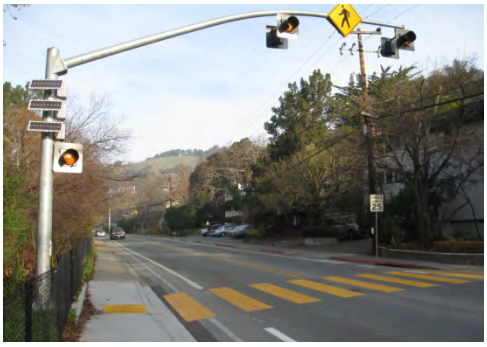
Rapid Flashing Beacons (also called active warning beacons) use high intensity, stutter flashing LED lights to increase visibility of midblock, pedestrian (or bicycle) actuated crossings. They use an irregular flashing pattern when activated (similar to that used by emergency flashers on police vehicles) but are otherwise "dark" when not in use. High-visibility signage should always accompany a flashing beacon.

Overhead Beacons are an older style of beacon often used for wider roadways without medians and other locations where signage visibility may be poor. They are typically more expensive than individual - mounted flashing beacons due to the need for mast arm installation.

HAWK (High Intensity Activated Crosswalk) signals (referred to in the MUTCD as pedestrian hybrid beacons) are used at midblock crossing locations and have displays similar to that of a traditional traffic signal. Pedestrians actuate HAWK signals by pushbutton to display a flashing yellow, to solid yellow, to solid red, at which time a walk indication activates. When the pedestrian clearance interval expires, the light turns flashing red and then off for motorists to proceed. HAWKs are also typically expensive due to the need for mast arms and potential coordination with adjacent signals.

Examples

RRFBs can be solar powered and are an inexpensive alternative to full signalization. Note: City of Palo Alto standards call for a circular, as opposed to a rectangular, beacon signal head.



An overhead solar-powered beacon assists a crossing of Sir Francis Drake in San Anselmo, CA.

Application

- The flashing beacon should be installed at least 100 feet from side streets or driveways that are controlled by a STOP or YIELD sign.
- Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk, or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance.
- The installation should include suitable standard signs and pavement markings. When used to assist bicycle crossings, a combined pedestrian and bicycle warning sign (W11-15) is strongly encouraged.

Pedestrian Crossing Beacons/Actuated Signals

Design References

- City of St. Petersburg, FL. 2007. *Increasing Motorist Yielding Compliance at Pedestrian Crosswalks From under 2% to as high as 94%.* http://www.stpete.org/stpete/bicycle/docs/ite_paper_07.pdf
- The application of experimental treatments within California should follow the California Traffic Control Devices Committee's (CTCDC) approval process (http://www.dot.ca.gov/hq/traffops/signtech/newtech/). Jurisdictions within California can apply to the CTCDC for permission to use experimental treatments. Note that the CTCDC has not approved the HAWK treatment to date. (See CTCDC's October 11, 2007 agenda and meeting minutes available on the Committee's website.)
- MUTCD Section 4F. Pedestrian Hybrid Beacons. Overhead flashing pedestrian beacons are governed under Section 4K.03 of the CA MUTCD.
- NACTO Urban Bikeway Guide
- USDOT. 2009. *Rectangular Rapid Flash Beacon*. FHWA-SA-09-009. http://safety.fhwa.dot.gov/intersection/resources/techsum/fhwasa09009/
- Bureau of Highway Operations (2010) HAWK Pedestrian Signals: A Survey of National Guidance, State Practice and Related Research http://on.dot.wi.gov/wisdotresearch/database/tsrs/tsrhawksignals.pdf
- California Vehicle Code 21650 (g): "*This section does not prohibit the operation of bicycles on any shoulder of a highway, on any sidewalk, on any bicycle path within a highway, or along any crosswalk or bicycle path crossing, where the operation is not otherwise prohibited by this code or local ordinance.*"

HAWK signal in Portland, OR assists with an arterial crossing on a bicycle boulevard. Note the use of the combined pedestrian/bicycle warning sign (W11-15).

Material Cost Estimate

Rapid Flashing Beacon: $10,000 to $15,000 for purchase and installation of two units.

HAWK Hybrid Pedestrian/Bicycle Signal: $50,000 each

Bike Signals/Crossbikes

Description

At special crossings of arterial roadways, or in locations that accommodate a high level of pedestrian and bicycle use, bike signals and crossbikes can improve visibility, assist with crossing, and separate bicyclists and pedestrians.

Bike Signals should not require the bicyclist to dismount. Where possible, it is ideal to provide a signal loop detector or remote detection rather than a push-button, because the latter requires the bicyclist to move out of the travel lane to actuate the signal.

"Crossbikes" can be used in higher-traffic areas where pedestrians and bicyclists are crossing together. They are most effective at trail crossings of arterial streets or at offset "T" intersections (such as those along El Camino Real) where higher visibility markings and added crosswalk width help minimize conflicts between pedestrians and bicyclists. They are also beneficial at trail crossings, bicycle boulevard crossings, and where the geometric design of an intersection includes a single crosswalk or 'stacked' crossing of an arterial.

Application

- At high demand trail crossings of arterial roadways and/or where Class I trails terminate at on-street facilities
- At "stacked" pedestrian crossings (i.e., where an off-set intersection or other circumstance limits crossings to one intersection leg only) that experience heavy bicycle demand and/or where dedicated turn phases allow a separate or protected non-motorized crossing
- At pedestrian scramble or "all way" phased intersections with heavy bicycle demand

Design References

- The application of experimental treatments within California should follow the California Traffic Control Devices Committee's (CTCDC) approval process (http://www.dot.ca.gov/hq/traffops/signtech/newtech/). Jurisdictions within California can apply to the CTCDC for permission to use experimental treatments.

Design

A bicycle signal is paired with a wider crosswalk to accommodate bicyclists in Berkeley, CA to assist with the Ohlone Greenway crossing of University Avenue.

Crossbikes are commonly used in Europe to separate pedestrian and bicycle crossings of major streets.

Material Cost Estimate

Bicycle signal installation cost varies depending on location and existing facilities. Crossbike treatments are generally similar in cost to high visibility crosswalks of the same width/length.

Bicycle Detection

Description

Design

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

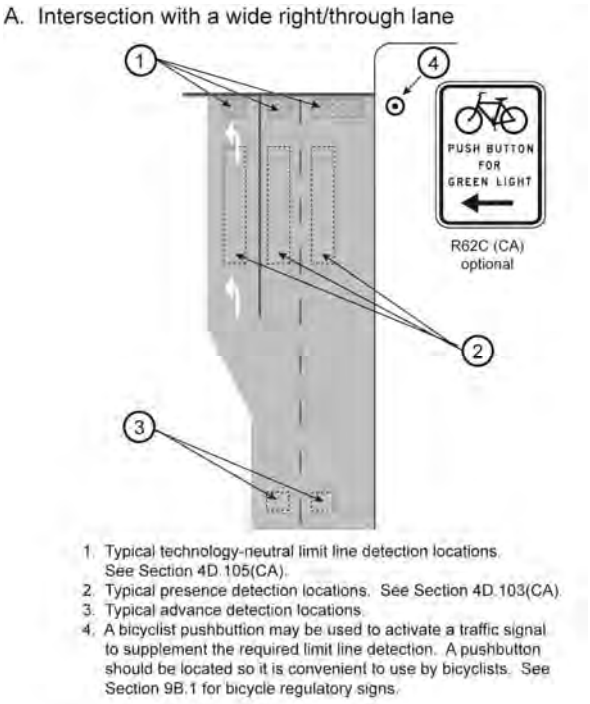
Microwave detection can count, as well as detect, bicycles as they approach an intersection. Palo Alto currently has grant funding to implement microwave detection in several locations. The cities of Pleasanton and Alameda are also using microwave radar detection and are testing its ability to extend green signal phases for slower moving bicyclists approaching an intersection.

Application

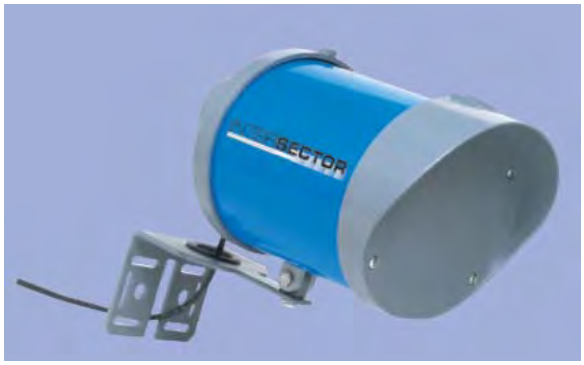
- CA Policy Directive 09-06 requires bicycle detection or fixed recall at all new and modified signals.
- Bicycle detection should be provided in a left-turn only lane where bicyclists regularly make left turn movements.
- The Reference Bicycle Rider must be detected with 95% accuracy within a 6' x 6' "limit line detection zone."

Design References

- National Cooperative Highway Research Program (2006). Improving Pedestrian Safety at Unsignalized Crossings, Report 562, 2006. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_562.pdf
- Caltrans Policy Directive 09-06. Provide Bicycle and Motorcycle Detection on all new and modified approaches to traffic-actuated signals in the state of California. http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy/09-06.pdf
- ITE Guidance for Bicycle—Sensitive Detection and Counters: http://www.ite.org/councils/Bike-Report-Ch4.pdf
- Santa Clara County, *County Expressway Bicycle Accommodation Guidelines* (2003)



Source: Caltrans Traffic Operations Policy Directive 09-06
Video Detection – Designs not available



A alternative to in-pavement loop detectors planned for use in Palo Alto is a pole-mounted microwave detection system called the "Intersector". More invormation is available at http://www.mssedco.com/intersector_sensor.htm

Pedestrian Scrambles

Description

Pedestrian scramble signals provide a dedicated traffic signal phase for all-way pedestrian and/or bicycle movement, lateral and diagonal between kitty-corners. During the pedestrian/bicycle phase of the scramble, all motor vehicle movements are stopped. Because scramble signals are not widely used in the United States, an education program should be implemented at the commencement of a pedestrian scramble.

Application

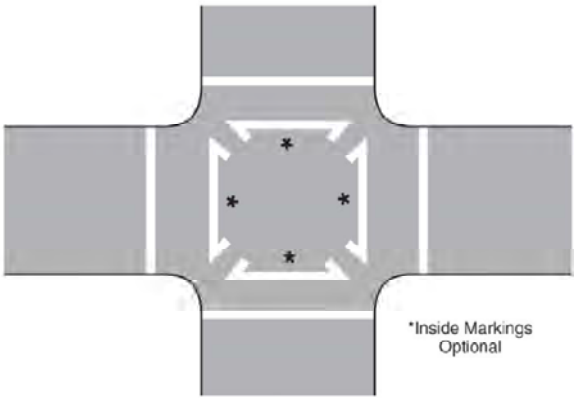
Use at intersections with very high pedestrian volumes and/or at intersections with a high pedestrian-motor vehicle collision rate.

Can facilitate movements at the terminus of a two-way cycle track or a Class I Path, where bicyclists need to cross the street diagonally to access the bike lanes in the correct direction.

Use an audible a signal to alert vision-impaired pedestrians of the walk interval.

May increase pedestrian violations due to increased delay; monitor and enforce.

Design



CAMUTCD example of exclusive pedestrian phasing crosswalk markings.

Design Reference

CAMUTCD provides guidance for exclusive pedestrian phasing.

Cities currently using this application include Oakland, Davis, and San Diego, California; Honolulu, Hawaii; and Portland, Oregon.

Materials Cost Estimate

$1,000 to modify signal operations

Additional cost for pavement treatments

Example

The City of Oakland installed a pedestrian scramble in its Chinatown, later adding pavement inlay designs to make crosswalks more visible.

Raised Crosswalks and Speed Tables/Humps

Description

Raised elements in the roadway vertically deflect traffic and are intended slow motorists and increase pedestrians' visibility. Speed humps are rounded raised areas, while speed tables are longer than speed humps and flat-topped. The VTA P*edestrian Technical Guidelines* notes that speed humps are uncomfortable for both vehicle occupants and bicyclists, and are not recommended. A raised crosswalk is a speed table that is marked and signed for pedestrian crossing. It extends fully across the street and can be loner and higher than a typical speed table. A raised intersection elevates the entire area, and improves the visibility of the crossing as a pedestrian area. Before installing raised crosswalks, designs should be approved by emergency vehicle operators including the fire department.

Application

Emergency vehicle response times should be considered where speed humps are used.

The ramp shapes of raised crosswalks and speed tables or humps are typically either sinusoidal, circular or parabolic, each offering motorists and bicyclists a differing level of comfort and effectiveness in reducing speed:

- **Sinusoidal ramps** are most comfortable for motorists and bicyclists but are least effective in reducing traffic speeds and are difficult to construct.
- **Circular ramps** offer a moderate comfort level for motorists and are moderately effective in reducing traffic speeds.

The height of raised crosswalk ends should be the same as the curb height but should not impede drainage. Detectible warning should be used where the raised crosswalk or intersection meets the sidewalk to warn pedestrians with visibility impairments.

Decorative surface material may be used to call attention to raised crosswalks.

The VTA *Pedestrian Technical Guidelines* recommends using speed tables and raised intersection in central business districts in "high pedestrian-use areas of or at interfaces between arterials and entrances to pedestrian supportive areas.."

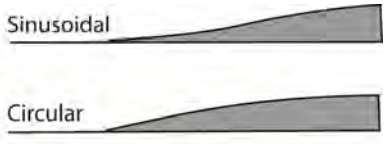
Design Reference

See also VTA *Pedestrian Technical Guidelines*, section 2.5 Traffic Calming.

Materials Cost Estimate

Costs can vary widely depending on use of decorative materials, existing grades, drainage issues, and use of curb extensions.

Design



Two types of raised crosswalk vertical deflection.

Example

Raised crosswalks calm traffic while enhancing pedestrian crossings.

Raised intersections also calm traffic, but can be expensive due to drainage issues.

Chicanes and Pinch Points

Description

Described as 'slow points' in the VTA *Pedestrian Technical Guidelines*, these features narrow a roadway mid-block. Chicanes create lateral shifts in a roadway with alternating curb extensions or islands. The intent of chicanes is to slow traffic speeds thereby increasing the comfort of bicyclists and pedestrians. Pinch points or chokers are a similar treatment that use curb extensions to create a narrow channel in the roadway midblock or at an intersection. Both treatments are appropriate along bicycle boulevards, although pinch points are preferred, as chicanes force bicyclists to share a narrower travel lane with motor vehicles. The intent of pinch points is to discourage cut-through traffic on residential roadways and decrease motorist speeds, thereby increasing the comfort of bicyclists. Work with emergency service providers when considering traffic calming or street closures/diverters.

Application

Use on low traffic volume residential streets.

Use in series' of three to effectively slow motorist speeds.

European manuals recommend extending the curb the one lane width with deflection angles of 45 degrees to prevent "straight line racing."

Consider leaving a 5-foot gap for bicyclists on bicycle boulevards to facilitate through-movements.

Consider integrating "Green Street" features into chicanes and curb bulb-outs (see VTA *Pedestrian Technical Guidelines*, 2.4D)

Consider bicycle access and circulation in development of slow points (VAT *Pedestrian Technical Guidelines*, Section 2.5); the Guidelines recommend that bulbouts be designed such that 14 feet of lane width remains, allowing enough space for cars and bicycles (Section 3.2B).

Design References

City of Portland recommends narrowing curb-to-curb width to 16 feet to avoid a requirement of advance warning sign installation.

City of Seattle recommends two-foot wide mountable curbs to facilitate emergency response.

Institute of Transportation Engineers - http://www.ite.org/traffic/chicane.asp

See also VTA *Pedestrian Technical Guidelines*, Section 2.5 Traffic Calming.

Materials Cost

$30,000 ea

Design

The City of Berkeley has installed a chicane along a bicycle boulevard that minimizes drainage costs by leaving a gap by the sidewalk.

This choker shortens a mid-block crosswalk and provides a channel for bicyclists and drainage.

Source: Project for Public Spaces.

Queuing Street

Description

Queuing streets are narrow residential streets that have low traffic speeds without the use of speed humps or bumps, which hinder emergency vehicles. They reduce pedestrian crossing distances, as well as maintenance and construction costs, and reduce impervious surfaces.

Application

Two-way streets should be between 20 and 28 feet. On a 28-foot street, two seven-foot parking lanes can be accommodated. On a 24-foot street, one parking lane is permissible, while no parking should be permitted on streets that are 20-feet wide.

Provide passing areas with a 20-foot wide clear area for parking of fire apparatus. (On streets with on-street parking, driveways tend to provide sufficient clear space for this.)

Use on residential or non-arterial streets only. Preferred for use on a connected street network with adequate street parking.

Prohibit on-street parking within 20-50 feet of the right-hand side of intersections to accommodate turning movements.

Minimum right-of-way standard is between 50 and 60 feet.

Design References

Oregon DOT's *Neighborhood Street Design Guidelines:* http://www.oregon.gov/LCD/docs/publications/neighstreet.pdf?ga+t

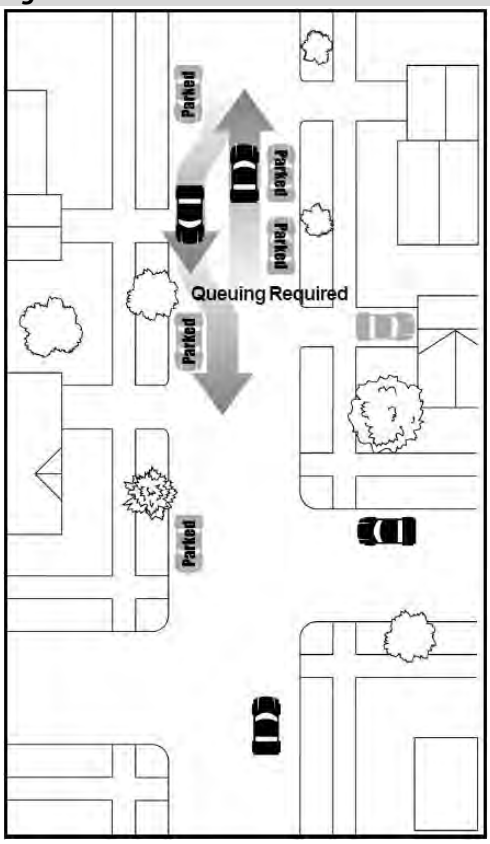
Institute of Urban and Regional Planning, University of California at Berkeley, *Residential Street Standards and Neighborhood Traffic Control:* http://web.mit.edu/ebj/www/Official%20final.pdf

Streets Wiki. *Skinny Streets:* http://streetswiki.wikispaces.com/Skinny+Streets

Materials Cost

N/A

Design



Source: Oregon DOT

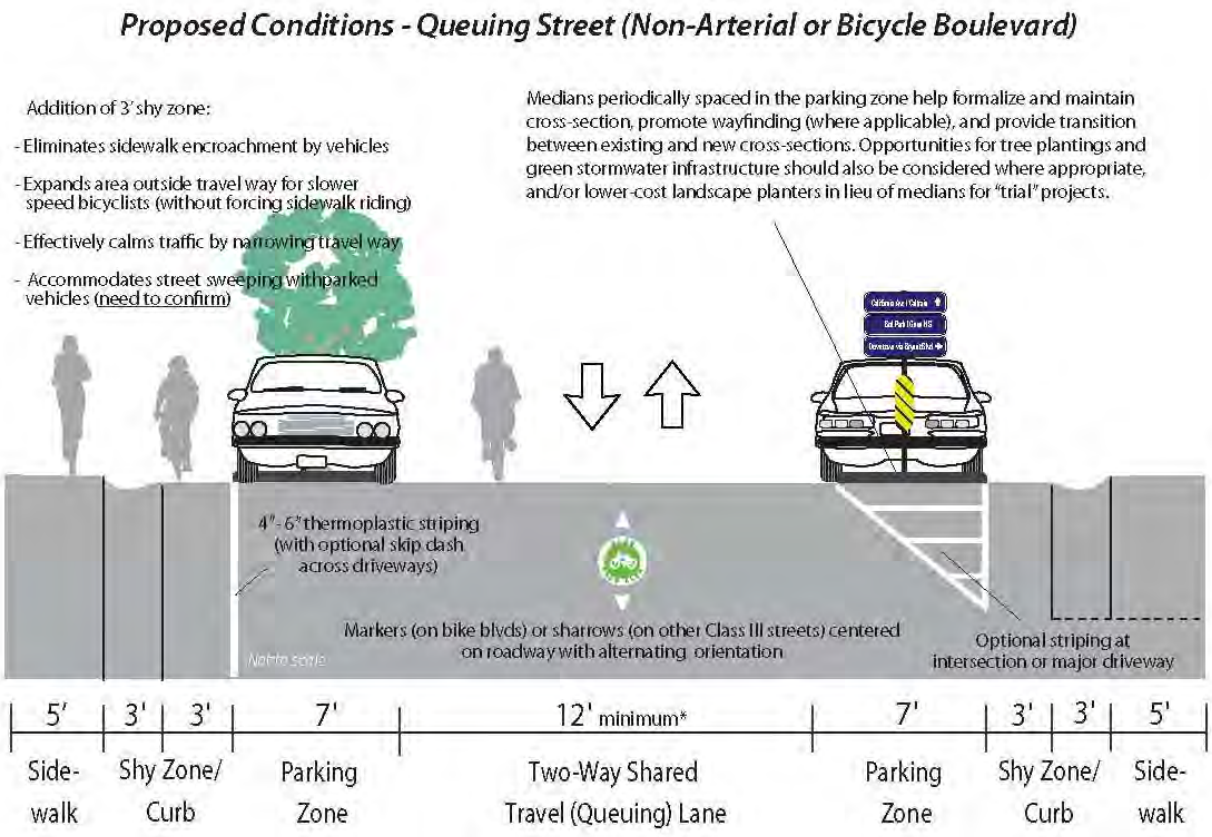
Example

Existing narrow "queuing streets" help make Castilleja Avenue and the Southgate neighborhood an attractive environment for bicycling and walking.

Source: Google Streetview

Queuing Street

Additional Discussion



* Reflects existing standards for two-way, low-volume residential streets with parallel parking. Additional effective travel way width can be achieved by staggering parking/medians or reducing shy zone to 2'. For more information see: http://www.oregon.gov/LCD/docs/publications/neighstreet.pdf?ga=t and http://web.mit.edu/ebj/www/Official%20final.pdf and http://streetswiki.wikispaces.com/Skinny+Streets

Neighborhood Traffic Circles

Description

Traffic circles are raised islands placed in the middle of local roadway intersections that control turning movements and help reduce vehicle speeds by forcing slow turns in a predictable manner. Because traffic circles do not require complete stops and have been shown to dramatically improve safety, they are generally considered more bicycle-friendly than traditional two- or four-way stops controls.* Additional benefits include reductions in local air and noise pollution from the removal of stop –and-go traffic, as well as visual and environmental benefits of added landscaping and tree planting opportunities. Traffic circles can also include a paved apron to accommodate the turning radii of larger vehicles including fire trucks and school buses where necessary.

**A Seattle study of 119 intersections where traffic circles were installed over a four-year period revealed a 94% reduction in collisions within the first year and similar numbers sustained over a longer time period.*

Application

Traffic circles should generally be between 10 and 20 feet in diameter, and mountable curbs can be considered in areas with high truck or bus volumes (VTA *Pedestrian Technical Guidelines).*

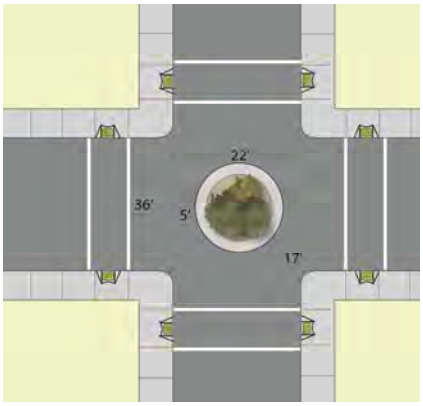
Location selection has typically been dependent on 85th percentile traffic speed, traffic volume, collision history, and community support.

Traffic circles may be installed independent of traffic calming where they are desirable to reduce travel delay and increase comfort and compatibility for bicyclists on designated bikeways (including bicycle boulevards).

Traffic circles should especially be considered where multiple bicycle boulevards or Class III bikeways intersect, in order to provide efficient traffic control for both corridors.

Traffic circles may not be appropriate where there is a dramatic difference in width of the intersecting roadways.

Design



Typical local roadway width in Palo Alto is 36 feet.

Design References

VTA recommends leaving 14 feet of clear roadway between the traffic circle and corners and including stop signs on all legs of a standard four-way intersection. At intersections with traffic volumes just shy of warranting stop controls, a modern roundabout should be considered.

See also VTA *Pedestrian Technical Guidelines*, section 2.5 Traffic Calming.

Institute of Transportation Engineers -www.ite.org/traffic/circle.asp

City of Olympia: http://olympiawa.gov/documents/PublicWorks/Technical_services/EDDS09/Chapter4_Drawings.pdf

Example

Traffic circles are great opportunities for natural landscaping and can reduce local air pollution and GHG emissions

Materials Cost

$20,000 - $50,000

Neighborhood Traffic Circles

Additional Discussion

Table A-1. Traffic Circle Design Guidelines (Olympia, WA)

STREET WIDTH	CURB RETURN RADIUS	OFF–SET DISTANCE	CIRCLE DIAMETER	OPENING WIDTH
20'	<15'	RECONSTRUCT CURBS		
	15'	5.5'	9'	16'+
	18'	5.0'	10'	17'+
	20'	4.5'	11'	18'–
	25'	4.0'	12'	19'+
24'	<12'	RECONSTRUCT CURBS		
	12'	5.5'	13'	16'
	15'	5.0'	14'	17'–
	20'	4.5'	15'	18'+
	25'	3.5'	17'	20'–
25'	<12'	RECONSTRUCT CURBS		
	12'	5.5'	14'	16'+
	15'	5.0'	15'	17'–
	18'	4.5'	16'	18'–
	20'	4.5'	16'	18'+
	25'	3.5'	18'	20'–
30'	10'	5.5'	19'	16'+
	12'	5.0'	20'	17'–
	15'	5.0'	20'	17'+
	18'	4.5'	21'	18'+
	20'	4.0'	22'	19'+
	25'	3.0'	24'	20'
32'	10'	5.5'	21'	16'+
	12'	5.0'	22'	17'–
	15'	4.5'	23'	18'–
	18'	4.0'	24'	19'–
	20'	4.0'	24'	19'+
	25'	2.5'	27'	20'
36'	10'	5.0'	26'	17'–
	12'	5.0'	26'	17'+
	15'	4.5'	27'	18'+
	18'	4.0'	28'	19'+
	20'	3.5'	29'	20'–
	25'	1.5'	33'	20'
40'	10'	5.0'	30'	17'+
	12'	4.5'	31'	18'+
	15'	4.0'	32'	19'–
	18'	3.5'	33'	20'–
	20'	3.0'	34'	20'
	25'	1.0'	38'	20'

Shared Space (Woonerfs)

Description

Shared Space streets, also known as woonerfs, living streets or home zones, are streets where pedestrians and bicyclists have priority over vehicles, yet where all modes of travel are allowed. Shared space can employ a variety of strategies to invite pedestrians and bicyclists and reduce motor vehicle speeds (typically to 15mph or less). Design elements include eliminating or reducing the number of signs, pavement markings, and curbs with the intention that people will rely on personal negotiation and attentiveness – rather than more passive adherence to traffic law – to navigate and move about safely. Other design elements include using pavers in addition to or instead of a formal sidewalk, pedestrian scale lighting, street trees, and street furniture.

In a neighborhood setting, shared space creates an environment where children could potentially play and pedestrians and bicyclists can move freely. In urban areas, shared spaces create opportunities for events, markets, and street shopping.

Application

Primarily successful in areas where access is prioritized over mobility and speed (e.g. retail corridors and on residential streets), and where high pedestrian and bicycle demand or play opportunities conflict with traditional sidewalk/crosswalk design.

Alleys and pedestrian lanes where service vehicle access must be maintained

Reduce motor vehicle speeds with traffic calming, street trees, and other features.

Meet Federal ADA access requirements, including providing a detectible warning and obstacle such as planter boxes between the sidewalk and street on curbless streets.

Design References

City of Seattle – Terry Ave North Street Design Manual

City of San Francisco – Better Streets Plan

American Planners Association – Planning and Urban Design Standards

FHWA – Pedestrian Facilities User Guide

CABE – Shared Space

Materials Cost

Variable. Usually developed as part of larger streetscape projects.

Design

Shared streets are usually distinguished by the removal or lowering of curbs, positioning of parking stalls, street trees and other furnishing elements, lack of pavement markings, and special surface treatments.

Many European countries use special signs to indicate shared space roadways in residential neighborhoods.

Festival Streets

Description

Festival Streets are local streets designed with high-quality urban design amenities that can be easily closed and programmed with community events. Examples include Davis Street in Portland's Chinatown, Lander Street in Seattle, and 3rd Avenue in Santa Monica.

Many options are available to define and separate space for pedestrians from the roadway area, which can be used in combination to provide both corridor-long barriers and more visible warnings. Examples include extruded curbs, parking stops, bollards or flexible bollards, planters, fencing, painted markings, paving materials, raised tactile devices, and other types of street furnishings.

Application

At the entrance, use signs, roadway narrowing, paving materials, street art, or a combination to inform motorists that they are entering a shared space.

Differentiate from other streets with alternate pavement materials and signage, and to reinforce with shortened sight lines (accomplished through placement of street furniture, parking, and/or landscaping), changes to the road geometry, and/or narrowing of the roadway.

Meet Federal ADA access requirements, including providing a detectible warning device and separation through planter boxes, bollards and other pbetween the sidewalk and street on curbless streets.

Design References

City of Seattle – Terry Ave North Street Design Manual

City of San Francisco – Better Streets Plan

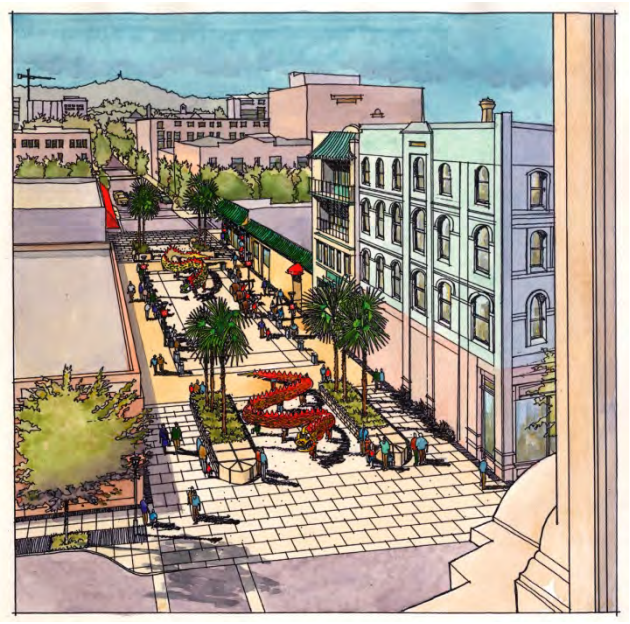
City of Portland,

American Planners Association – Planning and Urban Design Standards

FHWA – Pedestrian Facilities User Guide

CABE – Shared Space

Design



Streets designed for shared travel and/or frequent vehicle closures, such as Davis St in Portland, OR, are increasingly popular as economic development and urban open space projects.

Bicycle Parking

Description

Short-term parking accommodates visitors, customers, messengers and others expected to depart within two hours; requires approved standard rack, appropriate location and placement, and weather protection.

Bicycle corrals consist of bicycle racks grouped together in a common area within the public right-of-way traditionally used for automobile parking. Bicycle corrals are reserved exclusively for bicycle parking and provide a relatively inexpensive solution to providing high-volume bicycle parking. Bicycle corrals move bicycles off the sidewalks, leaving more space for pedestrians, sidewalk café tables, etc. Because bicycle parking does not block sightlines (as large motor vehicles do), it may be possible to locate bicycle parking in 'no-parking' zones near intersections and crosswalks. Bicycle corrals may also be located on the sidewalk where roadway paving and development projects allow for large curb extensions into the parking zone, although a curb ramp, rolled curb or other device should be used to ensure bicycle access from the street is maintained.

Application

A standard inverted-U style rack is recommended for Palo Alto. The rack element (part of the rack that supports the bicycle) should keep the bicycle upright by supporting the frame in two places without the bicycle frame touching the rack. The rack should allow one or both wheels to be secured.

Bicycle racks should be securely anchored to a surface or structure. Empty racks should not pose a tripping hazard for visually impaired pedestrians. Position racks out of the walkway's clear zone.

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

Guidelines for bicycle corrals:

- Use with parallel or angled automobile parking.
- Each motor vehicle parking space can be replaced with approximately 6-10 bicycle parking spaces.
- Protect bicycles from motor vehicles with physical barriers such as curbs or bollards and through application of other unique surface treatments (e.g. green thermoplastic markings) as needed.
- Establish maintenance responsibility when facility is built, particularly regarding street sweeping.
- Bicyclists should be able to access the corral from both the sidewalk and the roadway.

Example

Standard bicycle 'staple' rack.

On-street bicycle parking may be installed at intersection corners or at mid-block locations.

Bicycle Parking

Discussion

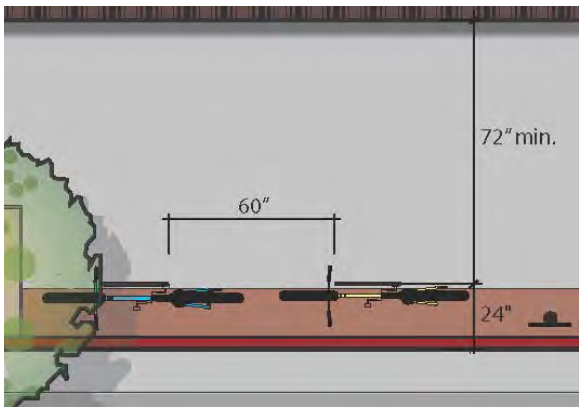
Summary of Recommended Design for Bicycle Parking

Design Issue	Recommended Guidance
Rack Spacing	Position racks with sufficient room between parked bicycles. Racks should be situated on 36" centers. A 6'aisle for bicycle maneuvering should be maintained beside or between each row of racks. For sidewalks with heavy pedestrian traffic, at least 7'of unobstructed right-of-way is required.
Minimum Rack Height	To increase visibility to pedestrians, racks should have a minimum height of 33 inches or be indicated or cordoned off by visible markers.
Signing	Where bicycle parking areas are not directly visible and obvious from the right-of-way, signs at least 12" square should direct them to the facility. The sign should include the name, phone number, and location of the person in charge of the facility, if applicable.
Lighting	Lighting of not less than one foot-candle illumination at ground level should be provided in all bicycle parking areas.
Frequency of Racks on Streets	In popular retail areas, two or more racks should be installed on each side of each block. Areas officially designated or used as bicycle routes may warrant the consideration of more racks.
Location and Access	Access to facilities should be convenient; where access is by sidewalk or walkway, ADA-compliant curb ramps should be provided. Employee parking facilities should be located near the employee entrance, and customer parking near public entrances. (Convenience should be balanced against the need for security if the employee entrance is not in a well traveled area). Bicycle parking should be clustered in lots not to exceed 16 spaces each.
Locations within Buildings	Provide bike racks within 50 feet of the entrance. Provide racks behind or within view of a security guard where possible. The location should be outside the normal flow of pedestrian traffic.
Locations near Transit Stops	To prevent bicyclists from locking bikes to bus stop poles, which can create access problems for transit users, particularly those who are disabled, racks should be placed in close proximity to transit stops where there is a demand for short-term bike parking.
Retrofit Program	In established locations, such as schools, employment centers, and shopping areas, the City should conduct bicycle audits to assess bicycle parking availability and access, and add racks if necessary.

Design References

- Association of Bicycle and Pedestrian Professionals Bicycle Parking Guidelines (2nd edition 2010)
- City of Oakland, CA Bicycle Parking Ordinance (2008)
- AASHTO Guide for the Development of Bicycle Facilities.
- Caltrans Highway Design Manual (Chapter 1000).
- MUTCD - California Supplement.

Design



Staple rack parking configuration and recommended clearances.

Maintenance

Description

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

Bicycles are more sensitive to subtle changes in roadway surface than are motor vehicles. Various materials are used to pave roadways, and some are smoother than others. Compaction after trenches and other holes are filled can lead to uneven settlement, which affects the roadway surface nearest the curb where bicycles travel.

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

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

Application

- Establish a seasonal sweeping schedule that prioritizes roadways with major bicycle routes.
- On all bikeways, use the smallest possible chip for chip sealing bike lanes and shoulders.
- If the condition of the bike lane is satisfactory, consider chip sealing only the travel lanes.
- Maintain a smooth surface on all bikeways that is free of potholes.
- Maintain pavement so ridge buildup does not occur at the gutter-to-pavement transition or adjacent to railway crossings.
- Inspect the pavement two to four months after trenching construction activities are completed to ensure that excessive settlement has not occurred.
- Check regulatory and wayfinding signs along bikeways for signs of vandalism, graffiti, or normal wear and replace signs as needed.
    - Ensure that shoulder plants do not hang into or impede passage along bikeways.

Guidance

Recommended Walkway and Bikeway Maintenance Activities

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

Bicycle Access During Construction

Description

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

Advance warning of the detour should be placed at appropriate locations and clear wayfinding should be implemented to enable bicyclists to continue safe operation along travel corridor. Bicyclists shall not be led into conflicts with mainline traffic, work site vehicles, or equipment.

Application

Detours should be adequately marked with standard temporary route and destination signs (M409a or M4-9c). The Pedestrian/Bicycle Detour sign should have an arrow pointing in the appropriate direction. Detours should comply with bike lane standards; 4-feet minimum, 5-feet desirable, and 6-feet if available. Flexible delineator posts between the rightmost automobile travel lane and the bicycle area can be used when 6-feet are available in the bike area. If shared use, minimum outside shared-lane width of 16-feet.

When existing accommodations for bicycle travel are disrupted or closed in a long-term duration project and the roadway width is inadequate for allowing motor vehicles and bicyclists to travel side-by-side, "share the road" signage (W11-1 and W16-1) should be used to advise motorists of the presence of bicyclists in the travel lane.

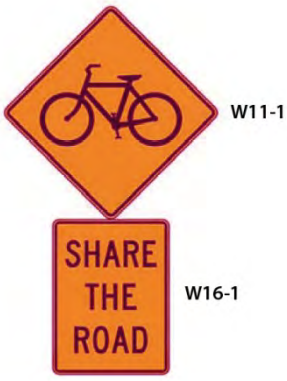
Signs should be places such that they do not block the bicyclist's path of travel and they do not narrow any existing pedestrian passages to less than 1200 mm (48 in).

Design References

- MUTCD – California Supplement
- California Highway Design Manual
- California Highway Design Manual
- Caltrans Traffic Operations Policy Directive 11-01
- Santa Clara County, *County Expressway Bicycle Accommodation Guidelines* (2003)

Examples

National MUTCD



California MUTCD

Arterial Bike Route Signage

Description

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

Many cities around the country have been experimenting with a new type of signage that encourages bicyclists to take the lane when the lane is too narrow. This type of sign is becoming known as BAUFL (Bikes Allowed Use of Full Lane). It can be used where lanes are less than 14 feet wide with no parking and less than 22 feet wide with adjacent parallel parking. The CA MUTCD states that Shared Lane Markings (which serve a similar function as Bikes May Use Full Lane signage) should not be placed on roadways that have a speed limit above 40 mph. Dedicated bicycle facilities are recommended for roadways with speed limits above 40 mph where the need for bicycle access exists.

These types of signs are appropriate on busier streets where shared lane markings are not encouraged (at least to the extent as they are on slower speed shared roadways), such as along segments of El Camino Real, Alma Street, Embarcadero Road, and Oregon Expressway.

Application

Placement:

- At the beginning of the bikeway
- When a bikeway turns (particularly in advance of left turns to allow a bicyclist time to merge for the turn)
- When bikeways intersect
- At intervals of ½ to one mile (based on density of streets) along routes with no designated bicycle facilities.

Design References

- MUTCD – California Supplement
- City of Oakland. 2009. Guidelines for Bicycle Wayfinding Signage

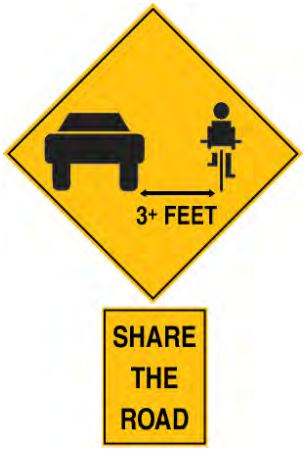
Materials Cost

- Sign, regulation: $150 each

Guidance

R4-11

Share The Road Signs (CA MUTCD)



Utah Share The Road Sign (Missouri Bicycle Federation)

Trail/Shared Use Path Lighting

Description

Lighting improves safety and enables the facility to be used year-round. However, lighting can be detrimental to sensitive habitats and undesired by neighbors. Lighting concerns are minimizing light pollution, maintaining a dark night sky, and protecting the light from vandalism.

Lights should not have a visible source, as it can blind users and pollute the night sky. Globes, acorns, and other light types that are not shielded on the top light the sky and should be avoided. Lights can have screens to avert the glare from neighbors, be programmed to be motion-actuated, or dim or turn off later in the night. Lighting should not be used near sensitive wildlife habitat areas.

Bollards provide an effective mounting location for pathway lighting. Their low height and frequent locations reduce light pollution by keeping the illumination source close to the trail surface. There are many types of lighting bollards available. Solar powered bollards lit by LEDs can last about 20 times longer than incandescent bulbs. Low-level lighting can be problematic due to their easy access for vandalism.

Inlaid lighting are usually dim lights which indicate the extent of the path. They can be artistic and can assist with placemaking on trails.

Solar Lighting can be used where running power to a trail would be costly or undesirable. Benefits include reduced carbon emissions, potential cost reduction of infrastructure and related maintenance, and increased flexibility in lighting design. Examples of existing multi-use trails lit by solar power include trails on the University of Wisconsin campus and the Metropolitan Branch Trail in Washington D.C.

Application

- Any trail built with transportation funding must be open 24/7 and should be lighted.
- Average maintained horizontal illumination levels of 5 lux to 22 lux should be considered (AASHTO). Where special security problems exist, higher illumination levels may be considered.
- The California Energy Commission defines mandatory standards for dark sky compliant lights, including minimum lamp efficacy requirements, cut-off requirements, automatic shutoff controls, and multi-level switching (See California Title 24, Section 6.)
- Light standards (poles) should meet the recommended horizontal and vertical clearances in AASHTO.
- Install fixtures near benches, drinking fountains, bicycle racks, trailheads, and roadway and trail crossings.

Design References

- Caltrans Highway Design Manual (Chapter 1000 Section 1003.1(16))
- AASHTO Guide for the Development of Bicycle Facilities, Chapter 2
- See *VTA Pedestrian Guidelines* Section 4.2B, Table 4.1 for recommended illuminance values for walkways.

Design Example

Bollard lighting can be used along trails to minimize night sky impacts.

Inlaid lightin at the Kansas City Art Institute (source: Bowman Bowman Novic, Inc.

Exhibit 1 Solar lighting is used along the Metropolitan Branch Trail in Washington, D.C. Source: http://www.thewashcycle.com

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Appendix B. Municipal Code Bicycle Parking Recommendations

B.1 Bicycle Parking Design Guidance

Palo Alto Municipal Code Section 18.54.060 discusses specific guidance for types of bicycle facilities. The recommendations are as follows, with recommended additional text in italics and removed text in strikethrough.

1. Short-Term Bicycle Parking ~~(Bicycle Racks)~~

Short-term bicycle parking is intended for shoppers, customers, and visitors who require bicycle storage for up to ~~several~~ *two* hours.

(A) Bicycle Rack

An acceptable bicycle rack is a stationary object to which the bicycle user can lock the frame and one or both wheels of a bicycle with a user-provided high-security U-shaped lock ("U-lock") or cable, and which is either anchored to an immovable surface or is heavy enough that it cannot be easily moved.

i. *Intended Use*

Bicycle racks located in publicly accessible areas are intended for short-term parking, to encourage shoppers, customers, and visitors to use bicycles.

ii. *Performance*

All bicycle racks provided pursuant to this ordinance shall support a bicycle by its frame in a stable upright position with both tires on the ground or floor, without damage to the bicycle *wheels, frame, components,* or its finish *and provide two points of contact with the bicycle's frame or wheel.*[6] The parts of the rack that secure the bicycle shall resist disassembly and cutting with manual tools. Bicycle racks should provide independent access to parked bicycles without the need for awkward movements even when the rack is fully loaded.

2. Long-Term Bicycle Parking

Long-term bicycle facilities are intended for bicyclists who need to park a bicycle and its components and accessories for *two hours or more* ~~extended periods during the day, overnight or for a longer duration~~. Long-term bicycle storage is typically for employees, students, residents and commuters. The facility ~~frequently~~ *should* protect~~s~~ the bicycle from inclement weather *with a free-standing shelter or an indoor cage or room.* ~~Four~~ Design alternatives for these facilities are as follows:

(A) Bicycle Locker

[6] Some popular bicycle racks do not technically comply with the requirement to have two points of contact with the frame; however, these rack designs provide the stability control intent by including the wheel. Specific examples used in Palo Alto include the Bike Arc and the Lightning Bolt racks.

A bicycle locker is a fully enclosed space for one bicycle, accessible only to the owner or operator of the bicycle. It protects the entire bicycle, its components and accessories from theft and inclement weather, including wind-driven rain. Bicycle lockers may be pre-manufactured or may be designed for individual sites.

i. Intended Use

Bicycle lockers are the preferred long-term storage option for employees or residents.

ii. Locking Device

Internal Lock. A bicycle locker must be equipped with an internally mounted key-actuated or electronic locking mechanism, and not lockable with a user-provided lock. Groups of internal-lock bicycle lockers may share a common electronic access mechanism provided that each locker is accessible only to its assigned user.

External Lock. An external-lock such as padlock hasps are not acceptable for most uses. External lock bike lockers may be permitted in shopping centers with the approval of the director on a case-by-case basis.

(B) Restricted-Access Bicycle Enclosure

A restricted-access bicycle enclosure is a locked area containing within it one bicycle rack space for each bicycle to be accommodated, and accessible only to the owners or operators of the bicycles parked within it. The maximum capacity of each restricted-access bicycle enclosure shall be 20 bicycles unless approved by Transportation Division staff. The doors of such enclosures must be fitted with key or electronic locking mechanisms that admit only users and managers of the facility. The enclosure doors must close and lock automatically if released.

~~In multiple-family residential developments, a common locked garage area incorporating bicycle racks shall be deemed a restricted-access bicycle enclosure provided that the garage is accessible only to the residents of the units for whom the garage is provided. In such cases it is preferable that the bicycle storage area within the garage be separately enclosed and secured to enable access only by bicycle owners.~~ (Note: text moved to B.iii.)

i. *Intended Use*

A restricted access enclosure is an alternative long term bicycle storage option for commercial and multifamily residential projects.

ii. Acceptable Racks

Bicycle parking facilities within a restricted-access enclosure can be racks, similar to those provided in short term storage (see previous section). Alternative rack types include wall-mounted racks or two-tier/double decker racks. A usable space two feet wide by six feet long shall be provided for each stored bicycle.

iii. Multi-Family Residential Developments

In multiple-family residential developments, a common locked garage area incorporating bicycle racks shall be deemed a restricted-access bicycle enclosure provided that the garage is accessible only to the residents of the units for whom the garage is provided. In such cases it is preferable that the bicycle storage area within the garage be separately enclosed and secured to enable access only by bicycle owners. The

required bicycle storage and household storage areas for each dwelling unit may be combined into a multifamily dwelling unit storage locker assigned to that unit, provided that the total space requirement shall be the sum of the household storage and bicycle storage requirements computed separately. (Note: text moved from B and C.)

iv. School Bicycle Enclosure

A school bicycle enclosure is a locked area at a primary, middle or secondary school, containing within it one bicycle rack space for each bicycle to be accommodated. The doors of such enclosures must be fitted with locking mechanisms that admit only school and maintenance staff, and must close and lock automatically if released. School bicycle enclosures should be kept locked except during student arrival and departure periods. The student bicycle parking requirement for a school may be provided by two or more enclosures where students arrive on bicycles from two or more points along the school perimeter. (Note: text moved from D).

~~(C) Multifamily Dwelling Unit Storage Locker~~ (Note: text moved to B.iii.)

~~A multifamily dwelling unit storage locker is a locked area separate from the dwelling unit, secured by a lock that can be opened only by the occupants of the respective dwelling unit.~~

~~i. *Intended Use*~~

~~A multifamily dwelling unit storage locker is intended for long-term storage of household possessions that are not kept in the dwelling unit, including bicycles.~~

~~ii. *Configuration*~~

~~In multiple-family developments, the required bicycle storage and household storage areas for each dwelling unit may be combined into a multifamily dwelling unit storage locker assigned to that unit, provided that the total space requirement shall be the sum of the household storage and bicycle storage requirements computed separately. A usable space 2' wide by 6' long shall be provided for each stored bicycle.~~

~~(D) School Bicycle Enclosure~~(Note: text moved to B.iii.)

~~A school bicycle enclosure is a locked area at a primary, middle or secondary school, containing within it one bicycle rack space for each bicycle to be accommodated. The doors of such enclosures must be fitted with locking mechanisms that admit only school and maintenance staff, and must close and lock automatically if released. School bicycle enclosures should be kept locked except during student arrival and departure periods. The student bicycle parking requirement for a school may be provided by two or more enclosures where students arrive on bicycles from two or more points along the school perimeter.~~

B.2 Bicycle Parking Location and Placement Guidance

Palo Alto Municipal Code Section 18.54.060B provides design standards for bicycle parking facilities. The following text presents the Municipal Code language, with recommendations for additions in italics and deletions in strikethrough. The recommendations are intended to clarify design requirements and allow for innovative bicycle parking facility types.

1. Location

~~(A) Neither short-term nor long-term bicycle parking areas shall be located inside occupied buildings.~~

(B) All bicycle parking areas shall be located at street floor level, or equivalent in a parking garage. ~~In underground garages, only long-term bicycle parking is allowed and such bicycle parking facilities must be located near employee elevators or stairwells.~~ (Note: moved to D).

(C) Short-term bicycle parking shall be located *in a well trafficked location visible from the entrance*, *preferably* within 50 feet of a main visitor entrance(s). Where there is more than one building on a site or where a building has more than one main entrance, the short-term bicycle parking must be distributed to serve all buildings or main entrance(s). *The main building entrance excludes garage entrances, trash room entrances, and other building entrances that are not publicly accessible.*

(D) ~~Long-term bicycle parking shall be situated at least as conveniently as the nearest convenient vehicle parking area.~~ *Long-term bicycle parking shall be located on site or within two hundred feet of the main building entrance. The main building entrance excludes garage entrances, trash room entrances, and other building entrances that are not publicly accessible. In underground garages, only long-term bicycle parking is allowed and such bicycle parking facilities must be located near employee elevators or stairwells.* (Note: moved from B).

(E) If required bicycle parking is not visible from the street or main building entrance, a sign must be posted at the main building entrance indicating the location of the bicycle parking.

2. Layout

(A) A bicycle parking space shall be at least two and a half feet in width by six feet in length to allow sufficient space between parked bicycles.

(B) Convenient access to bicycle parking areas shall be provided.

i. Where access is via a sidewalk or pathway, or where the bicycle parking area is next to a street, curb ramps shall be installed where appropriate.

ii. A ~~twenty-four~~ *thirty*-inch side clearance shall be provided between walls or other obstructions and the centerline of the ~~bicycles parked on the~~ nearest bicycle rack. *Large retail uses, supermarkets, grocery stores are encouraged to locate racks with a thirty-six inch clearance in all directions from any vertical obstruction, including but not limited to other racks, walls, and landscaping.*

iii. A minimum four foot aisle shall be provided to allow bicycles to maneuver in and out of the bike parking areas and between rows of bicycle parking facilities. An aisle into which the door of a bicycle locker opens shall be at least five feet wide. Aisle width shall be measured between the rectangular areas that bicycles will occupy when parked on bicycle racks and/or the surface area occupied by bicycle lockers. (Note: text moved from E.)

(C) Bicycle facilities shall be separated from vehicle parking and circulation areas by a physical barrier *such as a curb, wheel stop, pole, bollard, or similar feature capable of preventing automobiles from entering the designated bicycle parking area* ~~or by a distance sufficient to protect parked bicycles from damage by vehicles, including front and rear overhangs of parked or moving vehicles~~.

(D) Covered bicycle parking should be provided as specified below.

i. If more than 10 short-term spaces are required, at least fifty percent (50%) must be covered.

ii. *Short-term bicycle parking facilities serving community activity centers such as libraries and community centers should incorporate weather-protective enclosures shielding the designated bicycle area from typical inclement weather when feasible.*

iii. *Long-term bicycle parking shall be covered.*

~~(E) A four foot (4') wide aisle shall be provided to allow bicycles to maneuver in and out of the bike parking areas and between rows of bicycle parking facilities. An aisle into which the door of a bicycle locker opens shall be at least 5' wide. Aisle width shall be measured between the rectangular areas that bicycles will occupy when parked on bicycle racks and/or the surface area occupied by bicycle lockers.~~ Note: This recommendation was moved to (B. iii).

~~(F) Where a public sidewalk or walkway serves as an aisle of a bicycle parking area and bicycles are parked perpendicular to that sidewalk or walkway, an additional 12" of paved area shall be provided between the sidewalk and the area occupied by adjacent parked bicycles.~~

(G) *Bicycle parking facilities shall not impede pedestrian or vehicular circulation.*

i. *Bicycle parking racks located on sidewalks should be kept clear of the pedestrian through zone.*

ii. Where a public sidewalk or walkway serves as an aisle of a bicycle parking area and the doors of bicycle lockers open toward that sidewalk or walkway, the lockers shall be set back so an open door does not encroach onto the main travel width of the sidewalk or walkway.

3. Paving

Bicycle parking areas shall be paved. Aisles and primary access areas shall be paved with asphalt or concrete. Bicycle parking areas may be surfaced with alternate paving materials as approved by the director.

4. Lighting *and Visibility*

(A) Lighting of not less than one foot-candle of illumination at ground level shall be provided in both exterior and interior bicycle parking areas.

(B) In order to maximize security, whenever possible short-term bicycle parking facilities shall be located in areas highly visible from the street and from the interior of the building they serve (i.e. placed adjacent to windows).

5. Signage

(A) Where bicycle parking areas are not clearly visible to approaching bicyclists, signs shall be posted at the building entrance to direct cyclists to the facilities. (MUTCD sign D4-3 for bicycle parking). For bicycle parking areas intended for visitors, that entrance shall be the building's main entrance. For bicycle parking areas intended for employees, that entrance shall be the employee entrance served by the bicycle parking area.

(B) Long-term bicycle parking areas that incorporate bicycle lockers shall be identified by a sign at least 12"x12" in size that lists the name or title, and the phone number or electronic contact information, of the person in charge of the facility.

(C) Signs for restricted-access bicycle enclosures shall state that the enclosure shall be kept locked at all times.

6. Approval

(A) The director shall have the authority to review the design of all bicycle parking facilities required by this chapter with respect to safety, security, and convenience.

(B) Where bicycle lockers or restricted access bicycle enclosures are required for a use, the director may approve secure bicycle storage facilities providing the same level of security. The Transportation Division must approve bicycle parking areas located in parking garages.

B.3 Development Requirements

The Municipal Code requires bicycle parking by land use, specifying short- and long-term parking requirements as listed in Table B-1.

Table B-1. Minimum Off-Street Bicycle Parking Requirements

Use	Spaces	Parking Type Distribution
Residential Uses		
Single-Family Residential (Primary Unit)	None	N/A
Two-Family Residential (R-2 & RMD)	1 space per unit	100% long term
Multiple-Family Residential	1 space per unit	100% long term
Guest Parking	1 space per 10 units	100% short term
Educational, Religious, and Assembly Uses		
Business and Trade Schools	1 space per 40-person capacity or per 2,500 sf, whichever is greater	40% long term; 60% covered short term
Religious Institutions	1 space per 40 seats or 40-person capacity or per 2,500 sf, whichever is greater	20% long term; 80% covered short term, or as adjusted by the director as part of a conditional use permit
Mortuaries	2 spaces	100% short term
Private Schools and Educational Facilities		
Elementary	1 space per every 5 students	100% short term, enclosed
Grades 6-8	1 space per every 5 students	100% short term, enclosed
Grades 9-12	1 space per every 5 students	100% short term, enclosed
Private Clubs, Lodges, and Fraternal Organizations	1 space per 40 seats or 40-person capacity, based on maximum use of all space at one time	20% long term; 80% short term
Recreation Uses		
Commercial Recreation (health and fitness clubs)	1 space per 16-person capacity, or as adjusted by the director as part of a conditional use permit	20% long term; 80% covered short term, or as adjusted by the director as part of a conditional use permit
Community Facilities (swim club, tennis club, golf course, community centers, etc.)	None specified	None specified
Health Care Services		

Use	Spaces	Parking Type Distribution
Convalescent Facilities	1 space per 25 patient beds	2 long term spaces, remainder short
Hospitals	1 space per 25 patient beds	60% long term; 40% short term
Service Uses		
Animal Care Facilities	1 space per 3,500 sf (1 space minimum)	80% long term; 20% short term
Automobile Dealerships, Services & Service Stations	1 space per 10 employees	100% short term
Day Care Centers	1 space per 6 employees	100% short term
Day Care Homes	None	N/A
Financial Services	1 space per 2,500 sf	40% long term; 60% short term
General Business Services:		
Enclosed	1 space per 2,500 sf	80% long term; 20% short term
Open Lot	1 space per 5,000 sf	100% short term
Personal Services	1 space per 2,000 sf	20% long term; 80% short term
Residential Care Homes	None	N/A
Retail Uses		
Retail:		
Intensive	1 space per 2,000 sf	20% long term; 80% short term
Extensive	1 space per 3,500 sf	20% long term; 80% short term
Open Lot	1 space per 5,000 sf	100% short term
Eating and Drinking Services		
With drive-in or take-out facilities	3 spaces per 400 sf	40% long term; 60% short term
All others	1 space per 600 sf of public service area, plus 1 per 2,000 sf for other areas	None specified
Hotel/Motel/Inn	1 space per 10 guest rooms, plus requirements for accessory uses	100% short term
Shopping Center	1 per 2,750 sf	40% long term; 60% short term
Office Uses		
Administrative Offices:		

Use	Spaces	Parking Type Distribution
In the RP and ROLM districts	1 space per 3,000 sf	80% long term; 20% short term
In all other districts	1 space per 2,500 sf	None specified

Use	Spaces	Parking Type Distribution
Medical, professional, and general business offices		
In the RP and ROLM districts	1 space per 3,000 sf	60% long term; 40% short term
In all other districts	1 space per 2,500 sf	None specified
Manufacturing and Processing Uses		
Manufacturing		
In the RP and ROLM districts	1 space per 3,000 sf	80% long term; 20% short term
In all other districts	1 space per 5,000 sf	None specified
Research & Development		
In the RP and ROLM districts	1 space per 3,000 sf	80% long term; 20% short term
In all other districts	1 space per 2,500 sf	None specified
Warehousing & Distribution		
In the RP and ROLM districts	1 space per 3,000 sf	80% long term; 20% short term
In all other districts	1 space per 10,000 sf	None specified
All other uses		
	To be determined by the director	

Source: Palo Alto Municipal Code Section 18.52.040 Table 1.

Appendix C. BTA Requirements Checklist

The Bicycle Transportation Account (BTA) is the most common source of bicycle facility funding in the State of California. BTA funds can fund City projects that improve safety and convenience for bicycle commuters. In order for Palo Alto to qualify for BTA funds, its Master Plan must contain specific elements. **Table C-1** shows the requisite BTA components and their location within this plan. The table includes "Approved" and "Notes/Comments" columns for the convenience of the Caltrans official responsible for reviewing compliance.

Table C-1: BTA Requirement Checklist

Approved	Requirement	Page(s)	Notes/Comments
	Existing and future bicycle commuters	B-3 and B-4	See Tables B-2 and B-3.
	Land-use map/population density	3-21	Map 3-3
	Existing and proposed bikeways	3-21 and 6-3	Maps 3-3 and 6-1
	Existing and proposed bicycle parking facilities	3-26 and 5-12	Sections 3.4 and 5.2.10
	Existing and proposed multi-modal connections	5-4 and 6-10	Sections 5.1.4 and 6.1.6
	Existing and proposed facilities for changing and storage	3-26 and 5-12	Sections 3.4 and 5.2.10
	Bicycle safety and education programs	3-31 and 5-23	Sections 3.5.3 and 5.4
	Citizen and community involvement	1-4 and C-1	Section 1.5 and Appendix D
	Consistency with transportation, air quality, and energy plans	1-2 and D-1	Section 1.4 and Appendix E
	Project descriptions / priority listings	7-3	Table 7-1
	Past expenditures and future financial needs	7-24	Section 7.3

Demand and Benefits Model

A key goal of this Plan is to maximize the number of pedestrians and bicyclists in order to realize multiple benefits, including improved health, less traffic congestion, and better air quality levels. In order to achieve this, a better understanding of the number of existing and potential pedestrians and bicyclists is needed. The US Census collects only the primary mode of travel to work and it does not consider trips made by walking or bicycling when they are a component of a transit trip or if they are to school or for any non-work reason. Alta Planning + Design has developed a demand model that estimates usage based on available empirical data.

Calculations are included in this Plan to meet Caltrans Bicycle Transportation Account (BTA) requirements to provide "the estimated number of existing bicycle commuters in the Plan area and the estimated increase in the number of bicycle commuters resulting from implementation of the Plan." BTA compliance is important to Palo Alto's bicycle and pedestrian plan in order to grant proposed projects eligibility for funding from the State of California's BTA (approximately $7.2M, annually).

The model uses a market segment approach to estimate the number of bicycling or walking trips taken by populations that traditionally have a higher bicycle/walking mode split than work commuters (such as elementary school and college students). National transportation surveys, in particular the *National Household Travel Survey* (NHTS, 2009), have shown that commute trips are only a fraction of total trip an individual takes on a given day. The model uses the NHTS findings to estimate the number of non-work, non-school trips taken by commuters to determine the number of walking or bicycling trips that occur in a day.

Data Used in the Model

Journey-to-work information collected by the US Census Bureau's *American Communities Survey* (ACS) is the foundation of this analysis. The most recent ACS data available for the City of Palo Alto is the 2005-2009 five-year estimate. Model variables from the ACS include total population, employed population, school enrollment, and travel-to-work mode split.

The 2009 NHTS provides a trip type multiplier to estimate the number of utilitarian walking and bicycling trips made for non-commute reasons, such as shopping and running errands. Although these trips cannot be directly attached to a certain group of people (not all of the utilitarian bicycling trips are made by people who bicycle to work) these multipliers allow a high percentage of the community's walking and bicycling activity to be captured in an annual estimate.

Where available, local data were incorporated into this analysis. The VTA *2005-2006 On-Board Passenger Survey Final Report* states that 71 percent of passengers access transit by walking, while three percent bicycled. Data from the City/School Traffic Safety Committee, City/School Liaison, and Safe Routes to School Task Forces indicate that the average walking mode split to school is 23 percent, while the average bicycling mode split is 17 percent.

Existing Walking and Bicycling Trips

Table C-2 shows the results of the model, which estimates that almost 17,000 bicycle trips and more than 30,000 walking trips occur in Palo Alto each day. Based on the model assumptions, the majority of trips are non-work utilitarian trips, which include medical/dental services, shopping/errands, family personal business, obligations, transport someone, meals, and other trips.

Table C-2: Estimate of Current Walking and Bicycling Trips in Palo Alto

	Bicycling	Walking	Source
Commute Trips *(includes walking, bicycling, and walking or bicycling to transit trips)*			
Bicycle/ walking commuters	1,918	1,533	ACS 2005-2009
Weekday bicycle/walking trips	3,836	3,066	Number of walk or bike commuters multiplied by two for return trips
Total transit commuters	1,123		ACS 2005-2009 (Includes bus and Caltrain)
Bike- or walk-to-transit mode split	3%	71%	VTA 2005-2006 On-Board Passenger Survey Final Report
Bike- or walk-to-transit commuters	34	797	Number of transit commuters multiplied by mode split
Weekday bike- or walk-to-transit commute trips	67	1,595	Number of walk- or bike-to-transit commuters multiplied by two for return trips
Weekday bicycle/ walking commute trips	3,903	4,661	Number of commuters multiplied by two for return trips
School Trips			
K-12 bicycle/ walking commuters	2,341	3,167	School children population multiplied by mode split
Weekday K-12 bicycle/ walking trips	4,681	6,334	Number of student bicyclists multiplied by two for return trips
College Trips			
College bicycle/ walking commuters	986	242	Total full-time graduate and undergraduate enrollment (8,352) divided by 2007 university mode split (2.9% walk; 11.8% bicycle). Source: http://ucomm.stanford.edu/cds/2010.html
Weekday bicycle/ walking college trips	1,971	484	Number of college student bicyclists multiplied by two for return trips
Utilitarian Trips			
Daily adult bicycle/walking commute trips	5,874	5,145	Number of bicycle/walking trips plus number of bicycle/walking college trips
Daily bicycle/walking utilitarian trips	9,201	18,086	Utilitarian bicycle/walking trips multiplied by ratio of utilitarian to work trips (NHTS). Distributes weekly trips over entire week (vs. commute trips over 5 days)
Total Current Daily Trips	***19,757***	***29,565***	

Potential Future Walking and Bicycling Trips

Estimating future benefits requires additional assumptions regarding Palo Alto's future population and anticipated commuting patterns in 2035. The *Valley Transportation Plan* 2035 notes the Association of Bay Area Governments' (ABAG) projections for 27 percent population growth and 46 percent employment growth in Santa Clara County. The model uses these estimates to calculate the future conditions in Palo Alto. While the walking and bicycling mode splits would likely increase due to the improvements recommended in this Plan, they were kept the same for comparison purposes. **Table C-3** shows the projected future demographics used in the future analysis.

Table C-3: Estimate of Future 2035 Walking and Bicycling Trips in Palo Alto

	Bicycling	Walking	Source
Commute Trips			
Bicycle/ walking commuters	2,800	2,238	Employed population from VTA *Valley Transportation Plan* multiplied by mode split, (ACS 2005-2009)
Transit commuters	1,640		Ratio from ACS 2005-2009
Access to transit	3%	71%	VTA 2005-2006 On-Board Passenger Survey Final Report
Walk- or bike-to-transit commuters	49	1,164	Number of transit commuters multiplied by mode split
Weekday transit bicycle /walking commute trips	98	2,328	Number of transit bicycle/walking commuters multiplied by two for return trips
Weekday bicycle/ walking commute trips	5,699	6,805	Number of commuters multiplied by two for return trips
School Trips			
K-12 bicycle/ walking commuters	2,025	2,740	School children population multiplied by mode split
Weekday K-12 bicycle/ walking trips	4,050	5,479	Number of student bicyclists multiplied by two for return trips
College Trips			
College bicycle/ walking commuters	1,252	308	Employed population multiplied by commute mode split
Weekday bicycle/ walking college trips	2,503	615	Number of college student bicyclists multiplied by two for return trips
Utilitarian Trips			
Daily adult bicycle/walking commute trips	8,202	7,420	Number of bicycle/walking trips plus number of bicycle/walking college trips
Daily bicycle/walking utilitarian trips	12,847	26,082	Utilitarian bicycle/walking trips multiplied by ratio of utilitarian to work trips (NHTS). Distributes weekly trips over entire week (vs. commute trips over 5 days)
Total Future Daily Trips	***25,099***	***38,981***	

Appendix D. Public Outreach and Survey Summary

This appendix presents the community outreach conducted as part of this Bicycle and Pedestrian Plan. Outreach included the following components:

- Two meetings with Palo Alto Pedestrian and Bicycle Advisory Committee
- Two meetings with City/School Traffic Safety Committee
- Two meetings with the Planning and Transportation Commission
- Two presentations to City Council, including a Bicycle Tour
- Two Public Workshops
- One Online Survey with 515 responses
- Ongoing information and past presentations via Palo Alto Bicycle Program website and six-week public draft plan review period (plan and comments supplied/received) via dedicated (Alta-hosted) website

Each component provided essential data and information that informed the recommendations in this plan, as described in the following sections.

Pedestrian and Bicycle Advisory Committee

The Palo Alto Pedestrian and Bicycle Advisory Committee (PABAC) is a citizen advisory committee that reports to the Chief Transportation Official. PABAC members have interest in or knowledge of pedestrian and bicycling issues. PABAC's role is to review all issues related to walking and bicycling in the areas of engineering, enforcement, education, and encouragement.

During the development of this Plan, the consultant and City staff met with PABAC twice. PABAC provided input on the goals and objectives of this plan at the first meeting and on the recommendations at the second meeting.

Public Meetings

The public was actively engaged in the development of this plan. In addition to attending PABAC meetings, the public provided input on the policy and design priorities of this plan at an open house held in March 2011 and during a public review session of the draft BPTP in July 2011.

Community Survey

A community survey was administered in March and April 2011. The survey was available online and promoted via email list distributions and press release. Five hundred fifteen people responded to the survey and 457 of those respondents completed the questionnaire in its entirety. The questionnaire asked 39 questions regarding bicycle and pedestrian behavior, frequency and facility preference. Questions were phrased in stated preference and open-ended responses.

The following sections present the results of the most informative questions. Stated-preference questions are presented as response rates, which were calculated by the number of respondents that answered a question, not the total number of survey respondents. Some stated-preference questions permitted respondents to select multiple answers and therefore their response rate totals may exceed 100 percent. Responses to open-ended questions are presented in "wordclouds" to provide a sense of the most frequently cited words.[7]

Respondent Profile

Most respondents were between the ages of 35 and 64 (69 percent) and evenly split between males and females. Eighty eight percent of respondents live in Palo Alto and 62 percent work in Palo Alto.

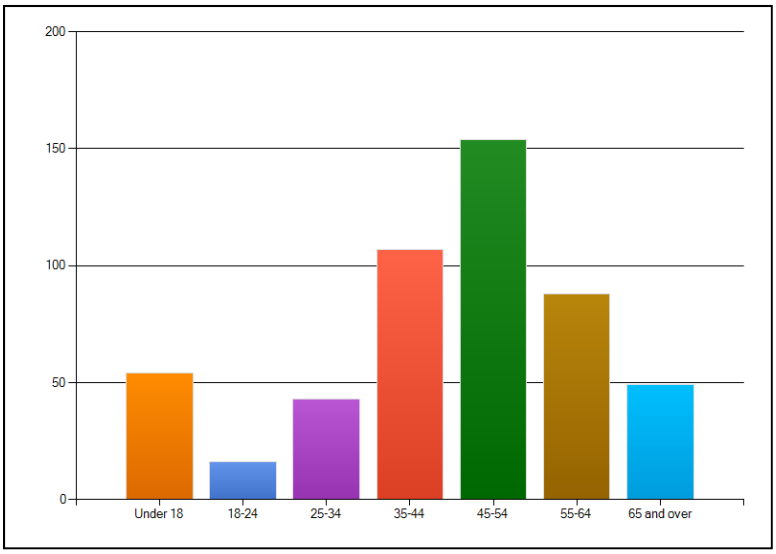

Figure D-1: Age of Respondents

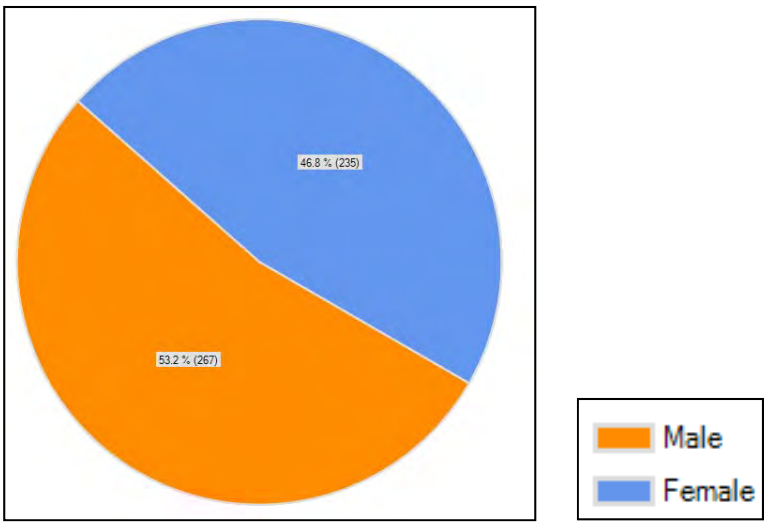

Figure D-2: Gender of Respondents

[7] Wordclouds are groupings of frequently cited words sized by citation frequency to create a visually stimulating graphic that provides a general sense of the question results.

Bicycling Confidence

Most respondents indicated having moderate to high confidence levels when riding a bicycle. Forty five percent of respondents are comfortable riding in most traffic situations regardless of the presence or type of bicycle facilities. Thirty two percent of respondents are comfortable riding in some traffic situations if appropriate bicycle facilities were provided.

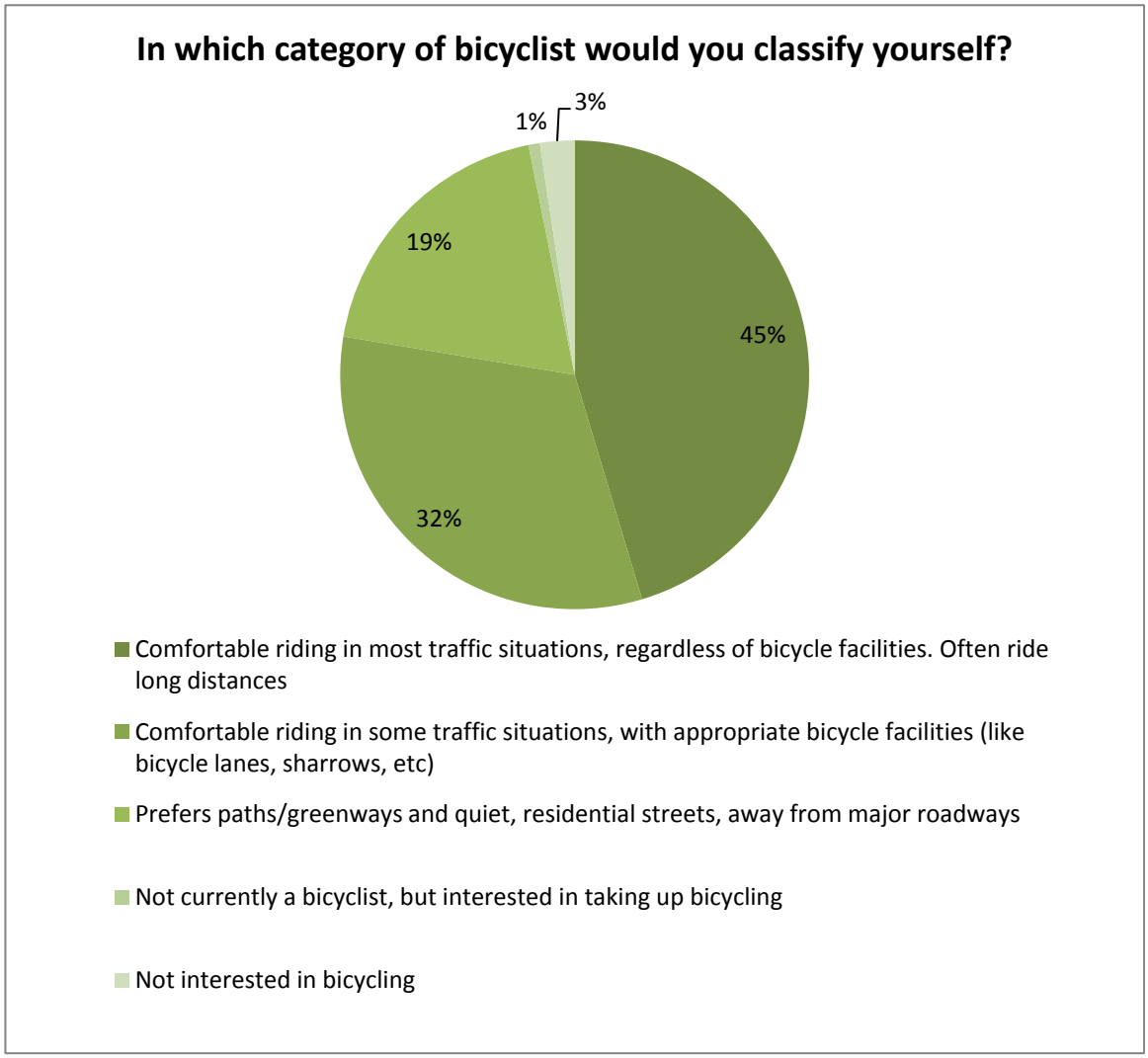

Figure D-3: Bicycling Confidence

Bicycling Frequency

The majority of respondents bicycle at least two to three times a week and three percent of respondents did not ride a bicycle. Respondents that bicycle infrequently or two to three times a month (22 percent) represent a part of the population that will potentially bicycle more if the City provides additional facilities.

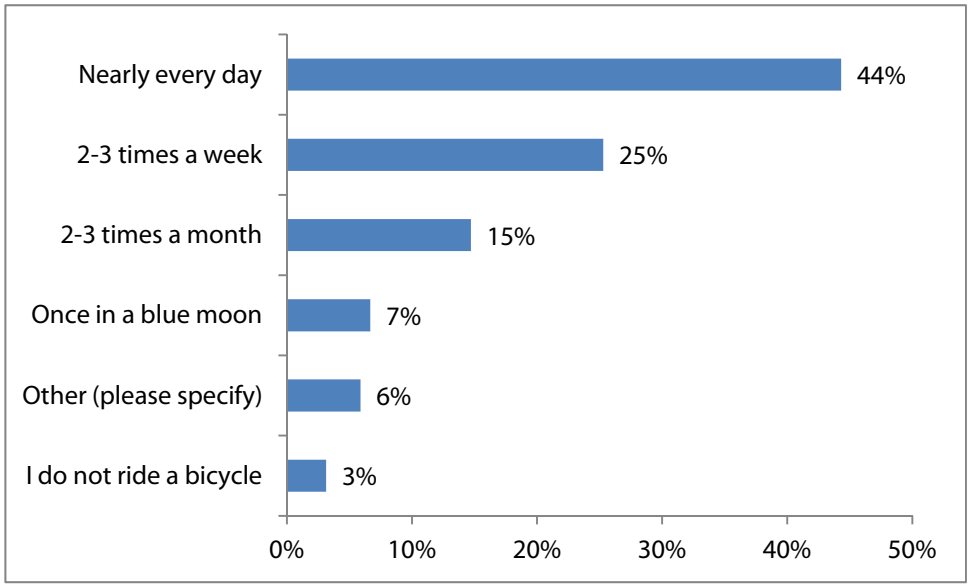

Figure D-4: Bicycling Frequency

Bicycling Trip Purpose

Overall, most respondents bicycle to get to and from work. Bicycling to and from school and for health/fitness were the second and third most popular trip purposes, with an even distribution of ages bicycling for health/fitness. The overwhelming majority (85 percent) of respondents under 18 years of age bicycle to get to and from school. **Figure D-5** presents the complete response results.

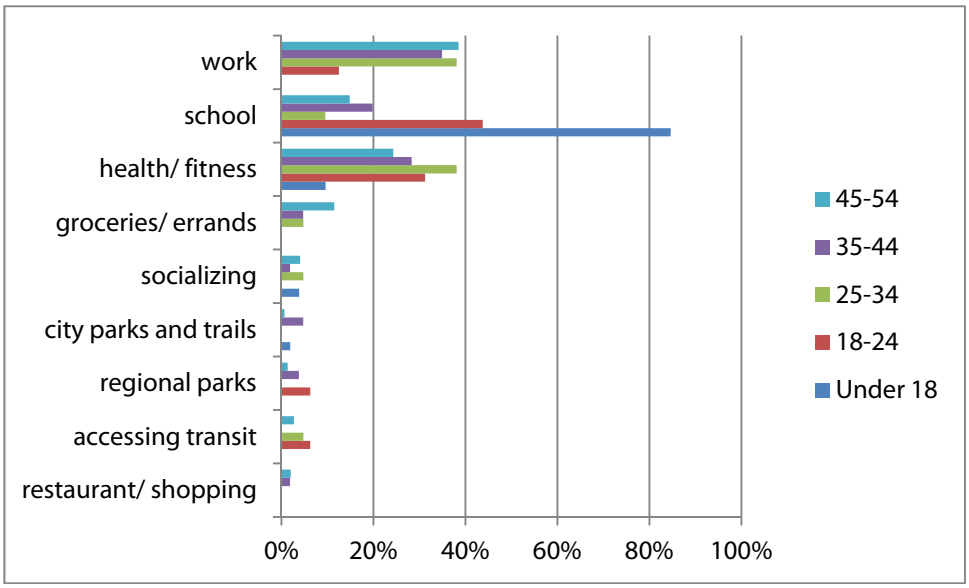

Figure D-5: Bicycling Trip Purpose

Cycletrack Preference

The majority (61 percent) of respondents would definitely feel safer riding on a cycletrack than in a bicycle lane and another 22 percent of respondents would probably feel safer. **Figure D-6** presents the complete results of this question.

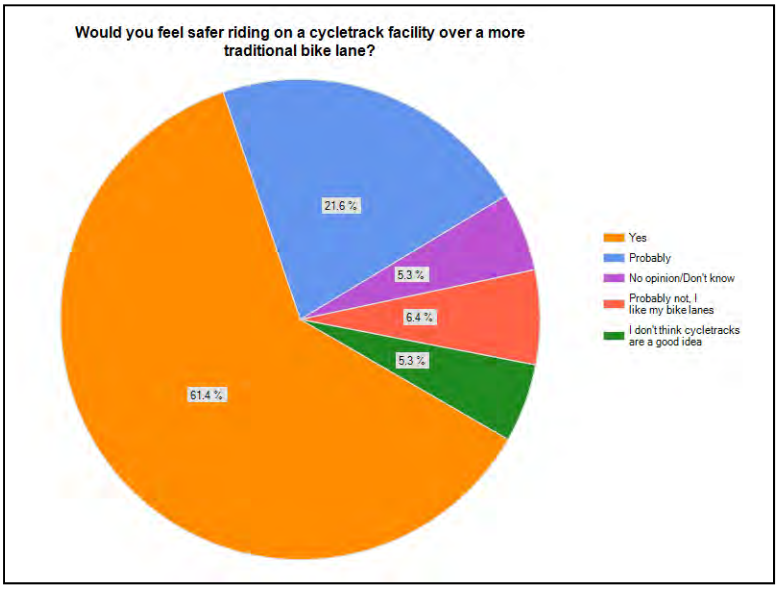

Figure D-6: Cycletrack Preference

A comparison of cycletrack preference and respondent bicycling confidence reveals preference for cycletracks regardless of confidence level. Seventy five percent of bicyclists who are comfortable riding in some traffic situations in addition to 49 percent of bicyclists that are comfortable riding in most traffic situations would definitely feel safer in using a cycletrack.

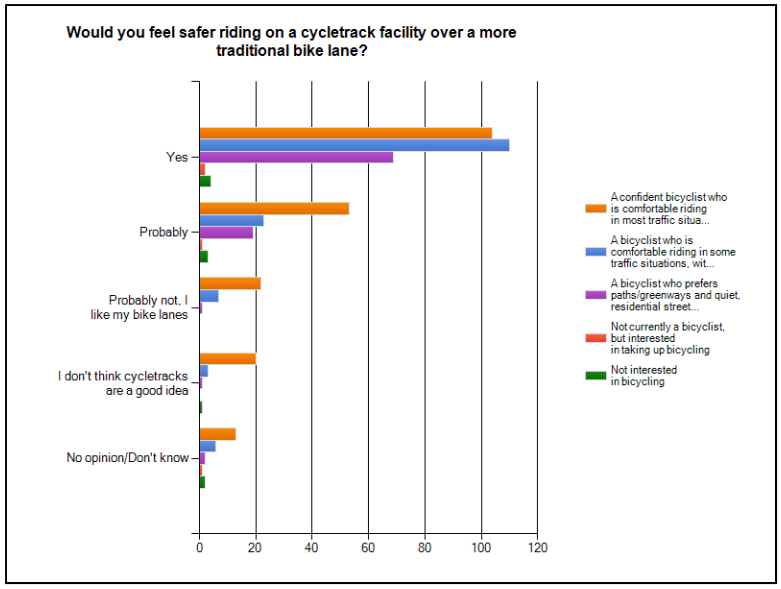

Figure D-7: Cycletrack Preference by Respondent Bicycle Confidence

When asked what streets are good candidates for cycletracks, 26 and 24 percent of people who responded to this question cited El Camino Real and Middlefield Road, respectively.

Desired Locations for Green Bike Lanes

Respondents were asked to identify locations where they would like to see green bike lanes. Of the 233 respondents to this question, 25 percent would like to see green bike lanes on El Camino Real and many of these respondents specifically identified El Camino Real at Embarcadero. Forty-four percent of respondents identified Page Mill with many citing the 280 interchange as the most desired location for green bike lanes. **Figure D-8** presents the most cited roadways for green bike lanes.

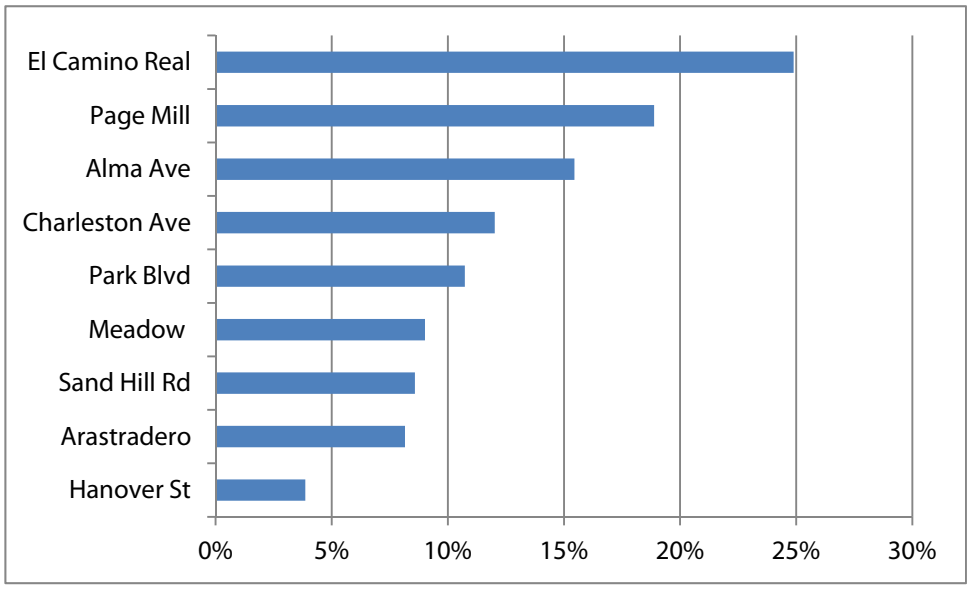

Figure D-8: Desired Locations for Green Bike Lanes

Desired Location for Bike Boxes

Respondents were asked to identify desired locations for bike boxes. Of the 190 respondents to this question, 17 percent cited various intersections on Middlefield Road including El Camino Real, San Antonio, California, and East Meadow. **Figure D-9** presents the most cited roadways where respondents desire bike boxes. Most respondents cited "major intersections" for all of the roadways.

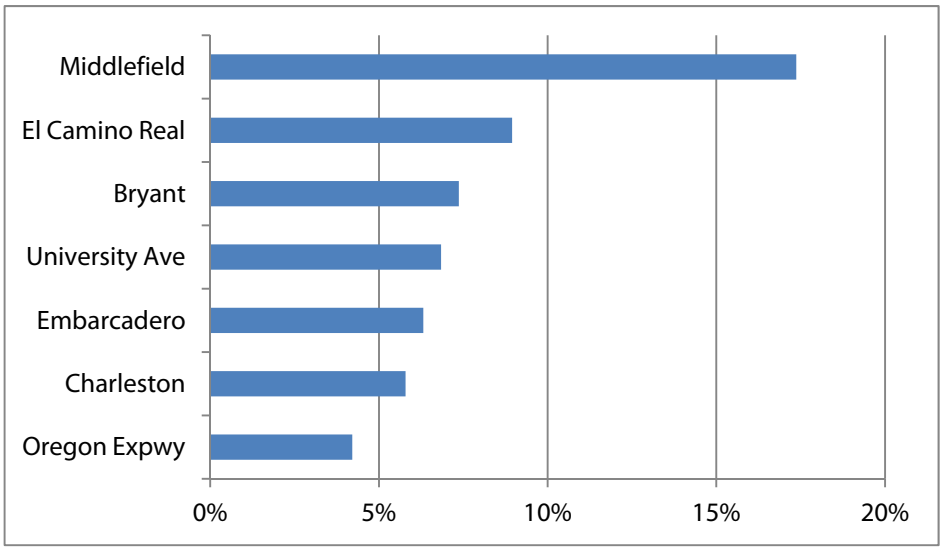

Figure D-9: Desired Locations for Bike Boxes

Back-In Angled Parking Preference

Fifty-four percent of respondents would definitely support a back-in angled parking pilot program and another 20 percent would probably support such a program.

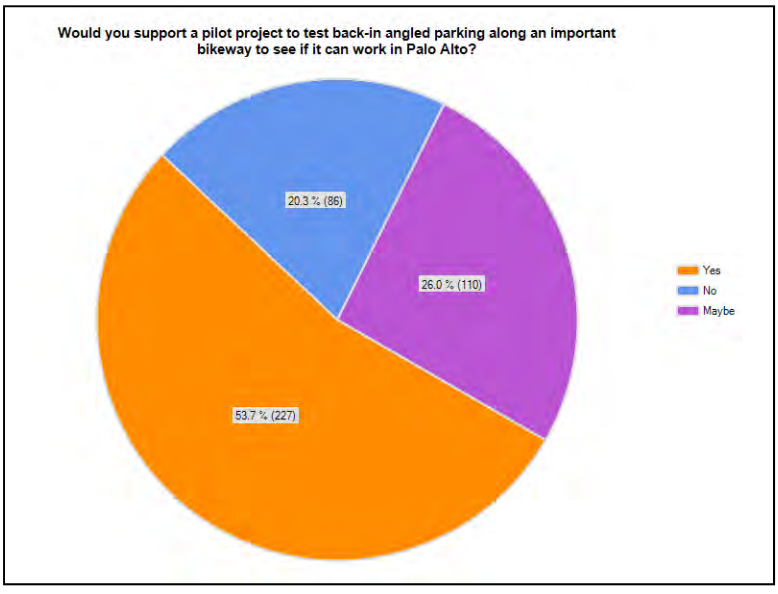

Figure D-10: Back-In Angled Parking Preference

Desired Locations for Bike Parking

Forty-two percent of the 233 respondents to this question would like to see more bike parking along California Avenue. Thirty and 27 percent of respondents would like to see more bike parking in the downtown area and along University Avenue, respectively. **Figure** D-11 presents a wordcloud of desired bike parking locations sized by citation frequency, in which the font size is related to the frequently with which the words were mentioned.

Figure D-11: Desired Locations for Bike Parking Wordcloud

Walking Trip Purpose

Thirty five percent of respondents most commonly walk for health/fitness. Other common trip purposes (cited by 10 to 20 percent of respondents each) include restaurant/shopping, grocery/errands, city parks/trails and schools. A comparison of trip purpose and age reveals that older respondents walk mostly for health/fitness while younger and college-aged respondents walk to get to and from school. **Figure** D-12 presents the complete results on why people walk in Palo Alto.

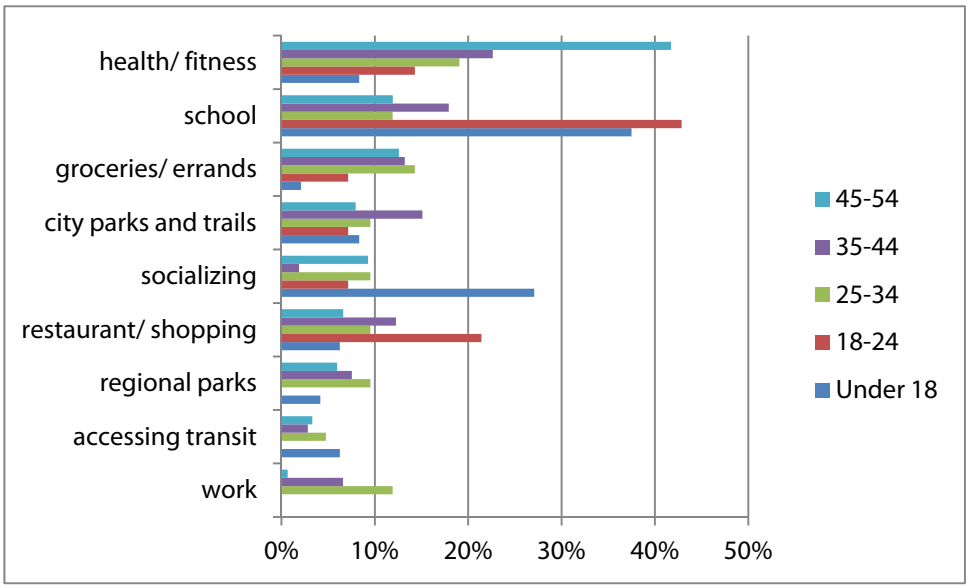

Figure D-12: Walking Trip Purpose by Age

Desired Walking Frequency

Sixty percent of respondents would like to walk more than they currently do. Of these respondents, 54 percent rate "pedestrian countdown signals" and 51 percent rate "more visible" crosswalks as very important.

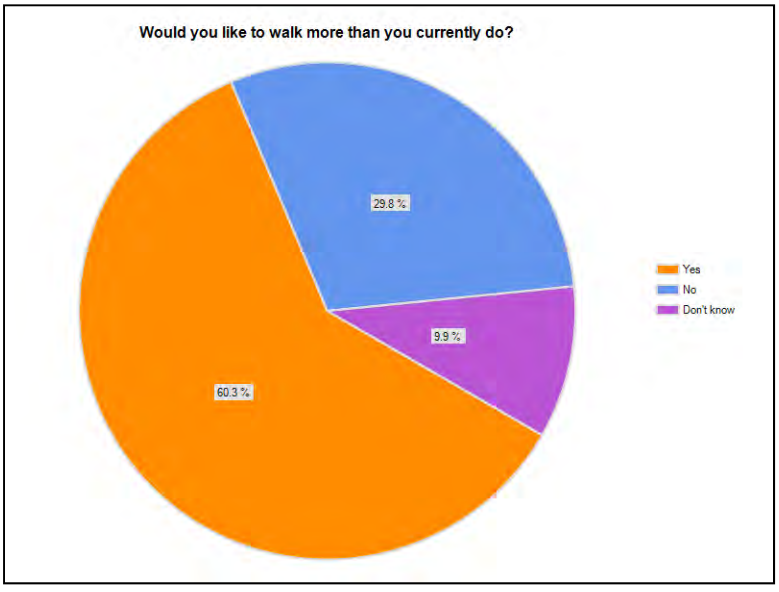

Figure D-13: Desired Walking Frequency

Importance of Pedestrian Improvements

Respondents feel that crossing improvements are "very important." Fifty-four percent and 47 percent of respondents feel that pedestrian countdown signals and crosswalks that are more visible are very important,

respectively. While decorative crosswalks are a crossing improvement, 35 percent of respondents cited them as not important.

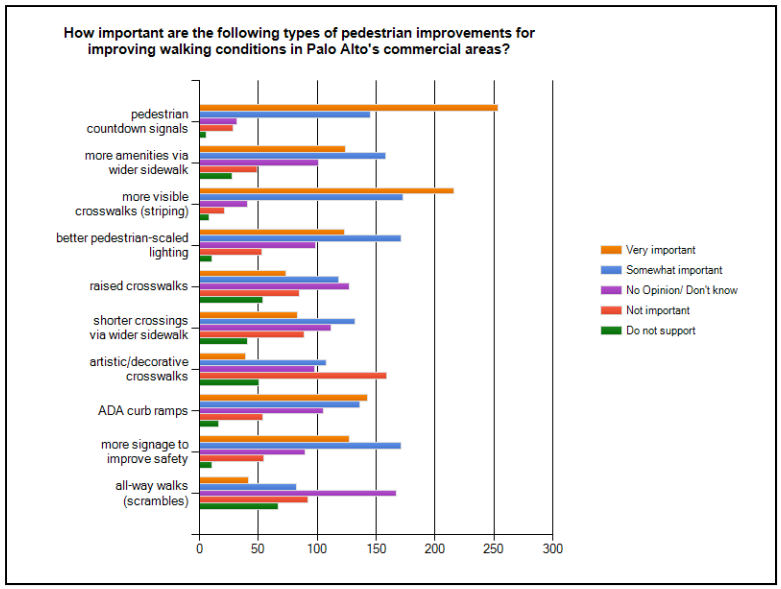

Figure D-14: Importance of Pedestrian Improvements

Location of Preferred Pedestrian Improvements

Respondents were asked to identify preferred pedestrian improvements and locations for those improvements within the downtown or commercial areas. Respondents cited University Avenue the most, followed by El Camino Real, California Avenue, and Middlefield Road. **Figure** D-15 presents a wordcloud of the response results, which sizes words according to citation frequency.

Respondents cited motorist speeding, red light running and failure to yield to pedestrians as frequently occurring on all of the aforementioned streets. In addition, respondents cited that the sidewalks on these streets are too narrow.

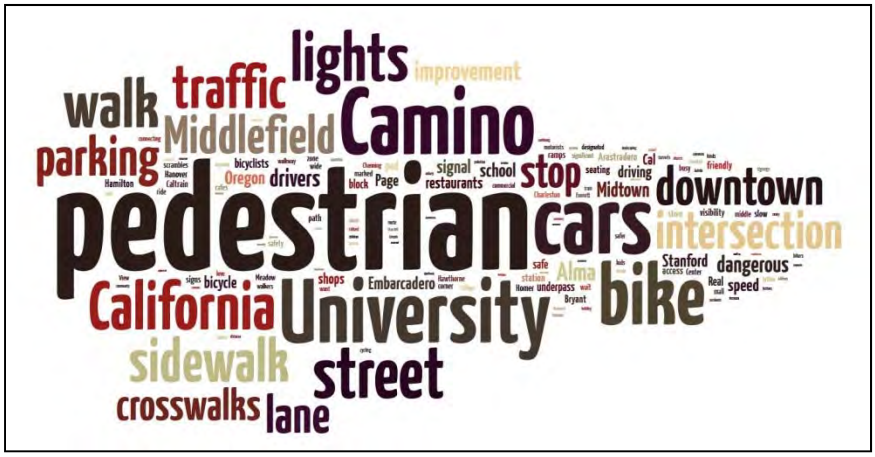

Figure D-15: Location of Preferred Pedestrian Improvements Wordcloud

Importance of Off-Street Trail Improvements

Sixty-one percent of respondents feel that expanding the trail network is very important. Respondents also feel that better street crossings and pavement resurfacing are important improvements while widening existing trails is the least important improvement. **Figure** D-16 presents the complete results of this question.

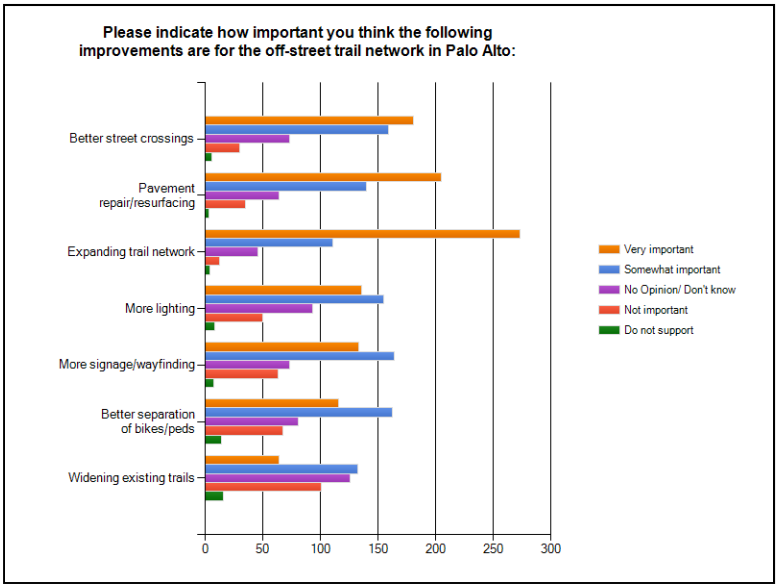

Figure D-16: Importance of Trail Improvements

Importance of Bicycle Facility Improvements

The most respondents (48 percent) feel that expanding the bicycle network should be the City's highest priority when improving bicycle facilities. **Figure** D-17 presents the complete results to this question.

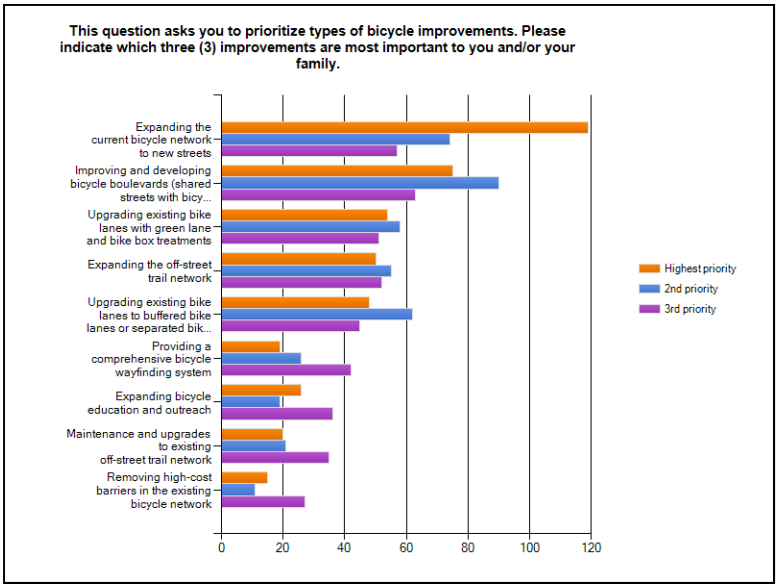

Figure D-17: Importance of Bicycle Facility Improvements

Transit Use Frequency

Of the 56 percent of respondents that answered this question, 75 percent rode Caltrain in the two weeks prior to completing the questionnaire. **Figure** D-18 presents the complete results to this question.

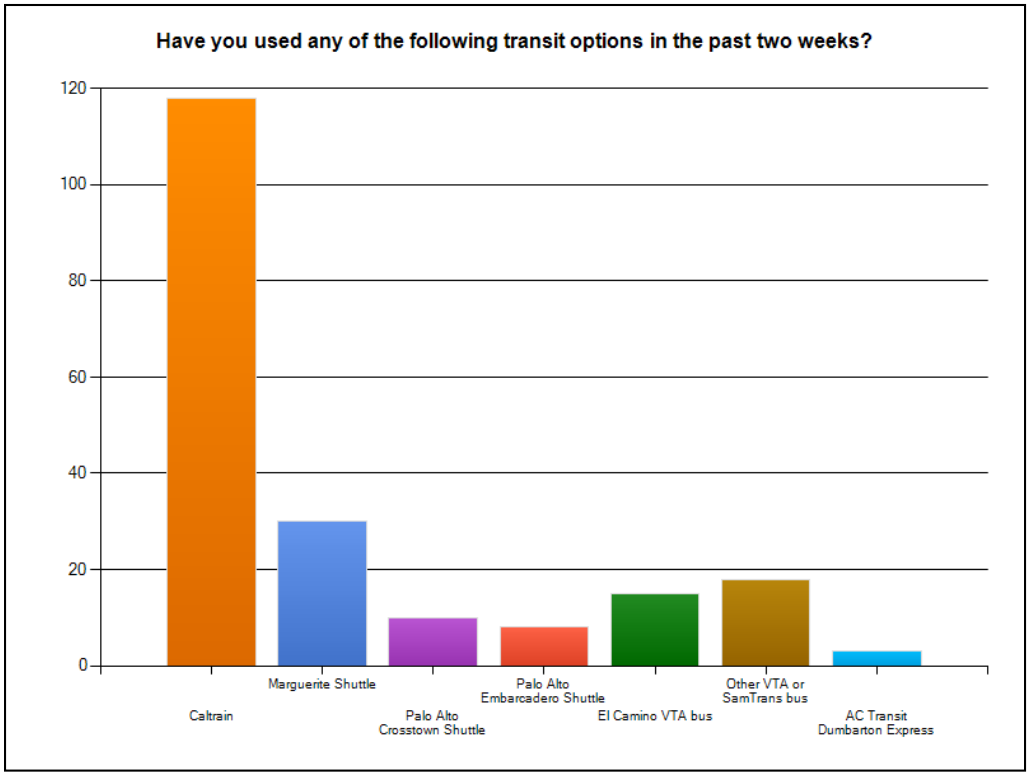

Figure D-18: Transit Use Frequency

Appendix E. Policy and Plan Framework

Planning Overview

The Bicycle and Pedestrian Transportation Plan is influenced by a number of existing plans, policies, and programs that are highly supportive of non-motorized travel and integrated planning. This appendix is a resource summary and select index of those documents and initiatives.

E.1.1 Federal

Numerous plans and policies at the Federal, State, Bay Area and County level guide bicycle and pedestrian planning. These various frameworks establish priorities that can directly influence and show support for non-motorized investments within the City of Palo Alto. The most relevant technical guidelines that directly affect bicycle and pedestrian facility planning and design are also included.

Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations (March 2010)

This official United States Department of Transportation (DOT) Policy Statement reflects and clarifies the Department's support for the development of fully integrated active transportation networks, and emphasizes the multiple benefits of walking and bicycling. Although not associated with new or modified federal programs or guidelines, the statement does encourage specific actions for improving bicycling and walking conditions, including considering bicycling and walking as equals with other transportation modes, avoiding minimum standards for bicycle and pedestrian facilities, where feasible, in anticipation of future growth in demand, and collecting data on walking and biking trips.

Manual on Uniform Traffic Control Devices (MUTCD) - (2009)

The *Manual on Uniform Traffic Control Devices* (MUTCD), which is administered by the Federal Highway Administration (FHWA), is a compilation of national standards for all traffic control devices, including road markings, highway signs, and traffic signals. It is updated periodically to accommodate the nation's changing transportation needs and address new safety technologies, traffic control tools and traffic management techniques. The MUTCD, the most recent version of which was published in December 2009, includes a separate chapter (Chapter 9) on traffic control standards and guidelines specific to bicycle facilities.

American Association of State Highway and Transportation Officials (AASHTO) - Guide for the Planning, Design, and Operation of Bicycle Facilities (2010 Draft)

Although the principle design reference document published by the American Association of State Highway and Transportation Officials (AASHTO) is often considered A Policy on Geometric Design of Highways and Streets (5th Edition), the Guide for the Planning, Design, and Operation of Bicycle Facilities has emerged as the more relevant and defining publication for technical issues dealing with bicycle facilities. This document - first published in 1981, revised in 1999, and currently making its way through a significant update process – is intended as a design resource for "proven and tested" national best practices in bicycle design. New elements

incorporated into the current draft include guidance on the use of shared lane markings, or "sharrows," and additional information on the design of shared use (bicycle and pedestrian) facilities.

E.1.2 State

A lot has changed at the statewide policy level since the development of Palo Alto's 2003 Bicycle Transportation Plan. Since 2006, the state legislature has signed into law three bills that directly and indirectly support bicycle facility development: the Global Warming Solutions Act, the Sustainable Communities Act, and the Complete Streets Act. Additionally, Caltrans adopted Deputy Directive 64-R-1, which directs Caltrans to provide for bicyclists and pedestrians in all roadway projects.

Assembly Bill 32: Global Warming Solutions Act (2006)

The 2006 Global Warming Solutions Act sets discrete actions for California to reduce greenhouse gas (GHG) emissions to 1990 levels by 2020, which represents a 25% reduction statewide. These actions focus on increasing motor vehicle and other sector efficiencies, and include identification of bicycling as one of several strategies to reduce California's emissions that contribute to global warming.

Senate Bill 375: Sustainable Communities (2008)

Put simply, SB 375 directly links land use planning with greenhouse gas emissions. The law requires the California Air Resources Board to set emissions reduction goals for metropolitan planning organizations. The GHG reduction targets for the Bay Area (adopted in September 2010) are a 7 percent reduction in per capita emissions by 2020 and 15 percent by 2035. Significant reductions in vehicle miles traveled (VMT) is also one of the targets of SB375, which is necessary to meet the state's emission reduction goals.

A Joint Policy Committee comprised of the Association of Bay Area Governments (ABAG), the Metropolitan Transportation Commission (MTC), Bay Area Air Quality Management District, and Bay Conservation and Development Commission is developing the Sustainable Communities Strategy (SCS), pursuant to SB 375. The SCS will include land use and transportation strategies that will allow the region to meet its GHG reduction targets, and will guide the Regional Housing Needs Allocation, the Regional Transportation Plan, and the Regional Transportation Improvement Program. Once those plans are in place, SB 375 will also relax California Environmental Quality Act (CEQA) requirements for certain projects that implement the region's Sustainable Communities Strategy.

Assembly Bill 1358: Complete Streets (2008)

AB 1358 requires the legislative body of any city or county, upon revision of a general plan or circulation element, to ensure that streets accommodate all user types, e.g. pedestrians, bicyclists, transit riders, motorists, children, persons with disabilities, and elderly persons. This requirement took effect as of January 1, 2011, meaning it applies to the Palo Alto Comprehensive Plan update process. The Bicycle and Pedestrian Transportation Plan will help clarify and expand measures to "accommodate" non-motorized users in Palo Alto.

Caltrans Deputy Directive 64-R1: Complete Streets (2008)

Similar to AB 1358, the California Department of Transportation Complete Streets Directive provides guidance for transportation facilities under state jurisdiction. The Directive codified the Department's intention to integrate motorized, transit, pedestrian and bicycle travel by creating complete streets that provide safe travel for all road users, beginning early in system planning and continuing through project delivery and maintenance and operations. In and around Palo Alto there are three such facilities – State Highways 101 and 82 (El Camino Real), and Interstate 280 to the west.

California Manual On Uniform Traffic Control Devices (CMUTCD – 2011 Draft)

This California Manual on Uniform Traffic Control Devices (California MUTCD) is published by the State of California Department of Transportation (Caltrans) and is issued to adopt uniform standards and specifications for all official traffic control devices in California, in accordance with Section 21400 of the California Vehicle Code. The California MUTCD uses a format similar to the national MUTCD. It incorporates FHWA's MUTCD in its entirety and explicitly shows which portions thereof are applicable or not applicable in California.

Caltrans Highway Design Manual

The Highway Design Manual (HDM) is currently being updated. The document provides detailed guidance related to planning and design of roadways, including bicycle and pedestrian facilities. Chapter 1000 discusses bikeway planning and design. A draft version is available online: (www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm).

California Vehicle Code, Streets and Highways Code

- The California Vehicle Code (CVC) regulates many aspects of transportation within the state, particularly vehicle use and registration, and enumerates the powers and duties of the Department of Transportation (Caltrans). Division 11 of the code also provides the legal framework, or "rules of the road," for motor vehicles, bicycles, and pedestrians operating on public roadways in California.
    - CVC Section 21200 – 21212 deals specifically with bicycle use and establishes that all persons riding a bicycle are considered "vehicles," subject to most rules and regulations provided elsewhere in the Vehicle Code. This includes the right to access all state highways except where bicycles are specifically excluded by official signage for the safety of all users, and the obligation to signal at all turns.
    - CVC Section 21949-21971 deals with pedestrian rights and responsibilities. It declares "safe and convenient pedestrian travel and access, whether by foot, wheelchair, walker, or stroller" a right of all state residents and establishes priority right-of-way for pedestrians crossing within "any marked crosswalk or within any unmarked crosswalk at an intersection" with few exceptions.
- The Streets and Highways Code enumerates additional provisions for the definition, use, administration, and financing of the state's highway and public transportation rights-of-way. Chapter 8 is concerned with non-motorized transportation, and further establishes the purpose and

administrative requirements for the Bicycle Transportation and Pedestrian Safety Accounts – programs dedicated to funding non-motorized improvements.

  - Section 890 – 894.2 includes the definition of three specific classes of "bikeway" facilities: a.) Class I bikeways, which provide a completely separated right-of-way designated for the exclusive use of bicycles and pedestrians with crossflows by motorists minimized. (b) Class II bikeways, such as a "bike lane," which provide a restricted right-of-way designated for the exclusive or semiexclusive use of bicycles, but with vehicle parking and crossflows by pedestrians and motorists permitted. (c) Class III bikeways, namely on-street "bike routes," which provide a right-of-way designated by signs or permanent markings and shared with pedestrians or motorists.

- Section 891.2 of the Bicycle Transportation Account Requirements enables cities and counties to prepare bicycle transportation plans, and identifies the elements to be included in order to make plan recommendations eligible for funding from the statewide Bicycle Transportation Account (BTA requirements).

E.1.3 Bay Area

Sustainable Communities Strategy (SCS) and Regional Transportation Plan (RTP)

The Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC) - the latter of which is the federally designated Metropolitan Planning Organization (MPO) for the San Francisco Bay Area region - are currently developing a Sustainable Communities Strategy to guide the update to the *Regional Transportation Plan* (RTP), planned for completion in 2013. The RTP defines the vision, strategy, and technical framework (e.g. demographic and travel forecasts) for planning and funding transportation improvements across all modes in the nine-county Bay Area. As required by federal law, MTC's RTP also establishes a 20-year budget – known separately as the Transportation Improvement Program (TIP) - that provides a comprehensive listing of surface transportation projects that may receive federal funds or that are subject to a federally required action or are regionally significant.

The update process for the current RTP, last adopted in 2009, calls for assessing three investment scenarios relative to a set of specific performance targets of congestion, vehicle miles traveled, emissions, and equity. The analysis applies land use and pricing sensitivity tests to each of the investment scenarios to see how such policy measures could help the region achieve the targets. Pursuant to SB375, the RTP and related Sustainable Communities Strategy efforts must also assess the relationship between vehicle miles traveled and regional jobs/housing targets, proximity to transit, and the regional targets for reducing automobile and GHG emissions (which for the Bay Area are a 7 percent reduction in per capita emissions by 2020 and 15 percent by 2035). Also pursuant to SB 375, the RTP/SCS will identify priority transit projects and corridors to incentivize development and investment – namely by the relaxation of CEQA requirements that stress accommodation of motor vehicle operations and can often hinder urban infill development.

Bay Area FOCUS Program

In conjunction with the Sustainable Communities Strategy, ABAG and MTC have implemented the FOCUS program, which unites efforts of four regional agencies into a single program that links land use and

transportation by encouraging the development of complete, livable communities in areas served by transit, and promoting conservation of the region's most significant resource lands.

Through FOCUS, regional agencies will direct existing and future incentives to Priority Development Areas and Priority Conservation Areas. Priority Development Areas are locally-identified infill development opportunity areas near transit. Priority Conservation Areas are regionally significant open spaces for which there exists a broad consensus for long-term protection. Priority Development Areas are generally areas of at least 100 acres where amenities and services can be developed to meet the day-to-day needs of residents in a pedestrian-friendly environment served by transit.

Regional Travel Demand Model

The recent policy changes mandated by SB375 and incorporated into the RTP/SCS efforts (namely the legally binding emphasis on "smart growth" land use scenarios and GHG reduction targets) are especially important for re-orienting the way MTC - and by extension all county and local jurisdictions - forecast future travel demand and assess the environmental impacts of individual transportation projects. Currently, all congestion management agencies in the Bay Area must develop a countywide travel model that is consistent with MTC's modeling methodology and databases. The purpose of this requirement is to bring a uniform technical basis for analysis to congestion management decisions and environmental determinations under CEQA.

Rather than extrapolate existing trends of sprawling land use patterns and assume steady annual growth in vehicle miles travelled, future travel demand forecasting in the Bay Area will be driven more than ever by policy priorities that embrace the efficiencies of compact, walkable design and pedestrian and bicycle activity. This is especially important for determining the feasibility of non-motorized projects, which in many cases (particularly for urbanized areas) involve reductions to roadway capacity and/or automobile levels-of-service (LOS).

Regional Bicycle Plan for the San Francisco Bay Area (2009)

The *Regional Bicycle Plan for the San Francisco Bay Area* (RBP) is a component of MTC's regional transportation plan *(Transportation 2035)*. The RBP's main purpose is to establish the network of regionally significant bicycle facilities (Regional Bicycle Network, or RBN) as well as to provide a high-level policy framework for MTC's approach to bicycle planning, including the definition of "routine accommodation" of bicycles for transportation facility design and programs. Additional RBP goals and policies include a 25% reduction in fatalities and injuries each from 2000 levels by 2035; emphasis of regional coordination on gap closure and consistent wayfinding; promotion of education and encouragement programs to raise bicycling awareness; transit support facilities; and a commitment to improving bicycle data collection and accessibility. The current plan estimates approximately $1.9 billion (2007 dollars) in capital project and program funding needs, and includes several on-street bicycle corridors in Palo Alto as part of the RBN.

San Francisco Bay Trail

Embedded within the Regional Bicycle Network is the San Francisco Bay Trail Plan, a proposal for the development of a 400-mile regional hiking and bicycling trail around the perimeter of San Francisco and San Pablo Bays. The plan was prepared by the Association of Bay Area Governments pursuant to Senate Bill 100, which mandated that the Bay Trail do the following:

- Provide connections to existing park and recreation facilities
- Create links to existing and proposed transportation facilities
- Be planned in such a way as to avoid adverse effects on environmentally sensitive areas

The concept plan for the trail includes a primary "spine" with spurs and connections that extend into and connect with local trail and bikeway facilities. Also included in the plan are additional policy discussions and a set of design guidelines specific to the Bay Trail development.

E.1.4 County and Peninsula Region

Valley Transportation Plan 2035 (VTP 2035)

The Valley Transportation Plan 2035 is Santa Clara County's long-range planning document that feeds into (and is consistent with) MTC's Regional Transportation Plan and incorporates specific needs identified by the Valley Transportation Authority (VTA) and individual municipalities, including Palo Alto. The VTP 2035 considers all travel modes and addresses the linkages between transportation and land use planning, air quality, and community livability.

VTP 2035 is framed around the notion that Santa Clara County is expected to grow by over 500,000 residents and 400,000 jobs by 2035 (increases of 27.5 and 45.6 percent, respectively), and that this growth will not be accommodated by increasing roadway capacity. With a roadway network that is essential "built out," VTP 2035 stresses the need to embrace carpooling, transit, biking, walking, technological efficiencies, and making shorter and/or fewer trips.

As with the Regional Transportation Plan, VTP 2035 includes a capital improvement program that is strongly weighted towards new investments in transit along with the maintenance and operation of the existing roadway network. As a policy, upgrades to pedestrian and bicycle facilities are strongly encouraged (and depending on the context, mandated) as part of regular street maintenance, bridge, and transit projects.

Notwithstanding VTP 2035's process of analysis and evaluation, things change and VTA regularly updates the plan at a minimum of every four years in a cycle coinciding with the update of the RTP. Plan updates will include the project planning, selection, programming, and delivery processes described above.

Bicycle Expenditure Program (BEP)

VTP 2035 identifies a need for bicycle capital projects totaling over $330 million. A Countywide Bicycle and Pedestrian Technical Advisory Committee comprised of 16 voting members, one from each of the 15 cities and one from the county identified and prioritized the list of projects.

The three major categories of projects that the CBP addresses are Cross-County Bicycle Corridors (CCBC), 24 On-Street Bicycle Routes, and 17 Trail Networks. These components are in various stages of completion with existing, planned, and undeveloped segments. When completed, the CCBC will be the most direct and convenient routes for bike trips to local and regional destinations across city or county boundaries. This list is used by VTA and local agencies in such activities as development review, transit planning, highway projects review, prioritizing local streets and roads projects, and collision monitoring. Only projects in the CBP are eligible for outside (non-BEP) funds that are controlled by the VTA.

Across Barrier Connections (ABC)

ABC is a list of locations of freeways, creeks, rivers, and active rail lines in the county presenting impenetrable barriers to bicycle circulation. Although the county has over 90 pedestrian/bicycle crossings, approximately 100 more are needed to provide a basic level of connectivity across these barriers.

Community Design and Transportation Program

The Community Design and Transportation (CDT) Program is VTA's Board-adopted program for integrating transportation and land use. Similar to the regional FOCUS program, CDT is a sustainable planning framework that considers all transportation modes and stresses the importance of a healthy pedestrian environment, concentrated mixed-use development patterns oriented to transit; and innovative urban design that embraces the interrelationships of buildings and streets along with the importance of people-oriented public spaces.

The CDT Program provides planning and capital grant funds for transportation-related projects that implement land use policies supportive of the CDT Principles, improve community access to transit, provide multimodal transportation facilities, and enhance the pedestrian environment along transportation corridors, in core areas and around transit stations. VTA receives funding for these grant programs from MTC's Transportation for Livable Communities (TLC) Program. The policies for funding the TLC Program come through the development of the RTP. The current allocation methodology is based on Santa Clara County's population share of the regional total and on the amount MTC requires for dedication to the county share (currently split on a 25 percent share for counties and a 75 percent share for MTC). VTA currently expects to allocate about $360 million to this program over the 25-year life of the VTP 2035 plan.

A central principle of the CDT Program is design for pedestrians. The county's transportation system and built environment currently focuses on cars rather than people. Pedestrian-oriented places encourage walking and exploration. Design elements of these places include safe and direct walking routes, wide sidewalks, and amenities such as street trees, lighting and benches.

Bicycle Share Program

In late 2008, a groundswell of interest in developing bike sharing programs swept the county. In 2009, VTA worked with the Silicon Valley Bike Coalition (SVBC), local employers, and cities to develop a bike sharing program. The initial steps include a pilot program that will identify consumer needs and markets, a management and operating approach, and key programs.

This program is expected to:

- Address land use inefficiencies of many suburban sprawl employment sites located far from transit.
- Provide access to the first and last mile from major transit stations.
- Supplement VTA and employer shuttles between transit and employer sites.
- Relieve overcrowding and the routine "bumping" of passengers with bicycles on Caltrain (and on VTA buses).

The Safe Routes to Transit (SR2T) program provided $500,000 to the VTA Pilot Bike Sharing program. In 2010, $4.3 million was secured through MTC's Climate Initiatives Program to develop an initial bike share

program with 1,000 bicycles along the Caltrain corridor in the cities of San Francisco, Redwood City, Palo Alto, Mountain View, and San Jose. A hundred bicycles (out of 1,000) are earmarked for Palo Alto, which will consist of large "hub" stations at the Palo Alto Transit Center and California Ave Caltrain stations; and a small number of "pod" stations at select sites to be determined by the VTA and City of Palo Alto.

VTA Bicycle Technical Guidelines

The Bicycle Technical Guidelines (BTG) are Palo Alto's current guide for designing most bicycle facilities. The Guidelines provide information for Member Agencies in planning, design, and maintenance of bicycle facilities and bicycle-friendly roadways.

Santa Clara Countywide Bicycle Plan (2008)

VTA's Countywide Bicycle Plan (CBP) refines and expands MTC's Regional Bicycle Network and complements local jurisdictions' bicycle plans, which are more focused on improvements serving local needs. The CBP contains policies and implementing actions that shape interagency coordination and region wide capital priorities, as well as a financially unconstrained master list of bicycle infrastructure projects. These projects are eligible for consideration for inclusion in the future as funding and leveraging opportunities become available.

Santa Clara County Countywide Trails Master Plan and Uniform InterJurisdictional Trail Design, Use, and Management Guidelines

The *Countywide Trails Master Plan* (1995) provides information and guidance for developing trails and multi-use paths in Santa Clara County. The Uniform Interjurisdictional Trail Design, Use, and Management Guidelines include comprehensive and detailed information about developing trails. In addition, the Santa Clara Valley Water District (SCVWD) has published *Guidelines and Standards for Land Use Near Streams* (2006)[8] in collaboration with the Water Resources Protection Collaborative. The guidelines provide proposed guidelines and standards for developing trails adjacent to water resources.

The Santa Clara County Parks Department has recently completed the Stanford trail segment (project S-1 from the County Plan) to Page Mill Rd and Arastradero Rd as part of 2005 expansion agreement under the existing Mayfield Agreement.

Grand Boulevard Initiative

The Grand Boulevard Initiative (GBI) is a collaboration of 19 cities, Santa Clara and San Mateo Counties, local and regional agencies and other stakeholders intended to improve the performance, safety, and aesthetics of the El Camino Real corridor from the Diridon Transit Hub in San Jose to Mission St in Daly City. The ultimate goal is for the corridor to achieve its full potential as a place for residents to work, live, shop and play, creating links between communities that promote walking and transit and an improved and meaningful quality of life. The GBI builds upon and supports several other transit and land use planning initiatives in Santa Clara County including the 522 Rapid bus service and service improvements being explored as part of VTA's BRT Strategic Plan. El Camino is also part of VTA's countywide Community Design & Transportation (CDT)

[8] http://www.valleywater.org/EkContent.aspx?id=2279&terms=+LAND+USE+NEAR+STREAMS

Program Cores, Corridors, and Station Areas framework, which shows VTA and local jurisdiction priorities for supporting concentrated development in the County.

Caltrain Station Access Program

The *2008 Caltrain Bicycle Parking and Access Plan* provides thorough bicycle facility data and improvement recommendations for the ten highest bicycle ridership stations in the system.

In 2010 Caltrain also began development of a Comprehensive Access Program that, when fully established, will include a Policy Statement, Strategic Plan, Capital Improvement Program, and Monitoring Program. In May 2010, the Caltrain Board of Directors adopted a Policy Statement that specifically prioritizes walking, transit, and biking – i.e. "green" and cost-effective modes – over the automobile as a way to maximize access and ridership over the long term. In order to customize each station's access improvement strategies, Caltrain has also identified four station typologies based on adjacent land use characteristics (**Figure** E-1). Once these types are applied in the Strategic Plan (anticipated in early 2011), a revised list of multi-modal improvements for all stations will follow. The suggested improvements provided in the Palo Alto Bicycle and Pedestrian Transportation Plan should assist Caltrain in revising the list of these multi-modal improvements.

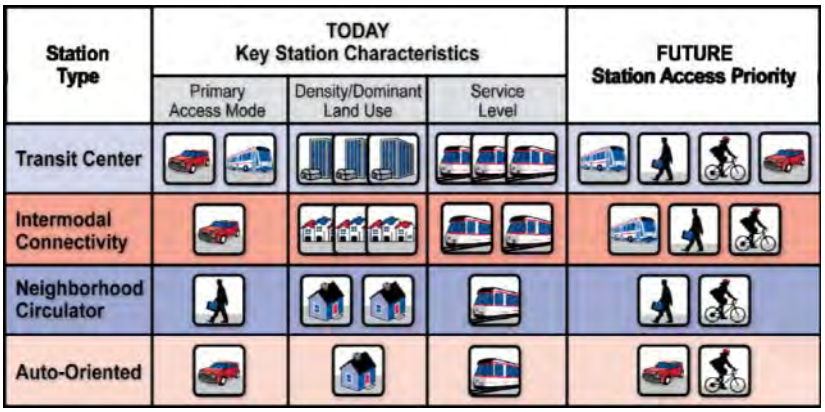

Figure E-1: Caltrain Station Typologies

(Source: Caltrain Access Policy Statement, May 2010)

E.1.5 City of Palo Alto

Comprehensive Plan

The City of Palo Alto's Comprehensive Plan establishes clear support and priority for investing in non-motorized transportation, improving access to transit, and other strategies that reduce dependence on single-occupant vehicles and improve the overall efficiency of the transportation system. These priorities are well represented in the adopted City budget and 2011-2015 Capital Improvement Program, which includes general funds for bicycle plan implementation and specific earmarks for larger projects that support walking and biking (such as the current planning and conceptual design for a new Highway 101 ped/bike crossing at Adobe Creek). The largest share of investment targeted at the public right-of-way, however, is pavement and utility maintenance, including the undergrounding of utilities and upgrades to sewer and water systems. Coordinating these programs is a high priority for the city and can be invaluable to leveraging non-motorized improvements. The current effort to update the Comprehensive Plan, and the annual budget revision process, are great opportunities to enhance coordination and keep the overall goals and policies of the Comprehensive Plan as relevant and up-to-date as possible.

Table E-1 lists key components of the *Comprehensive Plan* that relate to bicycling and walking, many of which the *Bicycle and Pedestrian Transportation Plan* (BPTP) address. **Table 2-1 in Chapter 2 of the Plan** lists the components of the Transportation Element. In addition, the following table highlights considerations that the City may want to take into account when updating the *Comprehensive Plan.*

Table E-1: City of Palo Alto Comprehensive Plan - Goal, Policy, Program Summary Table*

Goals	Policies and Programs (edited for relevancy)	Plan Relationship/Recommendation
Land Use and Design Element		
Goal L-3:	***Safe, Attractive Residential Neighborhoods, Each With Its Own Distinct Character and Within Walking Distance of Shopping, Services, Schools, and/or other Public Gathering Places.***	
	Policy L-15: Preserve and enhance the public gathering spaces within walking distance of residential neighborhoods. Ensure that each residential neighborhood has such spaces.	This policy provides significant support for the BPTP. In addition, the BPTP existing conditions notes the value of public gathering spaces and recommends amenities and designs to enhance pedestrian space.
	Policy L-17: Treat residential streets as both public ways and neighborhood amenities. Provide continuous sidewalks, healthy street trees, benches, and other amenities that favor pedestrians.	
Goal L-4:	***Inviting, Pedestrian-scale Centers That Offer a Variety of Retail and Commercial Services and Provide Focal Points and Community Gathering Places for the City's Residential Neighborhoods and Employment Districts.***	
	Policy L-21: Provide all Centers with centrally located gathering spaces that create a sense of identity and encourage economic revitalization. Encourage public amenities such as benches, street trees, kiosks, restrooms and public art.	Recommendations for Pedestrian Zones support the development and preservation of Pedestrian-Scale Centers .
	Policy L-22: Enhance the appearance of streets and sidewalks within all Centers through an aggressive maintenance, repair and cleaning program; street improvements; and the use of a variety of paving materials and landscaping.	
	Program L-18: Identify priority street improvements that could make a substantial contribution to the character of Centers, including widening sidewalks, narrowing travel lanes, creating medians, restriping to allow diagonal parking, and planting street trees.	This program directly supports the BPTP. BPTP recommendations for pedestrian enhancements, intersection improvements, and bikeways are in line with this program.
	Policy L-24: Ensure that University Avenue/Downtown is pedestrian-friendly and supports bicycle use. Use public art and other amenities to create an environment that is inviting to pedestrians.	The BPTP focuses recommendations for bicycle and pedestrian improvements in the University Ave/Downtown area.

Goals	Policies and Programs (edited for relevancy)	Plan Relationship/Recommendation
	Policy L-25: Enhance the character of the South of Forest Area (SOFA) as a mixed-use area.	The BPTP recommends additional signing to facilitate bicycle use of the Homer Ave Caltrain undercrossing.
	Policy L-27: Pursue redevelopment of the University Avenue Multi-modal Transit Station area to establish a link between University Avenue/Downtown and the Stanford Shopping Center.	The BPTP supports the redevelopment of the Transit Station and recommendas additional improvements to enhance bicycle and pedestrian access, circulation, and use.
	Policy L-29: Encourage residential and mixed use residential development in the California Avenue area.	This policy supports land uses that encourage walking and bicycling. Proposed improvements in the BPTP would facilitate travel along this corridor.
	Policy L-31: Develop the Cal-Ventura area as a well-designed mixed use district with diverse land uses, two- to three-story buildings, and a network of pedestrian-oriented streets providing links to California Avenue.	The BPTP recommends a feasibility, design, and planning study for the Bol Park/Cal-Ventura Trail Connector.
	Policy L-35: Establish the South El Camino Real area as a well-designed, compact, vital, Multi-neighborhood Center with diverse uses, a mix of one-, two-, and three-story buildings, and a network of pedestrian-oriented streets and ways.	
	Program L-33: Study ways to make South El Camino Real more pedestrian-friendly, including redesigning the street to provide wider sidewalks, safe pedestrian crossings at key intersections, street trees, and streetscape improvements.	The BPTP recommends a bike lane on El Camino Real from Sand Hill Rd to Page Mill Rd, as well as crossings and intersection improvements at Arastradero Rd and Los Robles Ave.
	Program L-34: Provide better connections across El Camino Real to bring the Ventura and Barron Park neighborhoods together and to improve linkages to local schools and parks.	The BPTP recommends crossing improvements across Matadero/Margarita Ave, which is a proposed bicycle boulevard.
	Policy L-39: Facilitate opportunities to improve pedestrian-oriented commercial activity within Neighborhood Centers.	The BPTP continues support for this policy and includes revised design guidelines for bicycle and pedestrian facilities that should be considered during Architectural Review Board deliberations and decisions.
	Program L-40: Make improvements to Middlefield Road in Midtown that slow traffic, encourage commercial vitality, make the street more pedestrian-friendly, and unify the northeast and southwest sides of the commercial area, with consideration given to traffic impacts on the residential neighborhood.	The BPTP recommends shared lane treatments on Middlefield Rd from Coleridge Ave/Embarcadero Rd to Marion Ave, as well as crossing improvements at California Ave.
	Program L-41: Support bicycle and pedestrian trail improvements along a restored Matadero Creek within Hoover Park.	The BPTP recommends a Class I Multi-Use Trail along Matadero Creek, including the section within Hoover Park.

Goals	Policies and Programs (edited for relevancy)	Plan Relationship/Recommendation
	Policy L-42: Encourage Employment Districts to develop in a way that encourages transit, pedestrian and bicycle travel and reduces the number of auto trips for daily errands.	
	Policy L-43: Provide sidewalks, pedestrian paths, and connections to the citywide bikeway system within Employment Districts. Pursue opportunities to build sidewalks and paths in renovation and expansion projects.	The BPTP recommends key corridors within and to Employment Districts to enable workers to commute by foot and bicycle.
	Policy L-44: Develop the Stanford Research Park as a compact employment center served by a variety of transportation modes.	Chapter 5 discusses opportunities for bicycle and pedestrian improvements within the Stanford Research Park area, including sidewalk gap infill, completing the Hanover St bike lanes at the approaches to Page Mill Rd, extension of the Bol Park/Hanover St path along Page Mill Road, as well as long-term improved trail connections to the VA hospital and across Matadero Creek.
	Policy L-61: Promote the use of community and cultural centers, libraries, local schools, parks, and other community facilities as gathering places. Ensure that they are inviting and safe places that can deliver a variety of community services during both daytime and evening hours.	The BPTP recommends bicycle and pedestrian facilities that provide safe and comfortable access to these destinations for all abilities of pedestrians and bicyclists.
	Program L-68: To help satisfy present and future community use needs, coordinate with the School District to educate the public about and to plan for the future use of school sites, including providing space for public gathering places for neighborhoods lacking space.	The BPTP recommends extending and expanding the Safe Routes to School Program in coordination with PAUSD.
	Program L-69: Enhance all entrances to Mitchell Park Community Center so that they are more inviting and facilitate public gatherings.	The BPTP identifies existing park trails in Mitchell Park and supports this policy.
	Program L-70: Study the potential for landscaping or park furniture that would promote neighborhood parks as outdoor gathering places and centers of neighborhood activity.	
	PolicyL-62: Provide comfortable seating areas and plazas with places for public art adjacent to library and community center entrances.	
	PolicyL-64: Seek potential new sites for art and cultural facilities, public spaces, open space, and community gardens that encourage and support pedestrian and bicycle travel and person-to-person contact, particularly in neighborhoods that lack these amenities.	The BPTP continues support for this policy and includes revised design guidelines for bicycle and pedestrian facilities that should be considered during Architectural Review Board deliberations and decisions.

Goals	Policies and Programs (edited for relevancy)	Plan Relationship/Recommendation
	Policy L-66: Maintain an aesthetically pleasing street network that helps frame and define the community while meeting the needs of pedestrians, bicyclists, and motorists.	The BPTP notes the importance of enhancing public space and providing pedestrian-scale design and amenities. Innovative facility designs integrate aesthetically pleasing designs into bicycle and pedestrian accommodations.
	Policy L-67: Balance traffic circulation needs with the goal of creating walkable neighborhoods that are designed and oriented towards pedestrians.	The BPTP identifies opportunities where roadway capacity allows for bicycle and pedestrian accommodation while minimizing impacts to automobile traffic circulation.
	Policy L-68: Integrate creeks and green spaces with the street and pedestrian/bicycle path system.	The BPTP recommends a series of Class I Multi-Use Paths along creek corridors, such as the Matadero Creek Trail.
	Policy L-69: Preserve the scenic qualities of Palo Alto roads and trails for motorists, cyclists, pedestrians, and equestrians.	Innovative facility designs integrate aesthetically pleasing designs into bicycle and pedestrian accommodations.
	Program L-71: Recognize Sand Hill Road, University Avenue, Embarcadero Road, Page Mill Road, Oregon Expressway, Interstate 280, Arastradero Road (west of Foothill Expressway), Junipero Serra Boulevard/ Foothill Expressway, and Skyline Boulevard as scenic routes.	Where appropriate the BPTP recommends bicycle and pedestrian treatments and/or improvements along these roadways, which may reduce traffic congestion and improve the scenic nature of these routes.
	Policy L-70: Enhance the appearance of streets and other public spaces by expanding and maintaining Palo Alto's street tree system.	BPTP recommendations for Pedestrian Zones and curb extensions note the desire for street trees.
	Policy L-79: Design public infrastructure, including paving, signs, utility structures, parking garages and parking lots to meet high quality urban design standards. Look for opportunities to use art and artists in the design of public infrastructure. Remove or mitigate elements of existing infrastructure that are unsightly or visually disruptive.	Innovative facility designs integrate aesthetically pleasing designs into bicycle and pedestrian accommodations.
Natural Environment Element		
Goal N:1	***A Citywide Open Space System that Protects and Conserves Palo Alto's Natural Resources and Provides a Source of Beauty and Enjoyment for Palo Alto Residents***	
	Policy N-2: Support regional and sub-regional efforts to acquire, develop, operate, and maintain an open space system extending from Skyline Ridge to San Francisco Bay.	This policy supports walking and bicycling to parks and trails through parks. The BPTP identifies existing parks trails as well as future opportunities.

Goals	Policies and Programs (edited for relevancy)	Plan Relationship/Recommendation
Goal N-2:	***Conservation of Creeks and Riparian Areas as Open Space Amenities, Natural Habitat Areas, and Elements of Community Design***	
	Policy N-10: Work with the Santa Clara Valley Water District and other relevant regional agencies to enhance riparian corridors and provide adequate flood control by use of low impact restoration strategies.	The BPTP recommends the use of the Santa Clara Valley Water District (SCVWD) 's *Guidelines and Standards for Land Use Near Streams* (2006)..
	Program N-11: Work with the Santa Clara Valley Water District to develop a comprehensive riparian corridor restoration and enhancement program that identifies specific stretches of corridor to be restored, standards to be achieved, and sources of funding. Include provisions for tree planting to enhance natural habitat.	The BPTP recommends new creek trail segments for further consideration, which should conform to SCVWD design guidelines.
Goal N-3:	***A Thriving "Urban Forest" That Provides Ecological, Economic, and Aesthetic Benefits for Palo Alto***	
	Program N-16: Continue to require replacement of trees, including street trees lost to new development, and establish a program to have replacement trees planted offsite when it is impractical to locate them onsite.	BPTP recommendations for Pedestrian Zones and curb extensions note the desire for street trees.
	Program N-19: Establish one or more tree planting programs that seek to achieve the following objectives: a 50 percent tree canopy for streets, parks, and parking lots; and the annual tree planting goals recommended by the Tree Task Force and adopted by the City Council.	The BPTP does not directly address this program, but priority consideration should be given to existing and proposed bicycle boulevards. In addition, the BPTP recommends a future study by Parks to identify a Palo Alto Greenway network that may be a priority for canopy coverage. Finally, the BPTP recommends the development of a Complete Streets project checklist that could include review of potential tree protection issues and replacement opportunities.
	Program N-20: Establish procedures to coordinate City review, particularly by the Planning, Utilities, and Public Works Departments, of projects that might impact the urban forest.	The BPTP recommends the development of a Complete Streets project checklist that could include review of potential tree protection issues and replacement opportunities.
Goal N-4:	***Water Resources that are Prudently Managed to Sustain Plant and Animal Life, Support Urban Activities, and Protect Public Health and Safety***	
	Policy N-21: Reduce non-point source pollution in urban runoff from residential, commercial, industrial, municipal, and transportation land uses and activities.	This policy supports development of the BPTP, which will decrease transportation-related pollution by shifting trips from single-occupancy vehicles.
	Policy N-22: Limit the amount of impervious surface in new development or public improvement projects to reduce urban runoff into storm drains, creeks, and San Francisco Bay.	The BPTP does not directly address these issues, but it recommends development of a Complete Streets project checklist that could include review and incorporation of green stormwater

Goals	Policies and Programs (edited for relevancy)	Plan Relationship/Recommendation
	Program N-36: Complete improvements to the storm drainage system consistent with the priorities outlined in the City's 1993 Storm Drainage Master Plan, provided that an appropriate funding mechanism is identified and approved by the City Council.	infrastructure or other improvements consistent with the Drainage Master Plan.
Goal N-5:	***Clean, Healthful Air for Palo Alto and the San Francisco Bay Area***	
	Policy N-28: Encourage developers of new projects in Palo Alto, including City projects, to provide improvements that reduce the necessity of driving alone.	This policy supports the development of the BPTP, and the Plan includes standards and guidelines that can be used by developers implementing bicycle and/or pedestrian improvements.
Community Services Element		
Goal C-1:	***Effective and Efficient Delivery of Community Services***	
	Policy C-4: Maintain a close, collaborative relationship with the PAUSD to maximize the use of school services and facilities for public benefit, particularly for young people, families, and seniors.	This policy is related to BPTP Objective 3.
Goal C-3:	***Improved Quality, Quantity, and Affordability of Social Services, Particularly for Children, Youth, Seniors, and People with Disabilities***	
	Program C-18: Encourage the continuation and development of after-school and evening programs for children and youth. Maximize participation in such programs by increasing the number of locations where the programs are provided and by supporting transportation options to these locations.	The Five "E's" program recommendations in the BPTP supports this policy by proposing educational programs that teach youth and adults safe bicycling and walking practices.
	Policy C-19: Continue to support provision, funding, or promotion of services for persons with disabilities through the Human Relations Commission, the Parks and Recreation Division, and other City departments. Support rigorous compliance with the Americans with Disabilities Act (ADA).	The BPTP identifies funding sources that can be used to improve ADA-compliance.

Goals	Policies and Programs (edited for relevancy)	Plan Relationship/Recommendation
Goal C-4:	***Attractive, Well-maintained Community Facilities That Serve Palo Alto Residents***	
	Program C-20: Conduct comprehensive analyses of long-term infrastructure replacement requirements and costs.	Appendix A includes recommendations for maintenance and life-cycle cost analysis for bicycle and pedestrian projects.
	Program C-21: Incorporate as an additional criterion used in prioritizing sidewalk repairs, a standard related to the level of pedestrian usage.	The BPTP supports this criterion, although an initial step is recommending pedestrian counts at key locations throughout the city. Also, proximity to or within a priority pedestrian area may be a substitute for actual pedestrian volumes if none are available.
	Policy C-26: Maintain and enhance existing park facilities.	The BPTP provides recommendations for additional park trail opportunities, as well as linking existing park trails into the on-street networks.
	Policy C-27: Seek opportunities to develop new parks and recreation facilities to meet the growing needs of residents and employees of Palo Alto.	The BPTP recommends new Class I Multi-Use Parks and trails that enhance recreational opportunities and connect recreational destinations.
	Policy C-28: Use National Recreation and Park Association Standards as guidelines for locating and developing new parks.	The BPTP recommends that parks be provided within a half-mile of all residential neighborhoods and employment areas (based on the National Recreation and Park Association's definition of walking distance).
Goal C-5:	***Equal Access to Educational, Recreational, and Cultural Services for All Residents.***	
	Policy C-29: Strategically locate public facilities and parks to serve all neighborhoods in the City.	The BPTP recommended trail and Class I Multi-Use Path system provides an interconnected network throughout the city.
	Policy C-30: Facilitate access to parks and community facilities by a variety of transportation modes.	The BPTP recommends bicycle and pedestrian facilities that provide safe and comfortable access to parks, schools, and community facilities.
	Policy C-31: Facilitate access to educational, recreational, and cultural services by continuing to provide financial assistance programs for residents with low-incomes and/or disabilities.	The Plan peripherally addresses this policy by prioritizing pedestrian access and safety improvements to such facilities.
	Policy C-32: Provide fully accessible public facilities to all residents and visitors.	The BPTP recommends bicycle and pedestrian facilities that provide safe and comfortable routes for pedestrians and bicyclists of all abilities.

Municipal Code

Non-motorized travel and improvements are supported on a daily basis by the Palo Alto Municipal Code, which regulates the standard of developments and use of city streets, among other functions. Recent best practice revisions to the code include Transportation Impact Fees for mitigating congestion in certain areas, strong requirements for bicycle parking with new projects, and urban design guidelines that foster pedestrian-friendly streetscapes. The Municipal Code also codifies certain roadway functions and purposes, such as specific arterial speed limit exceptions and major truck routes, and includes the School Commute Corridors Network. The School Commute Corridors Network designates a sub-set of Palo Alto's street system for special consideration in infrastructure improvement and travel safety enhancement. The purpose of this network is to give priority for pedestrian and bicycle facilities improvements, sidewalk replacement, street re-paving, and other enhancements to travel safety where it can most directly affect access to Palo Alto's schools. Much of the existing and proposed bikeway system encompasses the School Commute Corridors Network, as have ongoing capital improvement efforts related to the Palo Alto Safe Routes to School and neighborhood traffic calming programs.

The City of Palo Alto requires residents to license their bicycle. Bicycle licenses help the Police Department return a stolen bicycle to its owner and identify victims of collisions. The Fire Department and many local bicycle shops issue bicycle licenses for two dollars that expire in three years.

Abandoned bicycles are a nuisance to the community and other bicyclists. When left in a public place, abandoned bicycles create an eyesore and can obstruct pedestrian travel. When left on bicycle racks, abandoned bicycles take up a parking space that another bicyclist could use. If a bicycle is locked to public property, the Police Department will tag it with a 72-hour warning before cutting the lock.

Due to fiscal constraints, the Police Department does not currently remove abandoned bicycles on a consistent basis. However, residents may bring an abandoned bicycle to the Police Department office. The Police Department releases abandoned bicycles every Wednesday.

Climate Action Plan

Expanding efforts to reduce the number of school commutes by car is one of several recommendations from the 2007 Palo Alto Climate Protection Plan (CPP), which targets a 15 percent reduction in greenhouse gas emissions from 2005 levels by 2020 to comply with state reductions goals. Identifying automobile travel as comprising 36 percent of total GHG emissions within Palo Alto, the plan recommends hiring a full-time TDM coordinator position as soon as possible and in the medium-term expanding pedestrian-friendly zoning regulations and completing transit projects on El Camino Real and the Palo Alto Intermodal Transit Center. Disappointingly, the CPP does not reference the 2003 *Bicycle Transportation Plan* or efforts to accelerate its implementation – despite the fact that 83 percent of auto-related emissions are from discretionary, non-commute trips within Palo Alto (i.e., a significant percentage could be converted to zero-emission walking or biking trips).

Stanford University

The commitment to projects and programs that enhance walking and biking (and promote transit access) is reinforced by Palo Alto's close relationship with Stanford University. Development of University property is regulated by a General Use Permit (GUP) agreement with the County, which essentially caps the number of peak period trips to and from campus at 2001 levels. As the campus has sought to expand, this agreement has helped focus new investments in transit (of which the Marguerite Shuttle is a highlight) and the development of a comprehensive and successful Transportation Demand Management program. The agreement, however, does not include the Stanford Research Park or Stanford Medical Center, both of which generate high travel demand and are located in key gap sections of the proposed bicycle network.

The traffic mitigation and public benefit package approved in May 2011 as part of the Stanford Medical Center expansion identifies $3.53 million in pedestrian and bicycle-related improvements. This package includes $2.5 million in direct spending to enhance the pedestrian and bicycle connections from the Palo Alto Transit Center to the intersection of El Camino Real and Quarry Rd. In addition, the Medical Center will contribute almost $200,000 for a ped/bike Caltrain undercrossing.

Transportation Demand Management

Way2Go Program

The City's Way2Go Program is the foundation for a variety of alternative commute programs at the City and school levels. In addition to encouraging carpooling, Way2Go programs engage City officials and staff to actively participate and provide focused programs aimed at reducing vehicle miles traveled in Palo Alto.

Safe Routes to School

The City, in collaboration with the Palo Alto Unified School District and parent volunteers from the Palo Alto Council of PTAs, began to coordinate efforts to reduce congestion and improve safety for students on their way to and from school in 1994, using the traditional three E's of engineering, education, and enforcement. Since 2000, when this partnership was expanded to include the 4th 'E' of encouraging alternatives to single family driving to school, the City has seen a significant and on-going increase in biking and walking to school as a direct result of these efforts. **Table E-2** presents the number of students programs reached during the 2009/10 school year.

Table E-2: Existing School Programs and Number of Students Reached

Grade	Program	Responsible Party	Number of Students (2009/10)
K	Pedestrian safety class seminar and practice	Safe Moves	875
1	Pedestrian safety participatory assembly	Safe Moves	920
2	Pedestrian safety participatory assembly	Safe Moves	834
3	Bicycling life skills—three lessons: Class-based discussion and video: bike safety basics Key traffic skills for bicyclists (grade level assembly) On-bike event: students rotate through 5 stations	Classroom teachers Palo Alto Fire Department Parent volunteers Palo Alto Medical Foundation Stanford University Cycling Club	862
5	Bike/Traffic Safety Refresher Grade level assembly, with PowerPoint and "The Bicycle Zone" video	Palo Alto Fire Department	840
6 Middle School	Making Safe Choices: Drive Your Bike PowerPoint	Rich Swent, League Certified Instructor with Silicon Valley Bicycle Coalition	859
Total			***5,180***

Bike to Work and School Day

The City currently encourages residents to bicycle and walk by participating in Bike to Work Day and supporting the school district programs. Encouragement programs are essential to institutionalizing bicycling and walking as integral and widely-adopted transportation modes. Bike to Work Day is typically the second or third Thursday in May, which is Bike to Work Month. In the San Francisco Bay Area, 511.org leads a region-wide campaign promoting Bike to Work Month and Day. This campaign includes:

- Team Bike Challenges in which companies compete for bicycling the most miles to work during the month of May
- Energizer Stations located throughout the Bay Area, offering promotional materials and snacks to encourage bicycle riding to work

The City of Palo Alto sponsors four energizer stations for Bike to Work Day. Stanford University and Hewlett Packard also sponsor energizer stations bringing the total in Palo Alto to ten for most years.

In past years, Gunn High School promoted a Pedaling for Prizes promotion where students could win prizes including the grand prize of a bicycle. Palo Alto High School also sponsored energizer stations and students who bicycled were rewarded with treats.

Walk and Roll

International Walk to School Day is the first Wednesday in October. Palo Alto joins students from around the world in walking to school, with the intent of instilling a healthy commute habit for the remainder of the year. Activities such as Walking School Busses and Art Contests raise awareness about walking for transportation. Bicycling, skating, scootering, carpooling, and transit are all encouraged to help reduce the number of cars around schools.

Many Palo Alto schools participate in a Walk and Roll Day for Earth Day every April. This event reminds students and parents that schools support and encourage walking and bicycling to school.

Youth Bicycle Education

Palo Alto schools currently offer bicycle and pedestrian safety education courses for kindergarteners through third grade, and fifth and sixth grades. This program reaches over 5,000 students and includes instruction of all sixth graders by a League of American Bicyclists certified instructor (LCI). With the recently awarded Safe Routes to School VERBS grant, the City will update and expand this program.

The Parks and Recreation Department also provides youth bicycle education through the Enjoy Catalog. Participants must register online at the website provided in the following section: Adult Bicycle Education.

Adult Bicycle Education

Children mimic the behavior of their parents. Safe and lawful riding among children relies on their parents' modeling appropriate bicycling behavior. To ensure parents model the appropriate behavior, the Palo Alto Parent Teacher Association provides elementary parent education twice annually. This program teaches parents how to teach bicycle riding skills to their children In previous years, this program reached 120 parents annually, which will increase with the VERBs funded expansion of the program.

Student Hand Tallies and Parent Surveys

The City currently coordinates classroom tally counts by teachers in grades K-5 each fall to evaluate the effectiveness of its current education and outreach efforts. These tallies also allow a snapshot of mode share over time. Through the VERBS grant, an annual parent survey will be developed to identify parents' perceptions of barriers to walking and bicycling, which can be compared to data that have been collected since 1994.

Operation Safe Passage

The Palo Alto Police Department administers Operation Safe Passage, a program to enforce traffic violations committed by motorists, pedestrians, and bicyclists in and around all schools during peak commute hours. Police officers commonly focus on the following violations:

- Failing to stop for school buses with flashing stoplights

- Speeding vehicles
- Failing to yield to pedestrians
- Jaywalking
- Juvenile bicyclists without required helmets or not properly worn
- Seat belt and child restraint seat violations
- Cell phone or texting violations
- Stop sign violations

Crossing Guards

Crossing guards are critical to ensuring lawful use of roadway crossings among children and demand greater respect and yield compliance of motorists. Twenty-nine locations have crossing guards citywide. Table E-3 lists the crossing guard locations and the schools they serve.

Table E-3: Crossing Guard Locations

Intersection	Schools Served
El Camino Real/Arastradero	Gunn, Terman
El Camino Real/Maybell	Gunn, Terman
El Camino Real/Matadero	Gunn, Terman, Barron Park
El Camino Real/Los Robles	Gunn, Terman, Barron Park
El Camino Real/Stanford	Palo Alto, Jordon, Escondido
Arastradero/Donald	Gunn, Terman, Juana Briones
Arastradero/Coulombe	Gunn, Terman, Juana Briones
Maybell/Coulombe	Gunn, Terman, Juana Briones
Barron/El Centro	Barron Park
Alma/Charleston	Gunn
Alma/Meadow	Gunn, JLS
Meadow/JLS/Waverley	JLS
Charleston/Nelson	JLS, Fairmeadow, Hoover
Charleston/Carlson	JLS, Fairmeadow, Hoover
Middlefield/Meadow	JLS, Fairmeadow, Hoover
Middlefield/Mayview	JLS, Fairmeadow, Hoover
Middlefield/Charleston	JLS, Fairmeadow, Hoover
Louis/Greer	JLS, Palo Verde
Louis/ Loma Verde	Palo Verde
Louis/ Amarillo	Ohlone
Louis/North California	Jordan
North California/Newell	Jordan
Embarcadero/Newell	Walter Hays, Jordan
Embarcadero/Middlefield	Walter Hays, Jordan
Addison/Middlefield	Addison
Channing/Alester	Duveneck
Newell/ Dana	Duveneck
Los Altos Ave/El Camino Real	Santa Rita
Bryant/El Carmelo	El Carmelo

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Appendix F. Funding

Funding for bicycle and pedestrian facilities and programs originate at all levels of government. This chapter provides a menu of potential funding sources and is intended to be a resource for City staff. Summaries of federal funding sources begin this chapter, followed by summaries of state, regional, and local sources.

Federal Funding Sources

SAFETEA-LU, the Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users, is the primary federal funding source for bicycle projects. SAFETEA-LU is the fourth iteration of the transportation vision established by the Intermodal Surface Transportation Efficiency Act (1991). Also known as the federal transportation bill, Congress passed the $286.5 billion SAFETEA-LU bill in 2005. SAFETEA-LU expired in 2009, at which time Congress approved extending funds through 2010.

The next multi-year federal transportation bill reauthorization is anticipated in 2011. Funding for bicycle projects is likely to change. Historically, these modes have received larger allocations with each new multi-year transportation bill.

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

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

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

The following programs are administered by the Federal government.

Transportation Enhancements

The Transportation, Community and System Preservation (TCSP) Program provides federal funding for transit oriented development, traffic calming and other projects that improve the efficiency of the transportation system, reduce the impact on the environment, and provide efficient access to jobs, services and trade centers. The program provides communities with the resources to explore the integration of their transportation system with community preservation and environmental activities. TCSP Program funds require a 20 percent match. Congress appropriated $204 million to this program in Fiscal Year 2009. Funding has been extended under a continuing resolution for FY 2010.

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

Rivers, Trails and Conservation Assistance Program

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

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

National Scenic Byways Program

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

Nationally, $3 million were available each fiscal year between 2006 and 2009. Grant applications for National Scenic Byways Programs are forwarded to the FHWA division office by the state or tribal scenic byways coordinator.

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

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

State-Administered Funding

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

Bicycle Transportation Account

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

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

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

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

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

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

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

Recreational Trails Program

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

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

Online resource: http://www.parks.ca.gov/default.asp?page_id=24324

California Conservation Corps

The California Conservation Corps (CCC) is a public service program that occasionally provides assistance on construction projects. The CCC may be written into grant applications as a project partner. In order to utilize

CCC labor, project sites must be public land or publicly-accessible. CCC labor will not perform regular maintenance, but will perform annual maintenance, such as the opening of trails in the spring.

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

Transportation Planning Grant Program

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

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

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

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

Highway Safety Improvement Program

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

Caltrans issues an annual call for projects for HSIP funding to cities and counties. Projects must be in a publicly owned right of way or bicycle/pedestrian path that corrects or improves the safety of its users and must meet the goals of the Strategic Highway Safety Plan.

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

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

Environmental Enhancement and Mitigation Funds

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

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

State Highway Operations and Protection Program

The State Highway Operations and Protection Program (SHOPP) is a Caltrans funding source with the purpose of purpose of maintaining and preserving the investment in the State Highway System and supporting infrastructure. Projects typically fall into the following categories: collision reduction, major damage restoration, bridge preservation, roadway preservation, roadside preservation, mobility enhancement, and preservation of other transportation facilities related to the state highway system. In the past, SHOPP funds have been used to construct bicycle projects, including curb ramps, overcrossings, bike paths, sidewalks, and signal upgrades to meet ADA requirements. Jurisdictions work with Caltrans' districts to have projects placed on the SHOPP list.

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

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

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

Petroleum Violation Escrow Account (PVEA)

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

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

Office of Traffic Safety (OTS) Grants

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

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

The California application deadline is January of each year. There is no maximum cap to the amount requested, but all items in the proposal must be justified to meet the objectives of the proposal.

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

Community Development Block Grants

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

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

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

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

Locally-Administered Funding

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

Regional Surface Transportation Program

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

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

Transportation for Livable Communities Program

The Transportation for Livable Communities Program (TLC) provides grant monies to public agencies to encourage land use decisions that support compact, bicycle-friendly development near transit hubs. MTC's Transportation Plan 2035 stipulates all eligible TLC projects to be within Priority Development Areas (PDAs), which focus growth around transit. MTC selects projects based on their status (planned or proposed) and

their development intensity. MTC administers the TLC program with funds from the Regional Surface Transportation Project and caps grants at $400,000. Funds may be used for capital projects or planning.

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

Transportation Fund for Clean Air

Administered by the Bay Area Air Quality Management District (BAAQMD), the Transportation Fund for Clean Air (TFCA) is a grant program funded by a $4 surcharge on motor vehicles registered in the Bay Area. This surcharge generates approximately $22 million per year in revenue. TFCA's goal is to implement the most cost-effective projects in the Bay Area that will decrease motor vehicle emissions, and therefore improve air quality. Projects must be consistent with the 1988 California Clean Air Act and the Bay Area Ozone Strategy. TFCA funds covers a wide range of project types, including bicycle facility improvements such as bike lanes, bicycle racks, and lockers; arterial management improvements to speed traffic flow on major arterials; and smart growth.

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

Bicycle Facilities Program

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

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

Safe Routes to Transit (SR2T)

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

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

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

TDA Article 3

Transportation Development Act (TDA) Article 3 funds are state block grants awarded annually to local jurisdictions for transit and bicycle projects in California. Funds originate from the Local Transportation Fund (LTF), which is derived from a quarter-cent of the general state sales tax. LTF funds are returned to each county based on sales tax revenues.

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

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

Regional Bicycle Program

The Regional Bicycle Program funds construction of bikeways on the Regional Bikeway Network for the Bay Area. MTC administers RBP funds to county CMA's based on population, bikeway network capital cost, and unbuilt network miles.

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

County and Local Sources

Table F-1 lists the existing funding sources that are currently or could be used to fund bicycle and/or pedestrian improvements. Additional funding sources that could also pay for the improvements recommended by the BPTP are listed following the table.

Table F-1: Existing and Potential Funding - Palo Alto CIP and Other Plans

Project or Program	Responsible Division/ Sponsoring Agency	Funds/ Cost Allocation	Description
Palo Alto Capital Improvement Program 2011-2015			
Direct Funding			
Bicycle Plan Imple-mentation	Planning and Community Environment	$200,000	$50k/yr; From budget: "Six bike boulevards are yet to be implemented: Homer Ave; Matadero Ave/ Margarita Ave; Castilleja/Park Boulevard/ Wilkie Way; Everett Ave/ Palo Alto Ave; Chaucer/Boyce/ Melville; and Bryant St bike boulevard extension.
Sidewalk Repairs	Public Works	$3,374,000	$650k/yr; Backlog of sidewalk replacement is estimated to be complete in 2016. $50,000 will continue to be allocated for high pedestrian-use areas.
Safe Routes to School	Planning and Community Environment	$400,000	Includes expenditures for capital projects that help improve the School Commute Corridors Network and Neighborhood Traffic Calming Program
		$528,000	2010 VTA VERBS grant award of $528k for non-infrastructure projects and programs (education, encouragement, capacity building)
San Antonio Median Improvements	Public Works	$630,000	Project under construction with grant of $900,000 from Highway Safety Improvement Program (HSIP) to implement Phase II improvements (for a total project cost of $1.53 million).

Project or Program	Responsible Division/ Sponsoring Agency	Funds/ Cost Allocation	Description
Charleston/ Arasatradero Corridor Project	Public Works/Planning and Community Environment	$4,000,000	Total budget of $5.2 million including trial project and past expenditures; fund sources currently not identified for Phase II
El Camino/ Stanford Intersection	Planning and Community Environment	$1,668,000	$1.82 million total includes funds from '06-10 budget; 2006 VTA Community Design and Transportation (CDT) grant of $1.334 million.
101 Pedestrian/ Bicycle Overpass	Public Works/Planning and Community Environment	$250,000	$376k total budget for planning and design, including '06-10 expenditures; preferred alternative soon to be approved
Dinah/Summer Hill Shared Use Path	Planning and Community Environment	$300,000	Funds to leverage private redevelopment project to create a 15' x 130' public share used path; 2011 outlay
California Ave Streetscape Improvements	Public Works/Planning and Community Environment	$1,600,000	2010 VTA CDT grant; local match of $500k
Off-Road Pathways Maintenance	Public Works	$500,000	$100k/yr: The 9-mile off-road trail system in Palo Alto is 35 years old and has not been maintained or repaired. Cracks, pot holes, and base failures in areas cause significant safety issues. This project removes and replaces severely damaged sections of asphalt, repairs cracks and base failures, and resurfaces worn or uneven surfaces of off-road asphalt pathways and bicycle trails. Priority will be given to the repair of the most uneven sections of pathway. The project does not create new off-road trails.
Potential Direct and/or Partial "Accommodation" Funding			
Street Median Improvements	Public Works	$468,000	Renovates medians, planters, and islands by repairing or installing irrigation systems, replacing meters and backflow devices, signage and re-landscaping as necessary. The City maintains approximately 388 medians, islands, gateways, and traffic diverters throughout Palo Alto. These projects will be used for budget planning. Once individual projects are developed and funding is identified, the projects will be brought to Council on an individual basis with individual scopes of work. Fiscal Year 2012 work schedule includes: 7 cul-de-sacs, Island Drive, and Evergreen Park Barriers; Fiscal Year 2013 work schedule includes: medians for Page Mill/Oregon Expressway; Fiscal Year 2014 TBD

Project or Program	Responsible Division/ Sponsoring Agency	Funds/ Cost Allocation	Description
Thermoplastic Striping and Marking	Public Works/Planning and Community Environment	$250,000	$50k/yr to restripe roadways
Street Maintenance	Public Works	$18,768,000	This project provides for annual resurfacing, slurry seal, crack seal, and reconstruction of various city streets recommended in the City Auditor's report on street maintenance. The list of streets to be included in this project will be prioritized and coordinated with Utilities Department undergrounding projects. $630k estimate for 2011 according to VTA, including $549 VTA STP funds
Traffic Signal Upgrades	Public Works/ Planning and Community Environment	$670,000	
Adaptive Traffic Signal Control Project	Public Works/Planning and Community Environment	$476,000	May include $98k in local match from traffic signal upgrades CIP, along with federal earmark of $368k according to VTA records. $103k for design and $373k for construction at 9 identified intersections; additional funding anticipated from Stanford Hospital Expansion mitigation.
Sign Reflectivity Upgrade	Public Works	$300,000	Approximately $50k/yr to ensure compliance with the Manual on Uniform Traffic Control Devices (MUTCD) minimum reflectivity standards. City will phase in this project over a six-year period to ensure compliance by the 2018 deadline.
Parks - Benches, Signage, Fencing, Walkways, and Perimeter Landscaping	Community Services	$700,000	Average $150k/yr; Fiscal Year 2012 through Fiscal Year 2015 - To be determined
Open Space Trails and Amenities	Community Services	$741,000	$150k/yr: This project restores trails, fences, picnic areas, and campgrounds at Foothills Park, the Baylands, and the Pearson-Arastradero Nature Preserves to ensure that facilities are safe, accessible, and maintained for recreational uses. Staff continues to aggressively pursue grant funding opportunities for trail and open space amenity improvements. In the past five years, $435,000 from grant programs augmented the City's contribution to trails improvements.
Indirect and/or Potential Project Integration Opportunities			
Street Light Improvements	Public Works	$550,000	$135k/yr starting 2012; This project replaces street light poles, pole foundations, luminaires, and wiring as needed to maintain or improve street lighting. How do they determine?

Project or Program	Responsible Division/ Sponsoring Agency	Funds/ Cost Allocation	Description
City Facility Parking Lot Maintenance	Public Works	$300,000	100k/yr 2012-214, includes walkway and patio repair at main library, Junior museum, Lucie Stern Center; money does not include plans for Cubberly, for which reimbursement is expected through PAUSD, Foothill College, and/or parking fees.
ADA Compliance	Public Works	$600,000	Mostly earmarked for "buildings and facilities"; some path of travel improvements planned for 2013 and 2015 at city facilities
Art in Public Spaces	Community Services	$225,000	Approx. $50k/yr
City Park Improvements	Public Works	$1,700,000	Average $340k/yr; Fiscal Year 2012 - Wallis and El Palo Alto Parks Fiscal Year 2013 - Robles, Seal, and Werry Parks Fiscal Year 2014 - Baylands Athletic Center Parking lot improvements Fiscal Year 2015 - TBD
Rinconada Park Improvements	Public Works	$775,000	2012 outlay: This project's Fiscal Year 2010 funding has been deferred and the project will be re-evaluated during the Fiscal Year 2011 Capital Improvement Program prioritization process. Access and renovation
Hopkins Park improvements	Community Services	$95,000	2012: This project will enhance the quality and condition of Hopkins Park and address accessibility needs with sidewalk ramping and pathway repairs. This project will upgrade/renovate two mini parks on Palo Alto Ave along San Francisquito Creek, and the gateway area at the intersection of Palo Alto Ave and Middlefield Road.
Monroe Parks improvements	Community Services	$250,000	2011: This project will provide necessary upgrades to pathways, benches, trash, and recycling receptacles and play equipment at Monroe Park. Funding focuses on repairing existing infrastructure and does not entail full-scale park renovation.
Foothills Park Improvements	Community Services	$150,000	2012 - Asphalt paving of roads within park.
Cogswell Plaza Improvements	Community Services	$150,000	2011 - Funding focuses on repairing existing infrastructure and does not entail full-scale park renovations.
Smart Grid Technology Installation	Utilities	$11,500,000	Approximately $2-3 million/yr to implement portions of the Smart Grid Road Map that can be cost effectively applied to the City's electric, gas, and water utilities system resulting in operational cost savings, environmental benefits, and an increase the quality of life and productivity of the residents and businesses of Palo Alto.
Underground Systems Rehabilitation Projects (various)	Utilities	$4,430,000	Various location-specific projects, 2011-2015. Significant rehabilitation of underground electrical systems in Underground Districts 12, 15, 16, 20, and 24 with likely potential impacts and restoration to roadways and sidewalks

Project or Program	Responsible Division/ Sponsoring Agency	Funds/ Cost Allocation	Description
Under-grounding Projects - District 42, 43, 46, and 47	Utilities	$8,800,000	Various location-specific projects, 2011-2015. Removal of overhead electrical lines and replacement with underground systems, involving likely impacts and restoration to roadways and sidewalks.
Gas System Extensions	Utilities	$3,500,000	$700k/yr unidentified
Gas System Improvements	Utilities	$1,000,000	$200k/yr unidentified
Gas System Rehabilitation Projects 20-25	Utilities	$21,054,000	Average allocation of $4.25 million/year to design and replace leaking, inadequately sized, and structurally deficient gas mains and services. By researching the maintenance and leak histories of the mains in the gas distribution system, staff identifies mains and services with these problems. This gas system analysis, along with computer modeling of the proposed improvements to the gas distribution system and coordination with Public Works Paving CIP, is used to select candidates for main and service replacement.
Water System Rehabilitation Projects 24-29	Utilities	$33,532,000	Approximately 24 miles of the total 214 miles in the City's water distribution system are still in need of replacement or rehabilitation. Each year an average of $6.7 million is planned for a set of prioritized projects along the most deteriorated portions of the system.
Sewer System Extensions	Utilities	$3,750,000	$750k/yr: This project provides for the installation of sewer lateral connections, additions of existing mains, and extensions of mains for new or existing customers.
Wastewater Rehabilitation Projects 23-28	Utilities	$16,132,000	Each year an average of $3.3 million is allocated to projects that will implement high priority rehabilitation, augmentation, and lateral replacement work, which reduces inflow of rainfall and ground water into the collection system. The project will be comprised of streets identified in the Master Plan or video inspection work as deficient and in need of enlargement or rehabilitation. Priority will be given to areas identified by Public Works as targeted work zones ensuring infrastructure coordination among the different City departments.
Storm Drainage Funds - Channing/ Lincoln Storm Drain Improvements	Utilities	$5,600,000	2011-2014: This project consists of the installation of 5,800 linear feet of 36-inch to 60-inch diameter storm drain along Channing and Lincoln Avenues.
Matadero Creek Storm Water Pump Station and Trunk Line Improvements	Utilities	$2,155,000	2015 outlay: The streets in this area of the City are lower than the creek water level during storm events. Upgrades to the pump station and the storm drain pipelines leading to it will allow storm runoff to be pumped into Matadero Creek regardless of the creek level.

Project or Program	Responsible Division/ Sponsoring Agency	Funds/ Cost Allocation	Description
Storm Drain Rehabilitation	Utilities	$3,000,000	An average of $600k/yr for projects that will implement the recommendations established by the 1993 Storm Drain Condition Assessment Report. The specific pipes and drainage structures selected for replacement and/or rehabilitation will be determined based on their 1993 condition score and recommendations by field maintenance staff.
Stanford University Hospital Expansion - Proposed Mitigation and Public Benefit Package			
Direct Funding			
Citywide Transportation Impact Fees	Public Works/Planning and Community Environment	$2,200,000	Mitigation for public facilities and services that relieve citywide traffic congestion, namely City of Palo adaptive signal control technologies, expanded crosstown shuttle program, and new Everett Ave Caltrain undercrossing.
Palo Alto Intermodal Transportation Center Pedestrian and Bicycle Enhancements	Public Works/Planning and Community Environment	$2,250,000	For improvements between Palo Alto Intermodal Center and intersection of El Camino/Quarry Rd, with the majority for landscaped passive/active green space according to the proposal
Wayfinding Improvements	Public Works/Planning and Community Environment	$400,000	Pedestrian, bicycle, and transit wayfinding improvements on Quarry Rd between El Camino and Welch
Pedestrian Access Improvements	Stanford Medical Center	$700,000	Enhanced pedestrian connection between Medical Center and Palo Alto Shopping Center, from Welch Road to Vineyard Lane
Potential Direct and/or Partial "Accommodation" Funding			
Stanford University Medical Center Sustainability Fund	TBD	$4,000,000	Details to be determined by City of Palo Alto and Stanford Medical Center
Full-Time Transportation Demand Management (TDM) Coordinator	Stanford Medical Center	$100,000	Funding per year for coordinator position similar to Stanford University's program for Stanford Medical Center employees

Project or Program	Responsible Division/ Sponsoring Agency	Funds/ Cost Allocation	Description
Alpine Rd/I-280 Northbound Ramp Signalization	Caltrans/Santa Clara County	$30,000	Fair share contribution towards potential signal project
Ped/Bike Caltrain Undercrossing	City of Menlo Park	$183,000	Fair share mitigation cost for future potential project in Menlo Park
Planned Intersection Improvements	City of Menlo Park	$514,000	Contribution to planned improvements, including the intersections of Bayfront Expwy/University Ave and Willow/Middlefield Rd.
Traffic Signal Upgrades	City of Menlo Park	$72,000	Fair share mitigation for impacts at specified intersections, including along Sand Hill and Middlefield Rd
County/Regional Projects and Expenditure Programs			
Direct Funding			
Regional Bicycle Share Program	VTA/BAAQMD	Approximately $560,000	Palo Alto approximate portion of $6.9 million pilot program coordinated with VTA, BAAQMD, San Mateo County, and SFMTA, with majority of funds from MTC Climate Initiatives and Safe Routes to Transit grants. Includes 400 bicycles for San Jose and 100 for the City of Palo Alto focused on Caltrain corridor. Expected schedule includes planning/design for 2011, implementation in summer 2012.
Medians and Pedestrian Bulb-Outs on Junipero Serra Rd Near Stanford University	County of Santa Clara	$1,700,000	VTA Local Streets and County Rds Program
Palo Alto Bicycle Boulevards Network Project	VTA Bicycle Expenditure Plan	$5,000,000	Assumes implementation of 2003 Plan recommendations
Palo Alto California Ave. Caltrain Undercrossing Improvement	VTA Bicycle Expenditure Plan	$13,000,000	
Palo Alto US 101/Adobe Creek Ped./Bicycle Grade Separation	VTA Bicycle Expenditure Plan	$6,000,000 - 10,000,000	
Palo Alto South Palo Alto Caltrain Pedestrian/Bicycle Grade Separation	VTA Bicycle Expenditure Plan	$13,000,000	

Project or Program	Responsible Division/ Sponsoring Agency	Funds/ Cost Allocation	Description
Matadero Creek 101 Undercrossing	VT Bicycle Expenditure Plan	$2,000,000	
Partial and "Accommodation" Funding			
Page Mill/I-280 Interchange Improvements	County of Santa Clara	$4,950,000	City Staff is coordinating with County of Santa Clara and Caltrans to develop concept improvement plans.
Oregon Expressway Intersection Improvements	County of Santa Clara	$6,600,000	Multiple intersection and adaptive traffic signal improvements. Includes bicycle boulevard signal treatment at Ross Rd (similar to Bryant St at Embarcadero Ave)
Palo Alto Smart Residential Arterials Program	VTA/City of Palo Alto	$6,250,000	As shown in VTP 2035's Roadway Maintenance Program Project List
Palo Alto Intelligent Transportation Systems	VTA/City of Palo Alto	$1,800,000	As shown in VTP 2035's Roadway Maintenance Program Project List
Palo Alto Intermodal Transit Center	VTA/City of Palo Alto	$59,000,000	Unspecified improvements
El Camino Real BRT	VTA	$233,000,000	$2 million shown in MTC TIP for 2010-2012
Potential Coordination Funding and/or Indirect Value			
US 101 Pedestrian/ Bicycle Overpass at University Ave	East Palo Alto/San Mateo County	$2,399,000	East Palo Alto Overcrossing at University Ave; expenditures shown primarily for 2012 in MTC TIP
Bay Rd Improvement Phases II and III	East Palo Alto/San Mateo County	$11,897,000	Resurface, streetscape, bike lanes, and other improvements; expenditures shown for 2010-2011 in MTC TIP
El Camino Real Grand Boulevard Initiative	San Mateo County Transit District (SAMTRANS)	$3,994,000	Over $3 million shown in FY 2010-2011 in MTC TIP

LAKE TAHOE REGION BICYCLE AND PEDESTRIAN PLAN

Technical Amendment December 2014

2010

Establishing the Foundation for a World-Class Bicycle and Pedestrian Community at Lake Tahoe

TAHOE REGIONAL PLANNING AGENCY

Tahoe Metropolitan Planning Organization

FHWA Credit/Disclaimer:

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Lake Tahoe Bicycle and Pedestrian Plan
August 2010

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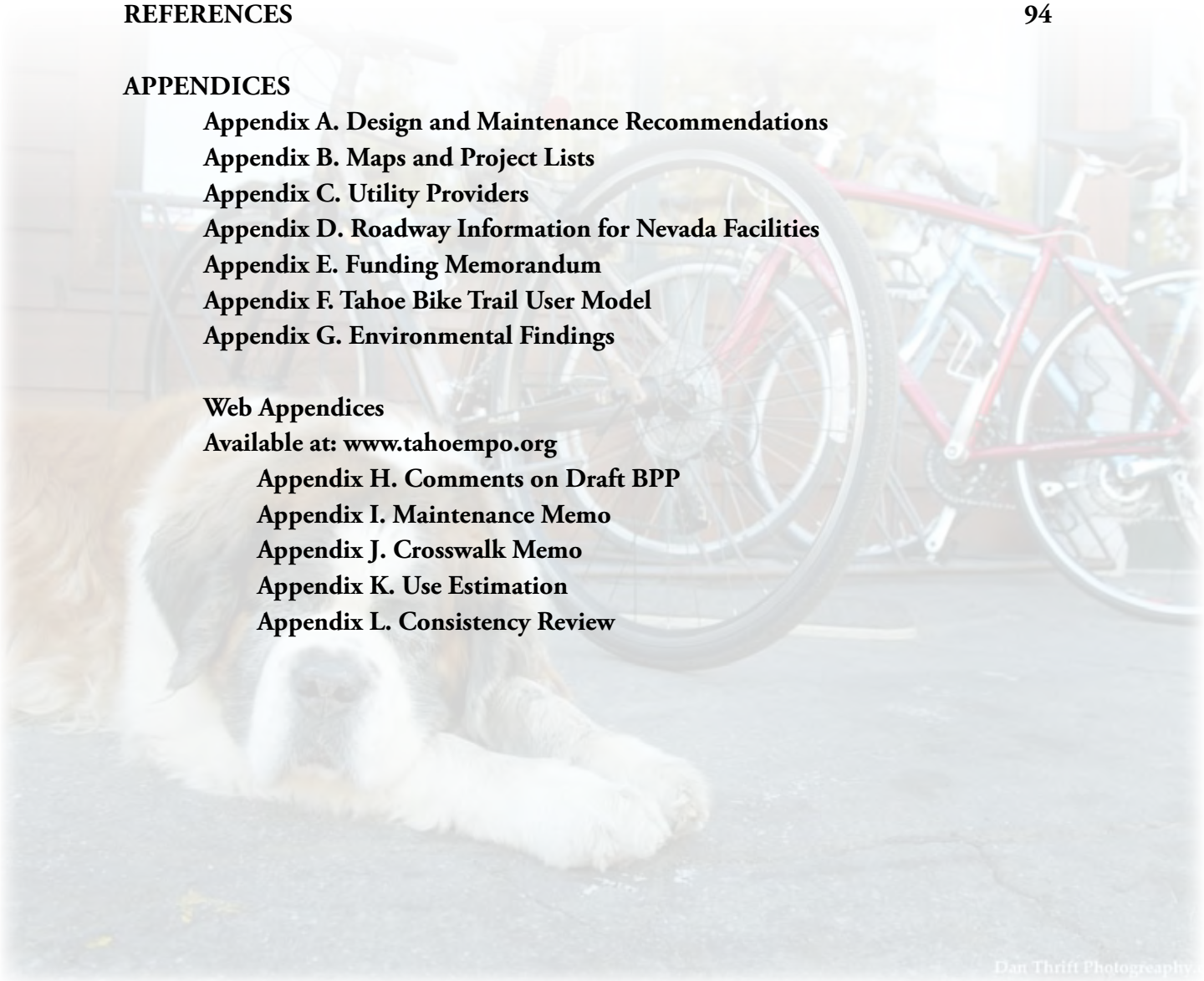


Section I: Introduction

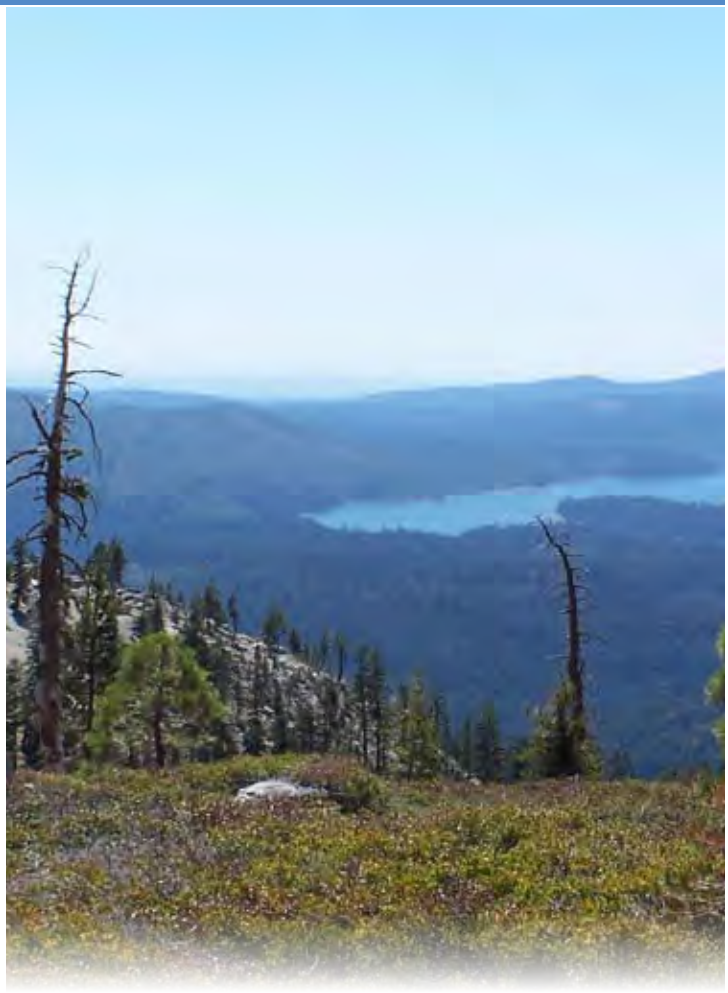
Let's bike and walk! Lake Tahoe's quiet forests, expansive meadows and sunny beaches invite and attract all types of outdoor enthusiasts. Lake Tahoe is a favorite playground for not only the 54,000 Basin residents, but also visitors from central California, Nevada and around the world. The Tahoe Regional Planning Agency (TRPA) and the Tahoe Metropolitan Planning Organization (TMPO) seek to improve bicycling and walking Region-wide in order to protect this beautiful natural environment, provide multiple mobility options, and maintain healthy communities.

Lake Tahoe communities have identified biking and walking opportunities as critical components of a well-rounded transportation system. A strong bicycle and pedestrian network draws people out of their cars, boosting the economy, improving air quality, and creating attractive, healthy communities. Connected bicycle paths, sidewalks, and transit can provide the backbone of a people-oriented transportation system that supports neighborhoods, commercial districts, and recreation areas. This connected transportation system that centers on non-motorized travel will also help Lake Tahoe meet TRPA environmental thresholds and greenhouse gas reduction targets.

Ultimately, Lake Tahoe communities envision an efficient and attractive bicycle and pedestrian network that encircles the Lake, providing complete connections between people and places.

The Lake Tahoe Bicycle and Pedestrian Plan (BPP) presents a guide for planning, constructing, and maintaining a regional bicycle and pedestrian network and support facilities and programs. The network includes on-street bicycle lanes and bicycle routes, and off-street paths and sidewalks. The BPP includes maps and prioritized project lists for the bicycle and pedestrian network, and lays out policies for local governing bodies and transportation agencies. Finally, to help ensure implementation, the BPP identifies potential funding sources and specifies recommended designs to encourage consistency and safety Region-wide.

The BPP serves as the Bicycle and Pedestrian element to both the TMPO Regional Transportation Plan (*Mobility 2030*), and the TRPA Transportation Plan (part of the TRPA Regional Plan). The TMPO is the federally-designated metropolitan planning organization for the Tahoe Region, and is responsible for transportation planning and distribution of federal transportation funding.



Study Area

The study area of the BPP includes the Lake Tahoe Basin, which straddles the California-Nevada border and lies between the Sierra Nevada Crest and the Carson Range (Figure 1, next page). Approximately two-thirds of the Basin is in California and one-third is in Nevada. In total, the Basin watershed contains 501 square miles with the Lake representing almost 200 square miles. The Basin includes the incorporated area of the City of South Lake Tahoe, CA, portions of El Dorado and Placer Counties, CA, portions of Douglas and Washoe Counties, NV, and the rural area of Carson City, NV.

Population and employment centers are clustered around the urbanized communities highlighted on Figure 1. Other nearby areas with significant populations include the Carson Valley, NV (25 miles), Reno, NV (37 miles), and Truckee, CA (15 miles).

Most of the area can be characterized as rolling to mountainous terrain with limited areas of level terrain along the north and south shores of the Lake. Approximately 85% of land in the Basin is publicly owned and managed by the US Forest Service and other state agencies.

TRPA Study Area

Figure 1: Study Area

Agency Roles and Responsibilities

Implementation of the BPP is a multi-agency effort, and the BPP fulfills multiple agency requirements. As a TMPO document, the BPP is incorporated by reference into the TMPO Regional Transportation Plan, *Mobility 2030*, and meets federal requirements for bicycle and pedestrian planning. The BPP is also part of the TRPA Regional Plan. Projects listed in the BPP are eligible for federal, state, and local grants. To apply for these grants, in most cases local jurisdictions will need to formally adopt the BPP.

The primary responsibility for construction and maintenance of the bicycle and pedestrian network lies with local jurisdictions, including counties, the City of South Lake Tahoe, public utility districts, state transportation agencies, regional transportation districts and public lands agencies. Private developers also play an important role in implementation of the network by constructing and maintaining segments that cross their property. The Goals and Policies (page 60) and Prioritized Project List (page 77) are intended to assist and guide in project implementation.

Photo: Tara Pielaet

The TRPA's primary implementation role is in carrying out the Goals and Policies, including writing supportive code. The TRPA will have an active role in the implementation of certain policies, such as working with project developers to accommodate bicyclists and pedestrians. Other policies direct the TRPA to collaborate with local jurisdictions and agencies, for instance in identifying and obtaining funding for projects. Finally, there are many instances where the TRPA will have an advisory role, by encouraging local agencies to increase walkability and bikeability through better signage, increased maintenance, or public outreach.

The BPP may be updated annually if there are sufficient technical changes.

Citizen and Community Input

The TRPA/TMPO held multiple meetings to solicit input on the BPP update. At three preliminary meetings, local planners, advocates and agency staff identified additions to the BPP that would strengthen their ability to provide for biking and walking needs. Staff also facilitated open houses with the public to review draft Goals and Policies, proposed project lists, and prioritization criteria.

Jurisdictions and stakeholders suggested the following additions to the BPP:

- Prioritize projects Region-wide so that Basin agencies can work together to construct projects that complement the existing network.
- Increase the focus on maintenance of existing facilities.
- Highlight the benefits of biking and walking to the environment, economy, and public health.
- Improve the TRPA's ability to require concurrent construction of bicycle and pedestrian facilities with new development, roadway and other capital projects.
- Provide consistent design guidance, particularly where there is flexibility in national or state standards.
- Update regularly the proposed project list and the status of high-priority projects.

The public indicated that bicycle and pedestrian planning should be prioritized as follows:

1. Path and lane construction and connectivity
2. Path, lane and sidewalk maintenance
3. Safety and education
4. Programs and events

They also indicated the following prioritization for project construction:

1. Fixes gap in existing network
2. Destination connectivity
3. Safety
4. Multi-modal connectivity
5. Predicted use
6. Environmental Impact
7. Cost/Benefit
8. Funding availability

The TRPA/TMPO meeting dates and locations were as follows:

- Jurisdiction and Stakeholder Meeting, Tahoe City, CA, October 2005
- Jurisdiction Meeting, Incline Village, NV, November 2008
- Lake Tahoe Bicycle Coalition (LTBC) Meeting, Stateline, NV, February 2009
- South Shore Public Open House, South Lake Tahoe, CA, October 2009
- North Shore Public Open House, Tahoe City, CA, October 2009
- Jurisdiction and Stakeholder Meeting, Stateline, NV, February 2010

In addition, TRPA/TMPO staff attended the meetings of multiple local groups to request input on the BPP. The list of contacts and detailed input from the public and the local agencies are presented in Appendix H.

Consistency with Other Plans

In order to ensure consistency with other planning efforts, a large number of documents were reviewed and incorporated into the BPP. A complete list is included in Appendix L, Consistency Review. Several of particular note are summarized here.

The ***Tahoe Regional Planning Compact*** states that the goal of transportation planning shall be:

a) To reduce dependency on the automobile by making more effective use of existing transportation modes and of public transit to move people and goods within the region

b) To reduce to the extent feasible air pollution which is caused by motor vehicles

In addition, Article I(b) of the Compact established TRPA's responsibility to set environmental threshold carrying capacities. The environmental thresholds were adopted in 1982, by TRPA Resolution 82-11. The thresholds cover various environmental components of the Tahoe Region, including air and water quality standards that are linked to transportation.

The ***TRPA*** and the ***TMPO Regional Transportation Plan, Mobility 2030*** contain general transportation goals and policies, many of which relate to biking and walking. The goals and policies of *Mobility 2030* serve as the basis for the goals and policies of the BPP. The Goals, Policies, and Actions section of the BPP is also consistent with the Goals and Policies of the Regional Plan.

Lake Tahoe Community Plans are part of the TRPA Regional Plan and outline bicycle and pedestrian policies and projects for specific neighborhoods in the Tahoe Region.

The California Bicycle Transportation Act (BTA). As California's Department of Transportation, Caltrans is the agency responsible for implementing bicycle and pedestrian facilities. Caltrans funds local facilities through its Bicycle Transportation Account (BTA). The BTA requires applicants to have adopted or updated a bicycle plan within the past five years. The adopted bicycle plan must comply with CA Streets and Highways Code Section 891.2, and include the eleven elements listed below. California cities and counties, with adoption of the BPP, will be eligible to receive BTA funding.

Elements for BTA eligibility:

- Estimated number of existing and future bicycle commuters;
- Land use and settlement patterns;
- Existing and proposed bikeways;
- Existing and proposed bicycle parking facilities;
- Existing and proposed multi-modal connections;
- Existing and proposed facilities for changing and storing clothes and equipment;
- Bicycle safety and education programs;
- Citizen and community participation;
- Consistency with transportation, air quality, and energy plans;
- Project descriptions and priority listings;
- Past expenditures and future financial needs.

California Highway Design Manual, Chapter 1000: Bikeway Planning and Design, Fifth Edition, California Department of Transportation (Caltrans), July 1, 1995 and the ***American Association of State Highway and Transportation Officials (AASHTO) Guides for the Development of Bicycle Facilities (1999) and Pedestrian Facilities (2004)*** identify specific design standards for bicycle and pedestrian accommodation, both off-street and on-street. They also provide classification systems for different types of bikeways (see page 15). Appendix A, Design and Maintenance Recommendations, is consistent with both Chapter 1000 and the AASHTO Guides.

The Nevada Department of Transportation (NDOT) plans for bicycling and walking in Nevada. NDOT's ***Nevada Bicycle Transportation Plan (2005)***, recommends that local agencies adhere to the AASHTO bicycle facility design standards.

The Federal Manual on Uniform Traffic Control Devices (MUTCD), 2009 Edition and the ***California MUTCD, 2010 Edition*** define the standards used by road managers to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public traffic. The Federal MUTCD is published by the Federal Highway Administration (FHWA), and the California MUTCD is published by Caltrans. Caltrans must officially adopt into the California MUTCD any new standards from updates to the Federal MUTCD. The Federal MUTCD was updated in December 2009, and Caltrans has until January 15, 2012 to adopt the newest standards. Appendix A, Design and Maintenance Recommendations

is consistent with both the Federal MUTCD and the California MUTCD.

Finally, ***Local Jurisdiction Plans and Local Agency Plans***, including general plans and transportation plans, contain project lists and policies that relate to bicycle and pedestrian planning in specific communities in the Basin. While most Basin jurisdictions refer to the BPP for their bicycle and pedestrian project lists, each has their own set of policies that relate to the promotion of bicycling and walking for transportation and recreation purposes. Some plans, such as the City of South Lake Tahoe General Plan or the North Lake Tahoe Resort Association Infrastructure and Transportation Integrated Work Plan include project lists or maps that have been incorporated into the BPP.

Bikeway Classifications

Class I/Bike Route

Caltrans Chapter 1000 and the ***AASHTO Guide for the Development of Bicycle Facilities (1999)*** provide for three distinct types of bikeway classifications as generally described below and depicted in Figure 2 on the following page. The Class I, Class II, and Class III types are unique to California, while the State of Nevada classifies bicycle facilities as Shared-Use Path, Bicycle Lane, and Signed Shared Roadway (previously Bike Route).

Class II/Bike Route

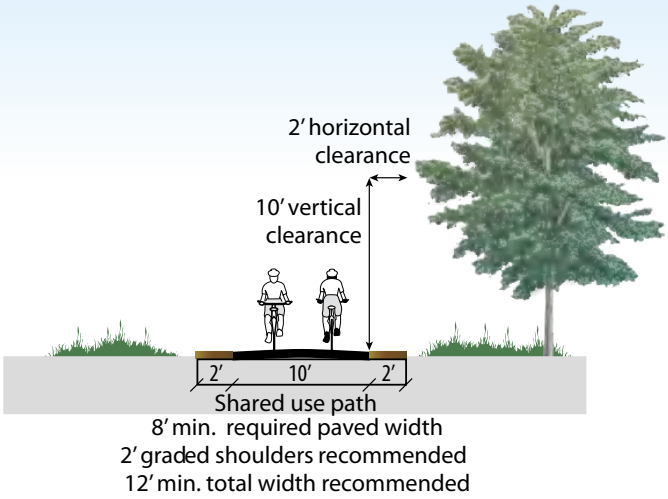
For consistency with other regional documents and past practices, the BPP refers to facilities as follows:

- Class I/Shared-Use Path - Provides a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross-flow from vehicles minimized.
- Class II/Bike Lane - Provides a striped lane for one-way bicycle travel on a street or highway.
- Class III/Bike Route - Provides for shared use with bicycle or motor vehicle traffic, typically on lower volume roadways.

Class III/Bike Route

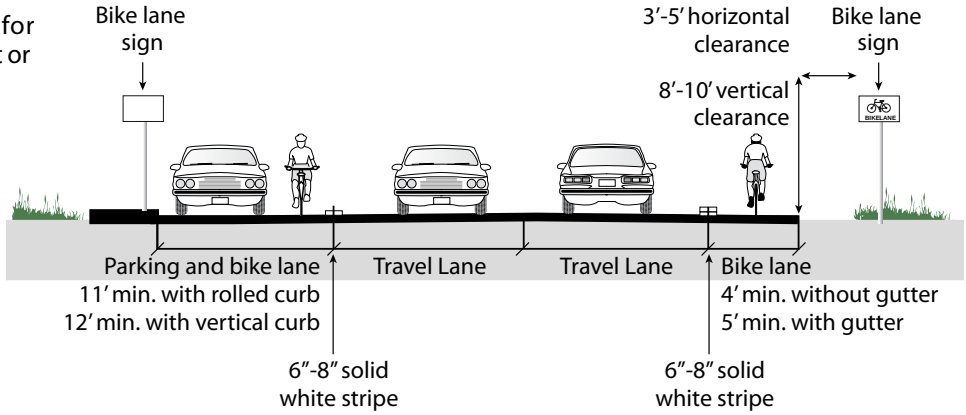
Shared Use Path (Class I)

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



Bike Lane (Class II)

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



Signed Shared Roadway (Class III/Bike Route)

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

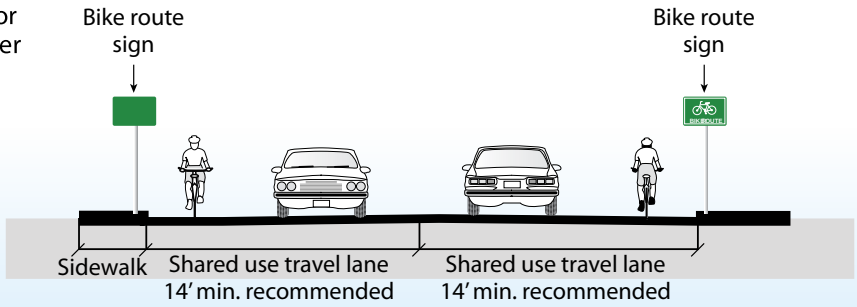


Figure 2. Bikeway Classifications

User Groups

One of the major challenges of planning bicycle and pedestrian facilities at Lake Tahoe is providing for the needs of different user groups. The diverse population of visitors and residents at Lake Tahoe guarantees a wide variety of preferences for facility types, including bicycle lanes and shared use paths. Both must be provided in order to meet the TRPA and TMPO goals of improving mobility and reducing environmental impacts.

The following description of user groups is adapted from the SR-89 Cascade to Rubicon Bay Bikeway Study (2003). These descriptions are generalizations, and the average user may have characteristics of more than one group. Rollerbladers and skateboarders are not addressed explicitly but could fall into any of the categories described here. The BPP does not address mountain bikers, hikers, and equestrians, who generally use the unpaved trail system, managed by the U.S. Forest Service. More information on the unpaved trail system can be found on maps available through the Lake Tahoe Basin Management Unit and local outdoor retailers.

Casual Users

This group includes families with young children, tourists or others out for a recreational ride or stroll and seeking a relaxed trip with attractive scenery. Casual cyclists generally prefer riding off-street on shared-use paths. They are typically not comfortable riding in traffic, and will avoid riding on busy streets, riding on the sidewalk if necessary. Tourists, often on rental bicycles, may ride more slowly than others due to their interest in the scenery and lack of familiarity with local routes. Tourists are not as adept as local riders at navigating confusing routes or traffic situations, thus clear signage is helpful. Bike routes that extend through low-traffic residential streets are generally acceptable for casual cyclists, even if not the most direct route between destinations.

Casual users may drive to a bike path, seeking designated parking areas or parking along the side of the road. Recreational destinations are important attractions for casual users.

Commuter and Utilitarian Cyclists

Commuters and utilitarian cyclists are those who use their bicycles to ride to work or school or to complete small errands such as shopping or visiting friends. They prefer on-road routes or separated shared-use paths, depending upon the age and ability of the rider. These cyclists are usually looking for direct routes between their neighborhoods and shopping and employment areas, although they may deviate a significant

distance for a route that is perceived to be safer. Commuter and utilitarian cyclists can often access their destinations along neighborhood streets, and designation of cross-town bicycle routes is a low-cost way to quickly provide good access for many riders. A large portion of this group is made up of "choice" riders who will decide whether or not to ride based on the availability of safe routes. The average cycling trip to work is 2.13 miles (National Household Travel Survey (NHTS) (2001-2002)).

Commuter and Utilitarian Pedestrians

Similar to their cycling counterparts, commuting and utilitarian pedestrians (this includes wheelchair users) are those who walk to work or school or errands. This user group generally needs sidewalks and paths that are separated from traffic and cleared of snow in the winter. They may also be comfortable walking on quiet, neighborhood streets. Many pedestrians are accessing transit. Paved, cleared continuous paths leading from neighborhoods to transit stops are vital for encouraging transit use and for providing safety for passengers getting on and off buses. Pedestrian commuting and walking trips generally range from about 0.25 miles to 1.5 miles in length (NHTS).

Road Cyclists

Road cyclists are those who use bicycling for intensive recreational purposes or exercise. Roadways are the type of facility that best accommodates their desire for higher speeds, longer distances, and fewer conflicts with other recreational users. Typical trip distances for the road cyclist can range from 20 to over 100 miles. While the average road cyclist would likely prefer to ride on roads with little or no traffic, they are generally comfortable riding in traffic if necessary. To this end, a road cyclist will tend to ride in a manner similar to a motor vehicle (e.g. riding in the vehicle lane when approaching traffic signals or making left turns) and in those cases may be referred to as "vehicular cyclists." Many of the scenic roadways around and entering Lake Tahoe provide ideal terrain for road cyclists. Improvements such as widening, adding bicycle lanes, and placing "Share the Road" signs can enhance the experience and encourage more riders to visit Lake Tahoe.

How To Use This Plan

The BPP is a handbook for multiple stakeholders. Various users will find different sections useful. The following text clarifies terminology used throughout the document and highlights each section of the BPP.

Terminology

Much of the text in this Plan refers to the bicycle and pedestrian "network" or bicycle and pedestrian "facilities." For the purposes of this document the "network" includes shared-use paths, bicycle lanes, bike routes, wide shoulders, and sidewalks. "Facilities" includes the network as well as other support facilities such as bicycle storage racks, lockers, crossing treatments and street markings. Shared-use paths may be referred to as "paths" or "trails." For more details on terminology, see the Definitions and Acronyms section, page 90.

Section 2. Benefits of Bicycling and Walking

Useful to those wishing to make the case for biking and walking in Lake Tahoe, whether to support a project, event, or overall culture shift.

Section 3. Benchmarks and Progress

Highlights progress and accomplishments made since the 2003 plan and sets new benchmarks for the current BPP.

Section 4. Infrastructure and Programs

Describes existing bicycle and pedestrian facilities and programs, and highlights needed improvements to promote safe biking and walking.

Overview of Plan

Section 5. Analysis of Demand/Bicycle Trail User Model

Estimates existing and future demand for the bicycle and pedestrian network using the Tahoe Bicycle Trail User Model. The model, developed specifically for the Lake Tahoe Region, will be used to help estimate the impacts of biking and walking Region-wide for the Regional Plan update. It can also be used to estimate biking and walking on individual path segments. Jurisdictions, departments of transportation, funders, and other long-term bicycle planners will find the model useful for estimating potential use of planned paths.

Section 6. Goals, Policies, and Actions

Sets the policy framework for decisions relating to biking and walking in the Lake Tahoe Region, incorporating the recommendations in the Infrastructure and Programs section. Local jurisdictions, departments of transportation, transit agencies, and TRPA environmental review staff will find Policies and Actions here that relate to their activities. This section also houses a Bicycle and Pedestrian Accommodation Policy (similar to "Complete Streets").

Section 7. Proposed Network

Includes the complete list and map of the bicycle and pedestrian network proposed in the Region, which includes recommendations made in the Infrastructure and Programs section. It also includes a shorter, prioritized list of projects.

Section 8. Cost and Funding Analysis

Includes a summary of costs and projected revenue sources for priority projects. This section also lists potential grant sources for construction of bicycle and pedestrian facilities, maintenance, and outreach.

Section 9. Implementation

Graphically depicts who is responsible for bicycle paths that are on the ground and how bicycle paths progress from planning to implementation in the Tahoe Region. It also depicts how projects are incorporated into the TMPO Regional Transportation Plan (*Mobility 2030*) and the Environmental Improvement Program (EIP). The multi-billion dollar EIP encompasses hundreds of projects designed to restore Lake Tahoe's clarity and environment. This section will be helpful for agencies who want to make sure that their projects are lined up for as much funding and support as possible.

Section 10. Useful Links

Highlights web links to other organizations and documents.

Definitions and Acronyms

Includes a list of definitions for transportation terms and acronyms.

References

Lists references cited throughout the BPP.

Appendix A: Design and Maintenance Recommendations

Identifies preferred designs for best accommodating bicyclists and pedestrians in roadway projects, new and existing development, and on bicycle facilities. This section will be especially useful to local jurisdictions, private developers building new commercial, multi-family, or tourist accommodation projects, and TRPA project review staff. All project implementers will want to refer to this section for consistency Region-wide, and to provide the amenities and features most commonly requested by the public that are approved in federal and state design manuals.

Appendix B: Maps and Project Lists

All maps and project lists are presented near the end of the document for easy reference and comparison.

Other BPP Appendices:

C. Utility Providers
D. Roadway Information for Nevada Facilities
E. Funding Memo
F. Bike Trail User Model
G. Environmental Findings

Web Appendices: www.tahoempo.org

H. Comments on Draft BPP
I. Maintenance Memo
J. Crosswalk Memo
K. Use Estimation
L. Consistency Review

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Section 2: Benefits of Bicycling and Walking

Bicycling and walking can provide multiple benefits to Lake Tahoe communities, including reducing air pollution, meeting greenhouse gas reduction targets, improving the local economy, and improving public health. Beyond the tangible benefits, biking and walking are pleasurable, relaxing outdoor activities that residents and visitors to Lake Tahoe seek out and enjoy. Biking and walking are critical for meeting the TRPA Compact goals of attaining environmental thresholds and reducing dependency on the private automobile.

How do we quantify the benefits of bicycling and walking? How do we evaluate the benefits versus the costs of building facilities? To answer these questions at a general level, the TRPA/TMPO compiled data from Tahoe surveys and research from other areas. Major findings include:

- The built-out bicycle and pedestrian network is estimated to reduce Vehicle Miles Traveled (VMT), a TRPA air quality threshold indicator, by 8,500 miles on a peak summer day.
- Overnight and day visitors who visit Lake Tahoe primarily for cycling purposes are estimated to bring between $6 and $23 million in local direct expenditures annually to Lake Tahoe communities. This compares favorably to an average of $3 million per year (over the last 10 years) spent on construction of the existing network.
- Neighborhood design, including the proximity of transportation systems, parks, and paths, is related to physical activity levels. Changing the built environment, such as introducing traffic calming, paths, and bicycle infrastructure increases levels of physical activity in the community.

The following pages describe in more detail the variety of benefits, as well as some of the costs associated with shared-use paths and bicycle and pedestrian-friendly communities.

Environmental Benefits

Shared-use paths can have impacts on multiple environmental threshold areas, including air quality, water quality, soils, wildlife, and recreation. The overall impact appears to be either positive or neutral on each of these threshold areas.

Vehicle Miles Traveled (VMT) is a TRPA **air quality** threshold indicator. VMT is linked to emission of nitrogen oxides, particulate matter, hydrocarbons, and greenhouse gas. Shared-use paths can both reduce VMT (as people shift from their cars to biking and walking) and contribute to VMT (as some may elect to drive to a path as a recreation amenity). To quantify potential impacts, LSC Consultants, with assistance from Alta Planning and Design, developed a Tahoe Bicycle Trail User Model that accounts for both the vehicle trip generation and reduction attributable to bicycle facilities. Estimates from the model indicate that if the full network were constructed, biking and walking trips would reduce VMT by approximately 8,500 miles on a peak summer day. This translates into a reduction of approximately 1,400 metric tons per year of carbon dioxide, a key greenhouse gas (U.S. Environmental Protection Agency). Lake Tahoe paths with greater proximity to population centers and popular destinations have the greatest potential to reduce VMT. Scenic paths far from population centers with unlimited parking are less likely to reduce vehicle trips, and in some cases may increase them (TMPO).

The Lake Tahoe Total Maximum Daily Load (TMDL), a program of research dedicated to identifying the primary sources of **water quality** degradation in Lake Tahoe, did not find that shared-use paths have a significant positive or negative impact on water quality. While paths in sensitive areas can impact stream environment zones (SEZ), and must be mitigated to allow ecosystem function to continue, these paths are not associated with the same runoff impacts as roadways due to the lack of road sanding

or heavy vehicle use. While shared-use paths can reduce VMT and hence atmospheric deposition, the primary strategies of the TMDL are currently focused on treatment of roadway runoff, advanced vacuum sweeping techniques and application of alternative roadway abrasives. The strategies do not focus on construction of paths. Over time, shared-use paths and bicycle lanes may positively affect water quality by reducing the need for impervious surfaces such as additional vehicle lanes or parking spaces.

Shared-use paths have a positive impact on the TRPA **recreation** threshold**.** Paths often provide excellent non-auto access to Lake Tahoe's recreation destinations, in addition to serving as recreation attractions. Even though biking or walking on a path sometimes involves a car trip, biking or walking as a recreation activity is generally considered to impact environmental thresholds less than other recreation activities such as boating, jetskiing, driving around the Lake, or off-roading.

Paths can have adverse impacts on **wildlife** and **sensitive plant species**, and are not permitted in wildlife protection areas or buffer zones, unless proven mitigation measures are implemented.

Economic Impacts

Bicycle paths provide many economic benefits including increased property values, direct expenditures at local businesses, employment opportunities, and personal savings from reduced vehicle use. Bicycle paths can increase the draw of the Region, encouraging visitors to extend their stay and spend more money. Surveys show that Lake Tahoe bicycle paths and bicycling events, such as America's Most Beautiful Bike Ride (AMBBR), an event with over 3,500 registered riders, attract users with relatively high disposable income.

Specific survey findings from the Lake Tahoe Bicycle Coalition and the TRPA indicate:

- Over 52 percent of Lake Tahoe path users have annual income levels of over $100,000, and 65 percent have a college degree or higher.
- Fifty-six percent of AMBBR survey respondents have incomes over $100,000, and 75 percent have at least a college degree.
- Twenty-seven percent of AMBBR respondents spent more than $2,500 on the purchase of their bicycle.

Many areas have conducted studies to understand the extent of **direct expenditures** related to bicycling on state and local economies. In 1999, the Maine Department of Transportation estimated that direct spending by bicycle tourists in Maine totaled $36.3 million. The Colorado Department of Transportation found the total economic benefit from bicycling to the State of Colorado to exceed $1 billion annually. The Mineral Wells to Weatherford Rail-Trail near Dallas, Texas, was estimated to generate local revenues of $2 million annually in 1999 (Rails-to-Trails Conservancy).

Lake Tahoe visitor direct expenditures related to bicycle paths can be calculated from local data. Tahoe-specific studies show the average daily expenditure for visitors is approximately

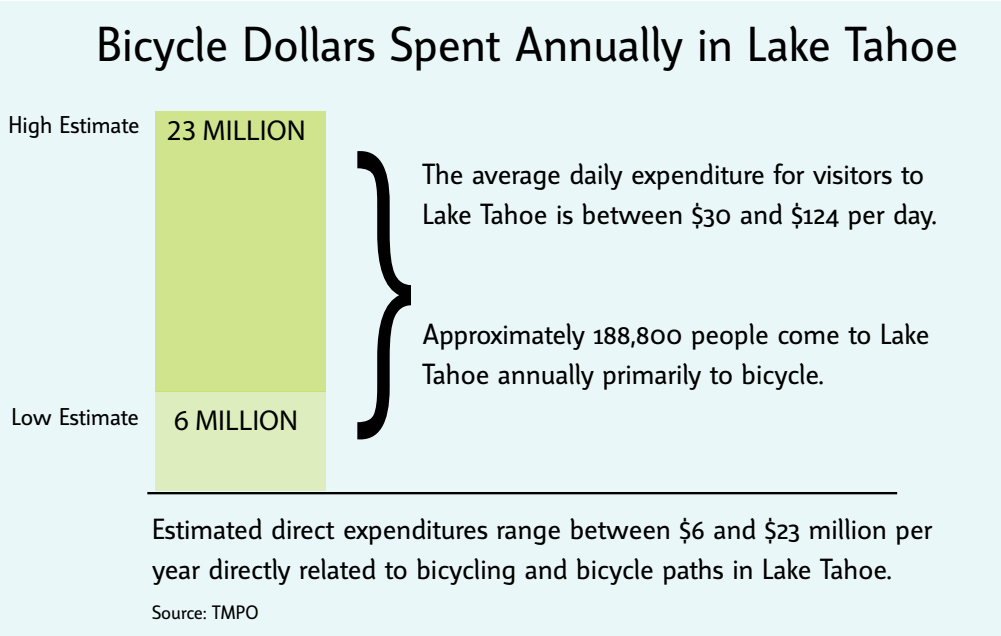
Photo: Ty Polastri

$124 per day (TMPO; Lake Tahoe Visitors Authority (LTVA); North Lake Tahoe Resort Association (NLTRA); TRPA/Tahoe Coalition of Recreation Providers (TCORP)). This is probably a high estimate, as it is not broken down by visitor activity while in the Region. For a low estimate, the research in Maine, which has many similar characteristics to Lake Tahoe, found an average daily expenditure of approximately $30 for visitors who participated in partial day bicycle trips. Tahoe bike path surveys show that approximately 30 percent of path users come to Lake Tahoe primarily for cycling purposes, or approximately 188,800 people annually (TRPA/TCORP; TMPO). Multiplying these by the estimated expenditure yields a low estimate of $6 million per year and a high estimate of $23 million per year directly related to bicycling and bicycle paths in Lake Tahoe.

Visitors are attracted to regions that offer a variety of activities, and the opportunity to bicycle or walk can play an important role in enticing visitors. A study conducted by the LTVA in 2008 stated that length of stay is "probably the most important factor to influence the economic impacts on the Tahoe Region…" Expanding bicycling and walking opportunities could encourage people to extend their stay. Approximately 13% of visitors surveyed in a North Carolina Northern Outer Banks study stated that their visit duration was longer by an average of three to four days due to the excellent bicycling opportunities (Lawrie).

Property value is another source of economic benefit to the Tahoe Region related to bicycle paths. Multiple studies show increases in property values based on proximity to a bicycle path or greenway. A 1998 study of property values along the Mountain Bay Trail in Brown County, Wisconsin showed that lots adjacent to the trail sold faster and for an average of 9 percent more than similar property not located next to the trail (Rails-to-Trails Conservancy). Several other studies also show a range of increases in property values and faster sales times for houses in proximity to trails and greenways (Los Angeles County Metropolitan Transportation Authority).

There are **other economic benefits** of bicycling and walking that are not so easily quantified, such as job creation and savings from fuel consumption, car payments, car maintenance, and car storage. Savings from these sources can free up discretionary income and allow both residents and visitors to spend more in Lake Tahoe communities.



Health Impacts

In recent years, public health professionals and urban planners have become increasingly aware that the impacts of motor vehicles on public health extend far beyond the negative effects of air pollution that include asthma and other respiratory diseases. Reliance on the automobile has led to lack of physical activity, which in turn has been linked with cardiovascular disease, thromboembolic stroke, hypertension, type 2 diabetes, and osteoporosis (Haskell). During the past 20 years there has been a dramatic increase in obesity in California and Nevada as well as the United States as a whole. In 2008, California's obesity rate was approximately 22 percent, compared to less than 10 percent in 1990. Nevada's obesity rate was approximately 27 percent in 2008 compared to approximately 17 percent in 1999 (1990 data was not available for Nevada) (Centers for Disease Control and Prevention (CDC)).

The Centers for Disease Control/American College of Sports Medicine recommended in 2007 that all healthy adults aged 18 to 65 years need moderate-intensity physical activity at least three days each week (CDC). Community design, including the provision of bicycle paths, influences the ability of local residents to attain these levels of exercise through their daily activities, such as commuting to work or school, or taking a recreational walk.

In addition to individual health benefits, physical activity provides fiscal savings by reducing health care costs and lost days of work.

- Annual per capita health cost savings from physical activity have been found to vary between $19 and $1,175, with a median value of $128.

- Multiplying the $128 median value of annual per capita health cost savings by the population of Lake Tahoe communities yields over $7 million of health care cost savings annually.

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Section 3: Benchmarks and Progress

The 2003 Bicycle and Pedestrian Master Plan was the launching point for major improvements to the bicycle and pedestrian network, as well as the catalyst for strengthening policy language. The 2003 Plan also set several ambitious benchmarks. This section charts the Region's progress toward those benchmarks and describes new strategies for meeting bicycle and pedestrian goals.

New Facilities

The 2003 plan envisioned 60 additional miles of bicycle and pedestrian facilities by 2008, and 174 additional miles of bicycle and pedestrian facilities by 2023. As a measure of success, between 2003 and 2010 approximately 13 miles of the proposed network were built (Table 1). In addition, another 19 miles, mostly of bicycle lanes, are currently in construction or scheduled to be within the year, bringing the total to 31 miles. (See the "status" column in Table 18, Proposed Bicycle and Pedestrian Project List, Appendix B.) These miles of bikeway fill important gaps in the network.

New Policies

Since 2003, several new policies have been implemented at TRPA to help facilitate concurrent construction of facilities in new and re-development and roadway projects. In the past, although projects were listed in the Bicycle and Pedestrian Plan, they were sometimes overlooked by developers and project reviewers. While many new projects did include the proposed bicycle and pedestrian components, such as the Sierra Shores development in South Lake Tahoe, and the Caltrans water quality improvements in the North Shore, a few projects invested significant capital into improvements without providing for the bicycle facilities called out in the BPP.

Facility Name	Responsible Agency	Miles
Sawmill 1A Shared-Use Path (2007)	El Dorado County	1.2
Sawmill 1B Shared-Use Path (2008)	El Dorado County	0.3
15th Street Bike Path and Bridge (2003)	City of South Lake Tahoe	0.3
15th Street Bike Lanes (2008)	City of South Lake Tahoe	0.3
Lyons Avenue (2006)	City of South Lake Tahoe	0.3
Ski Run Blvd Shared-Use Path - 2004	City of South Lake Tahoe	1
South Lake Tahoe Ballfields Shared-Use Path (2003)	City of South Lake Tahoe	0.5
(2007)	City of South Lake Tahoe	0.3
Lakeside Trail Shared-Use Path - Phases IB, IIA, IIB, III, IV (2004-2007)	TCPUD	0.4
SR 28 through Incline Sidewalk 2006	Washoe County/IVGID	2.1
Country Club Sidewalk (Incline Village)	Washoe County/IVGID	0.5
Incline Way Sidewalk (Incline Village)	Washoe County/IVGID	0.1
Tanager Sidewalks (Incline Village)	Washoe County/IVGID	0.2
College Way Bike Lanes (Incline Village)	Washoe County/IVGID	0.4
Kings Beach to North Stateline Bike Lanes (2009)	Caltrans	0.9
SR 89 Emerald Bay Road Bicycle Route	Caltrans	3.6
USFS Tallac Historic Site Trail	USFS	0.6
Total		**13**

Table 1. Facilities constructed since adoption of 2003 Bicycle and Pedestrian Master Plan

To address this problem, TRPA staff incorporated a bicycle and pedestrian checklist into its project application process, and created an interactive, online map: http://gis.trpa.org:82/BIKEMAP. By visiting this site, project applicants can determine the proximity of their project to proposed and existing facilities and include them into their plans at the earliest stage. In addition, TRPA staff has held multiple meetings with Caltrans and NDOT planners, designers, and engineers to discuss the need for bicycle and pedestrian accommodation. Building on this, the 2010 BPP includes policy language on accommodation of bicyclists and pedestrians ("Complete Streets" language) that is anticipated to be adopted into the TRPA Code of Ordinances with the Regional Plan update. On-going meetings with Caltrans and NDOT are also called for as part of this BPP.

Notable accomplishments in the period from 2003 to 2010 include:

- Completion of the first phases of the Sawmill Bike Path in Meyers, which will eventually connect the existing Pat Lowe Memorial Trail to the South Tahoe "Y"
- Over three miles of new sidewalk in the Incline Village Commercial Area
- New bicycle lanes in the Incline Village and Kings Beach areas
- Shared-use paths on both sides of Ski Run Boulevard in South Lake Tahoe
- Missing links on the Lakeside Bike Trail in Tahoe City
- City of South Lake Tahoe allocation of $25,000 towards community bicycle racks
- Completion of the 15th Street Bike Trail in the City of South Lake Tahoe
- Sixty thousand copies of the Lake Tahoe Bicycle Trail Map distributed
- Bicycle and pedestrian checklists in TRPA project applications, plus on-line, interactive map of proposed bicycle and pedestrian network
- Recognition of the City of South Lake Tahoe as a bronze-level League of American Bicyclists (LAB) Bicycle-Friendly Community 2006, 2008
- Recognition of North Lake Tahoe-Truckee Resort Triangle with "Honorable Mention" by LAB Bicycle Friendly Community Program.

Cascade to Rubicon Bay Bikeway Study

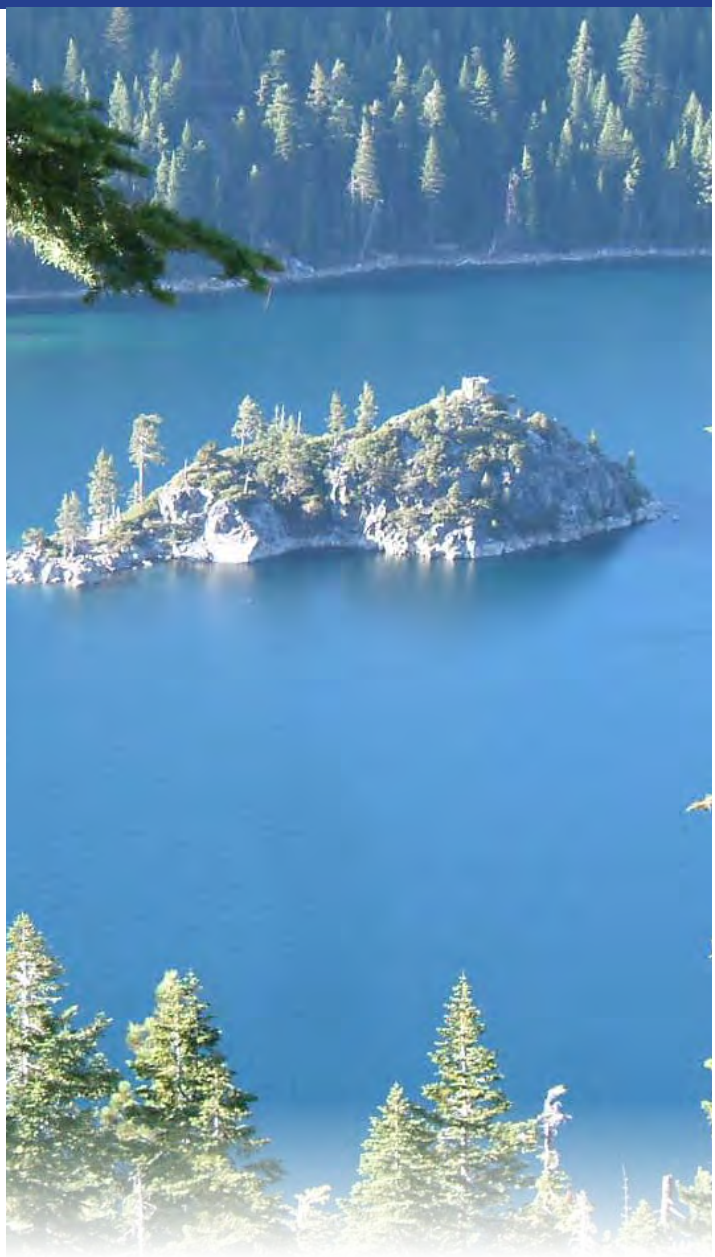
Another important plan published concurrently with the 2003 Bicycle and Pedestrian Master Plan is the Caltrans State Route 89—Cascade to Rubicon Bay Bikeway Study. This plan researched several ways to improve bicycle access along the severely constrained section of roadway around Emerald Bay.

There were three major recommendations from this study:

- Widen the highway from 2 to 4 feet where feasible. Divert riders onto a combination of on-street neighborhood routes and new Class I/ Shared-Use Paths where topography allows.
- Facilitate a bicycle ferry from Camp Richardson to Meek's Bay.
- Expand existing transit to better serve bicyclists around the Emerald Bay Area.

Improvements to transit have occurred around the Emerald Bay Area, implementing some of the goals of the SR-89 study. During the summer, there is now hourly service from both Tahoe City and South Lake Tahoe to Emerald Bay by trolley with bicycle racks.

While this section of roadway remains one of the most difficult sections of the round-the-lake bikeway to complete, feasible improvements have been identified and are included in the BPP. Some lower cost improvements, such as routing bicyclists through the Rubicon neighborhood on a Class III/Bike Route could happen in a short timeframe.



Improvements to transit have occurred around the Emerald Bay area.

Benchmarks and Monitoring

Setting benchmarks and monitoring progress helps track the effectiveness of plans, projects, and programs. The TRPA runs a robust monitoring program to track progress toward the benchmarks listed below.

In 1999, the Federal Highway Administration (FHWA) and the National Highway Traffic Safety Administration established two goals pertaining to bicyclists and pedestrians: 1) to improve safety and 2) to increase use by the year 2022. Specifically, the national goals were to reduce the number of bicycle and pedestrian injuries and fatalities by 10 percent and increase the number of trips made by biking and walking to 15 percent. The goals of the 2010 BPP mirror the broader performance measures of the Federal Highway Administration, while establishing specific benchmarks attainable for a 20-year horizon.

In order to track progress, the 2010 BPP sets the following performance benchmarks:

Benchmark 1:	Double the percentage of commuters who bicycle or walk to work from 3.8 percent of all employed residents to 7.6 percent of all employed residents per U.S. Census data by 2023.
Benchmark 2:	Increase the percentage of residents and visitors who bicycle and walk to commercial and recreation destinations from 16 to 25 percent in the summer, and from 13 to 20 percent in the winter by 2023. By 2030, increase to 30 percent in the summer and 25 percent in the winter.
Benchmark 3:	Implement 20 percent (approximately 45 miles) of all recommended facility improvements within five years (by 2015).
Benchmark 4:	Implement 40 percent (approximately 90 miles) of all recommended facility improvements within ten years (by 2020).
Benchmark 5:	Decrease the bicycle and pedestrian accident rate.

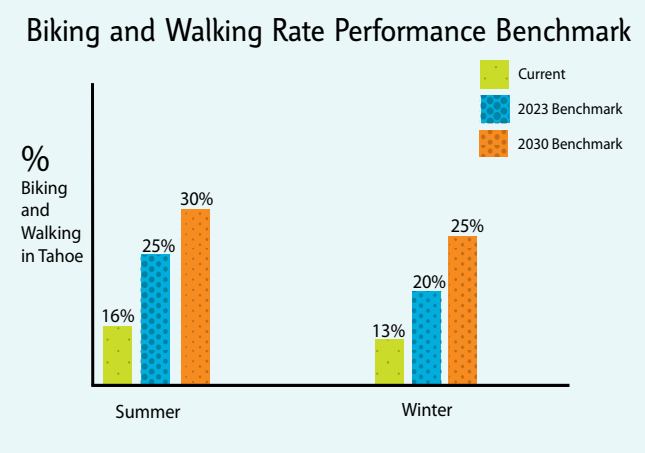
Section 6, Goals, Policies, and Actions on page 60 is the strategy to achieve these benchmarks. The actions specified in Section 6 are the new, near-term activities that will move the Region closer to meeting the benchmarks set here.

The first two benchmarks address the percentage of trips made by biking and walking, which is a good measure of air quality improvement and the success of the BPP. Almost all of the goals, policies, and actions in Section 6 relate to achieving these two benchmarks. Benchmark 1 is measured through U.S. Census journey-to-work data, and will be evaluated when the next U.S. Census is available, anticipated near the end of 2010. Although "journey-to-work" data only

captures resident trip patterns, it is an extremely useful measurement because it is easily comparable to other regions. Current journey-to-work data are shown in Table 9 on page 54.

Since visitor travel is not captured by Census journey-to-work data, TRPA developed performance measures and associated monitoring protocols that capture the biking and walking rates of both residents and visitors. These studies focused on travel to commercial and recreation destinations. In the 2006/2008 studies, the percentage of people who bicycled to commercial or recreation areas in the summertime was 4 percent, and the percentage who walked was 12 percent. In the winter, the percentage who bicycled was 1 percent and the percentage who walked was 12 percent. These surveys are conducted every four years. Benchmark 2 is related to these performance measures.

Completion of the pedestrian and bicycle network and improvement of pedestrian crossings, as called for in Goal 1 are crucial to achieving the non-auto mode shares specified in Benchmarks 1 and 2. Benchmarks 3 and 4 are direct measures of on-the-ground network completion.



Benchmark 5 relates to pedestrian and bicyclist safety. As with the goal of increasing the mileage of on-the-ground facilities, reducing the number of pedestrian and bicycle-related collisions also contributes to shifting more people out of their cars. This benchmark should be tracked by comparing the rate of pedestrian and bicycle-related collisions in relation to overall collisions. The rate of collisions was not tracked in past documents, so a comparison cannot be made at this time, however the current rate is about 1%. Goals 1 and 2 and associated policies help achieve Benchmark 5.

BPP GOALS

GOAL 1:
A complete bicycle and pedestrian network that provides convenient access to basin destinations and destinations outside the Basin.

GOAL 2:
To raise awareness of the bicycle and pedestrian network and encourage safe and increased bicycling and walking

GOAL 3:
To provide environmental, economic, and social benefits to the Region through increased bicycling and walking.

Section 4: Infrastructure and Programs

This section describes the status of bicycle and pedestrian facilities in the Region as of 2010, as well as support facilities and programs. The discussion focuses on connectivity and gaps in the network, safety issues, and multi-modal connections, and includes recommendations for future improvements.

Existing facilities include shared-use paths, bicycle lanes, bicycle routes, and sidewalks. Table 2 (page 36) breaks out the mileage of existing bicycle and pedestrian facilities by jurisdiction. See Appendix B, Figure 8 for a map displaying the existing bicycle and pedestrian facilities within the Lake Tahoe Basin and Table 17, Existing Bicycle and Pedestrian Network, for a list of these projects.

Bicycling

The infrastructure that supports bicycling in the Region includes shared-use paths, bicycle lanes and routes, and end-of-trip support facilities such as bicycle parking and showers.

Shared-Use Paths

Existing shared-use paths are concentrated in the north shore communities of Tahoe City, CA and Incline Village, NV and the south shore community of South Lake Tahoe, CA. Over 13 miles of nearly continuous Class I/Shared-Use Path stretches from the mid-point of Tahoe's west shore at Sugar Pine Point State Park through Tahoe City and north to Squaw Valley. There are other segments of 1 to 5 mile-long paths scattered throughout Stateline, NV, Meyers, CA, El Dorado County, CA, and Kings Beach, CA.

Major gaps in the network are along the east shore of Lake Tahoe, around Emerald Bay and Homewood on the west shore, between Tahoe City and Kings Beach, Crystal Bay and Incline Village, and Meyers, CA and South Lake Tahoe, including connections to both the South Tahoe "Y" and Stateline. There are also localized gaps. There are two gaps in South Lake Tahoe's otherwise continuous network. One is a section along the Lake from El Dorado Beach to Ski Run Blvd, and the other is a section along Harrison Avenue, a short street near U.S. Highway 50 fronting several blocks of businesses. (See Figure 8, Existing Bicycle and Pedestrian Network Map in Appendix B.)

There are also missing links in the Lakeside Trail in Tahoe City, and at Homewood, on the west shore. These gaps in otherwise continuous paths are the highest priority for completion. Next in priority are extensions to existing paths that begin to complete the round-the-lake network, such as Phase 1 of the Nevada Stateline-to-Stateline Bikeway (see Chapter 7, Proposed Network, page 74)

Bicycle Lanes and Bicycle Routes

South Lake Tahoe, El Dorado County and Incline Village are the communities with significant bicycle lanes and routes. South Lake Tahoe and Meyers have bicycle lanes on six of the eleven major

connectors or arterials. All of these bicycle lanes feed directly into cross-town corridors by connecting to either shared-use paths or signed, stenciled bicycle routes. An 8-mile, continuous bicycle lane is located along Pioneer Trail in the South Shore. Three and a half miles of continuous bicycle lane along State Route 28 connect Incline Village from end to end. Two bicycle lane and shoulder projects, on State Route 28 from Dollar Hill to Kings Beach in the North Shore, and on State Route 89 from Meyers to the El Dorado/Alpine County line in the South Shore are under construction at the time of printing of the BPP.

South Lake Tahoe uses bicycle routes as important connections in cross-town corridors. With the exception of the two significant gaps mentioned on the previous page, a combined system of shared-use paths and bicycle routes connects the South Tahoe "Y" to Stateline on both the east and west sides of U.S. Highway 50. South Lake Tahoe has recently undertaken an effort to add a "sharrow" stencil to its on-street routes. The on-street route system could be further enhanced by adding directional signage to U.S. Highway 50 alerting riders that an alternative route exists.

South Lake Tahoe "sharrow"

Bicycle Parking and Showers

End-of-trip infrastructure such as bicycle racks, bicycle lockers and showers also promote bicycling by increasing its security and convenience. In the Lake Tahoe Region, almost all schools, libraries, transit stations, and recreation centers have some form of bicycle rack. Some government buildings, office buildings, retail centers, public spaces and parks have designated bicycle parking. "Bike to Work, School, Play" riders who participated in an end-of-event survey in 2009 reported that 22 out of the 26 different work locations represented had adequate bicycle parking for employees. Thirteen out of the 26 employers had showers available for employees.

The City of South Lake Tahoe, working in collaboration with the Lake Tahoe Bicycle Coalition initiated a new program in 2010 distributing bicycle racks to public centers and businesses.

Jurisdiction	Class I Path	Class II Bike Lane (1)	Class III Bike Route	Sidewalk	Total
El Dorado County, CA	9	7	4	0	20
City of South Lake Tahoe	8	8	9	4	29
Placer County, CA	14	2	2	1	19
Douglas County, NV	2	0.1	1	1	5
Washoe County, NV	10	4	7	6	26
Carson City, NV	0	0	0	0	0
Total	**43**	**21**	**22**	**12**	**99**

Note 1: Miles of roadway with Bike Lanes. For maintenance purposes, this figure should be doubled since bicycle lanes are on both sides of the roadway.

Table 2. Miles of existing bicycle and pedestrian facilities

All commercial, tourist, recreation and residential centers should have short-term bicycle parking, such as inverted "U" racks. Bicycle lockers should be considered in locations where bicyclists may need to leave their bicycle for several hours, such as at a transit center. Until recently, TRPA only required the installation of secure bicycle parking for employers with more than 100 employees (TRPA Code of Ordinances, Chapter 97). However, bicycle storage is now required as part of all new developments. Project applicants and TRPA project review staff should refer to Appendix A, Design and Maintenance Recommendations for specifics on amount and type of bicycle storage required.

Inverted "U" bicycle parking at Heavenly Village in South Lake Tahoe.

Walking

A safe and comfortable walking environment is vital to the success of tourist-centered communities. At some point, virtually all travelers become pedestrians, walking from their parked car to a storefront, stepping off a bus, or strolling from their accommodations to the Lake. Planning for pedestrian safety and convenience requires integrating pedestrian needs into street design and building design from the earliest stages. In addition to sidewalks and paths, slow vehicle speeds, convenient and safe crossings, and mixed land-uses also support walking.

Sidewalks

Pedestrians use both sidewalks and shared-use paths for walking. The provision and maintenance of sidewalks is not consistent among the communities in Lake Tahoe. Both Tahoe City and Incline Village have emphasized construction and maintenance of their sidewalk network in providing an attractive frontage and access to businesses and recreation areas along major travel routes. Significant gaps in the sidewalk network are most noticeable in South Lake Tahoe and Kings Beach. Both of these communities have high volumes of pedestrians, many of whom access transit along the main highway. Most sidewalks along U.S. Highway 50 in South Lake Tahoe are planned to be constructed by 2012 through a Caltrans water quality project. The sidewalks in Kings Beach are planned to be constructed through an upcoming commercial core improvement project.

Crossing Protection

There are few marked crossings at unsignalized crossing points in the Lake Tahoe Region, particularly along the state highways. In recent years, the trend has been removal of marked crosswalks by roadway agencies due to concerns that traditional crosswalk markings do not afford enough protection for pedestrians on busy roadways. Exceptions include a flashing beacon on the West Shore Trail at the crossing of Sequoia Avenue and State Route 89 in Sunnyside, and crosswalks in the downtown areas of Tahoe City, Kings Beach, North Stateline and other limited locations. Crosswalks have been maintained on some residential streets and lower volume streets, particularly near schools.

While the current high traffic volumes and speeds on most major roadways in the Lake Tahoe Region may mean that traditional crosswalks (two painted

lines) are not appropriate, removing crosswalks altogether discourages walking and biking and does not meet the goals of pedestrian and bicycle-friendly communities. There are a variety of crossing treatments that can be considered during project design to enhance safety and walkability for pedestrians, depending on vehicle speeds and volumes.

Advance stop bars are placed 30 to 50 feet in front of the crosswalk and are generally accompanied by a "yield here to pedestrians" sign. The main purpose of advance stop bars is to provide a better line of sight between the pedestrian and an approaching driver whose view may be partially blocked by another car that has already stopped at the crosswalk.

In-roadway warning signs are placed in the roadway, between travel lanes to alert drivers to the presence of a crosswalk. The purpose of these signs is to remind drivers of the state law to yield or stop for pedestrians in the crosswalk. These signs have been used successfully in Tahoe City during the summer.

In-roadway warning sign.

Finally, **flashing beacons** may be used to alert drivers to crossing pedestrians. Some flashing beacons are designed to flash only when activated by a pedestrian, while others flash constantly. Pedestrian-activated flashing beacons have a much higher vehicle compliance rate than constantly-flashing beacons. The "Sequoia Crossing" of SR 89 by the West Shore Trail south of Tahoe City is a good example of a flashing beacon activated by a pedestrian or cyclist.

The "HAWK" Pedestrian Crossing

HAWK (High-intensity activated crosswalk) beacons are an innovative new form of pedestrian signal, which have been used extensively in Tucson, Arizona. The HAWK signal displays a solid red phase to drivers while pedestrians see a "Walk" phase. The signal then changes to a flashing "Don't Walk" phase for pedestrians and a flashing red phase for vehicle traffic so that vehicles may proceed if the crosswalk is clear. Evaluations of HAWK beacons on both 4-lane and 6-lane roadways report a driver yielding rate exceeding 95 percent (Fitzpatrick). HAWK signals are approved for use in Nevada but not yet in California.

A detailed discussion of crossing treatments and some traffic calming measures appropriate for different locations in Lake Tahoe is included in Appendix A, Design and Maintenance Recommendations.

In addition to physical improvements, **education** can increase the effectiveness of existing crossings. Some communities have undertaken crosswalk enforcement operations in coordination with local police departments to educate drivers on pedestrians' right to cross

the road. In Las Cruces, New Mexico, local police officers dressed as superheroes attempted to cross at marked crosswalks to draw attention to the need for vehicles to stop at crossswalks.

Crosswalk enforcement operation in Las Cruces, New Mexico.

Street Design

Other treatments can be applied to streets and highways to increase walkability, particularly in urban centers or areas with high pedestrian volumes. In some cases, treatments may physically slow traffic, for instance with speed humps. In other cases, road design, including narrower roadways, street trees or pedestrian refuge islands naturally signals drivers to drive more slowly in order to safely navigate the roadway.

Pedestrian refuge islands can be installed in the middle of multi-lane roadways at intersections or mid-block locations. They reduce pedestrian exposure to motor vehicles, allow pedestrians to consider traffic coming from one direction at a time and provide a place for slower pedestrians to rest or wait. These island can also include paver stones or vegetation to aesthetically break up large expanses of asphalt.

Street trees and furniture increase appeal.

Street trees and furniture can increase appeal for pedestrians as well as slowing vehicle speeds by effectively reducing driver sight-distance. Street trees and furniture also provide a buffer between vehicles and pedestrians by cutting down on noise and increasing the feeling of safety.

Road diets are becoming popular in locations where roadways have been designed much wider than is necessary for existing or anticipated traffic. Particularly on 4-lane roadways without a center turn-lane, where average daily traffic is less than 15,000 cars per day, there are opportunities for re-design. In such cases, incorporating a center turn-lane, and converting width from an outside lane to wider sidewalks, pedestrian refuge islands, bicycle lanes, and other features increases safety and mobility for all users. Placer County is planning this type of re-design in the community of Kings Beach.

Land Use Design

Finally, land use design plays perhaps the most important role in creating walkable and bikeable communities. A mix of residential, retail and other commercial uses increases the population living within walking distance of their destinations. The opportunity to live and stay in downtown areas decreases the need for housing in outlying areas, and ultimately will be one of the greatest factors in reducing long-distance commuting by vehicle.

The preferred alternative proposed for the update of the 20-year TRPA Regional Plan envisions a shift of this type in the location and form of new and re-development. This alternative proposes walkable, mixed-use nodal centers, with incentives to shift existing development out of sensitive, outlying areas. A focus on "Complete Streets" and safe access for users of all modes of transportation will provide a means for people to travel safely to their destinations without the need to rely on an automobile.

Regional and Multi-Modal Connections

Full connectivity between populated areas and major attractions, both inside and outside the Region, is important if the bicycle and pedestrian network is to adequately serve residents and visitors. Visitors who wish to enjoy Lake Tahoe by bicycle or foot may wish to arrive in the Region without their car. Once here, in order to travel between communities at the Lake, they require good connections via regional bikeways and transit. The extent of

existing regional and multi-modal connections is discussed below, and a map of major trip attractors, generators and transit connections is shown in Figure 9 (Major Trip Attractors and Generators, Appendix B).

Regional Connections

Because Lake Tahoe communities are relatively small, most of the existing bicycle and pedestrian network is focused on connecting communities to recreation areas and providing strong internal connections. Some regional bicycle travel, however, occurs between communities in the Lake Tahoe Region and areas outside the Region such as Truckee, CA, Reno, NV, Gardnerville/Minden, NV, and Carson City, NV. California State Routes (SR) 89 and 267 provide direct access to and from Truckee. There is a shared-use path along SR 89 from Tahoe City to Squaw Valley Ski Resort. Bicycle lanes or wide shoulders are planned for the near future along both of these roadways, and a bicycle path paralleling SR 267 will eventually connect Kings Beach to Northstar Resort and the Martis Valley. Placer County and the Town of Truckee have expressed interest in completing a shared-use path connecting Squaw Valley to the Truckee Legacy Trail Network, and are

also working with Caltrans on a bicycle and pedestrian tunnel in Truckee to improve connections between Tahoe City and Truckee.

U.S. Highway 50 and Nevada State Routes 207 and 431 provide connections to and from Carson City, Gardnerville/Minden, and Reno. State Route 431 is currently signed as a bicycle route. A possible future connection between Stateline, NV and the Gardnerville/Minden area could be made via an existing dirt trail along the old Pony Express trail in Douglas County to a planned paved, shared-use path on the Carson Valley side.

Bicyclists were observed along each of the routes listed above during summer field visits, with the highest concentration of bicyclists on the shared-use path along SR 89 between Truckee and Tahoe City.

Multi-Modal Connections

Multi-modal connections in the Region are important when barriers to continuous bicycle and pedestrian travel exist. In the Lake Tahoe Region, these barriers include topography, distance or lack of continuous bicycle and pedestrian facilities. Transit service is provided by several publicly-operated transit systems, tourist-oriented trolley services, and privately-operated shuttle systems and taxi services. On the South Shore, a consortium of public and private transit providers, including El Dorado County, the City of South Lake Tahoe, Douglas County, Heavenly Resort, and several casinos operate BlueGO, a coordinated transit system. Service on the north shore is operated by Placer County, with funding from Washoe County Regional Transportation Commission to serve the Nevada portion of the North Shore. This service is known as the Tahoe Area Regional Transit (TART) system.

In addition to fixed-route systems, BlueGO provides flex route and demand-response service to Douglas County and El Dorado County, including the City of South Lake Tahoe. Specific transit stops and service areas are displayed in Figure 9, Appendix B. All BlueGO and TART buses are equipped with bicycle racks.

Transit service to communities outside of the Region is relatively good, with service provided by BlueGO from the South Shore to Carson City and the Minden/Gardnerville area; South Tahoe Express between the South Shore and Reno, NV; North Lake Tahoe Express between North Shore, Truckee, and Reno; and by Amtrak to Sacramento and train connections to other major destinations throughout California. Both Amtrak and BlueGO provide carrying capacity for bicycles on these inter-regional connections.

Safety and Outreach

Safety is a major concern for users of the bicycle and pedestrian network. People often cite their perceptions about safety as the reason they do not bicycle or walk more often. Given the potential for serious injuries involving accidents with motor vehicles, this concern is understood. In addition to the physical improvements described on the previous pages, such as enhanced crossing treatments and traffic calming, safety education for both children and adults is an important component of a comprehensive plan. Existing bicycle and pedestrian safety programs in the Lake Tahoe Region are summarized in Table 3 on the following page.

As indicated in Table 3, law enforcement agencies in the Region are actively involved with student education through bicycle rodeos or other events. These events are particularly useful in demonstrating how bicyclists and pedestrians are to use the roadway system safely.

Beyond safety education, outreach programs that encourage biking and walking are a vital part of Lake Tahoe's planning effort. Many individuals wish to ride or walk more often, but lack information on bicycle routes, basic bicycle maintenance, and ways to incorporate riding into their commute to work. Outreach and events put on by local agencies and organizations can make bicycling and walking fun activities and can be useful ways to disseminate important tips.

Local agencies and advocacy groups have put significant effort into providing a well-publicized and popular "Bike to Work, School, and Play Challenge" each year, attracting over 700 participants in 2009, many of whom were students. Two schools in South Lake Tahoe have started bicycle clubs, and the South Lake Tahoe police, California Highway Patrol, and El Dorado County Sheriff's departments continue to hold their "Bicycle Rodeo" event for kids annually. In addition, the Lake Tahoe Bicycle Coalition distributes a popular Lake Tahoe Bike Trail Map.

Bike to Work, School, and Play Week attracted over 700 participants in 2009, many of whom were students.

Agency	Contact Number	Programs Offered
CHP - South Lake Tahoe Area	(530) 577-1001	Bicycle Rodeos late May / early June - Skills Instruction - Free Bicycle Inspection and Repair - Helmet Program
CHP - North Tahoe Area	(530) 582-7570	Pedestrian Safety Education Program "When in Doubt Don't Step Out" Works in conjunction with schools to conduct bike safety programs
Nevada Highway Patrol	(775) 684-4808	No programs currently offered
Placer County Sheriff - Kings Beach Area	(530) 581-6369	No programs currently offered due to budget constraints
Placer County Sheriff - Tahoe City Area	(530) 581-6300	No programs currently offered
Tahoe City Public Utility District	(530) 583-3796	Annual Bike Derby at Rideout Community Center North Tahoe/Truckee Bicycle Map
El Dorado County Sheriff - South Lake Tahoe Area	(530) 573-3000	Work in conjunction with CHP and Kiwanis to conduct bicycle education programs
Washoe County - Incline Village Constable's Office	(775) 832-4103	Annual Bicycle Rodeo (June) - Skills Instruction - Free Helmet Program - Challenge Course
Washoe County School District	(775) 348-0200	Safe Routes to School Program
Douglas County Sheriff	(775) 586-7250	No programs currently offered in Lake Tahoe
City/County of Carson City	(775) 887-2020	No programs currently offered in Lake Tahoe
South Lake Tahoe Police Department	(530) 542-6100	South Tahoe Middle School Police Activities League (PAL) Bike Club Work in conjunction with CHP and El Dorado County Sheriff's Department to conduct bicycle rodeos
Tahoe Truckee School District	(530) 541-2850	No District program offered -Up to individual sites to coordinate programs
State of Nevada	(775) 888-RIDE	Bicycle and Pedestrian Program - Safe Routes to School Program - Safety Education Office of Traffic Safety -Ped/Bike education programs and grants Lake Tahoe/Nevada State Park -Mountain Bike Safety Patrol Nevada Bicycle Advisory Board -Education Outreach Nevada Department of Transportation -Bicycle/Pedestrian program and outreach
State of California	(916) 653-2750	Bicycle and Pedestrian Programs -Interactive videos to schools -"From A to Z by Bike" book hand-outs
Lake Tahoe Community College	(530) 541-4660	Mountain biking and road riding courses
Lake Tahoe Unified School District	(530) 541-2850	No District program offered -PAL Bike Club at South Tahoe Middle School: Bike safety, bike maintenance, bike rides -Bobcat Outdoor Club at Bijou Community School: Bike skills & safety, bike maintenance, bike rides
Douglas County School District	(775) 782-5134	No District program offered - Up to individual sites to coordinate programs
Tahoe Regional Planning Agency	www.tahoempo.org	Lake Tahoe Bike Challenge
Lake Tahoe Bicycle Coalition	www.tahoebike.org	Bike Week/Bike Month Bike Film Fest Bicycle Awards Lake Tahoe Bike Trail Map

Table 3. Bicycle and pedestrian safety and outreach program summary

Maintenance

Local agencies in the Tahoe Region have made a significant investment in the construction of pedestrian and bicycle facilities, providing valuable recreational and transportation benefits to local residents and visitors. The TRPA/TMPO has found through public input and discussions with local agencies that Tahoe area shared-use paths and sidewalks are sometimes not maintained at a high enough standard to meet user needs. Major maintenance issues in Lake Tahoe include lack of consistent snow removal from sidewalks and paths during the winter months, forcing users into the street, and insufficient long-term sidewalk and bicycle facility maintenance, such as crack repair and re-striping.

Basin agencies have successfully addressed facility maintenance in some locations, using a variety of strategies. The following highlights the obstacles agencies face, the costs of maintenance, and ideas from Lake Tahoe and other areas that could be considered when developing long-term maintenance strategies.

Obstacles to Proper Maintenance

Based on input from Lake Tahoe public agencies, there are three main obstacles to successful shared-use path and sidewalk maintenance programs in the Lake Tahoe Region.

- Lack of dedicated funding
- Lack of proper equipment
- Confusion or conflicts regarding responsibilities

The first and most common issue is a lack of dedicated funding. Grants are typically not available for maintenance activities, but are available for construction of new facilities. Second, proper equipment or appropriately trained personnel may not be available. For example, shared-use paths require narrow snow-blowers for snow removal, but jurisdictions may not own these machines, or the machines may not be capable of removing the heavily-packed snow pushed on to paths by snow-plows. Third, there may be confusion or conflicts between different parties regarding whose responsibility it is to maintain sidewalks and shared-use paths. In most cases in Lake Tahoe, where there is no business improvement district or other type of assessment district, maintenance of sidewalks falls to the private property owner. Jurisdictions are responsible for enforcing this private maintenance role, but they may lack the funding or political will to effectively do so.

Photo: Ty Polastri

Maintenance Costs

Costs for maintaining paths vary widely, based on the level of maintenance provided by an agency. Annual per-mile costs of path maintenance range from a low of $1,050 for basic maintenance of a path in the City of South Lake Tahoe to a high of $14,000 per mile for landscaping, snow removal and path maintenance in the Ski Run Business Improvement District. Table 4 summarizes the costs for maintaining facilities in selected areas of the Tahoe Region, based on conversations with members of each agency.

Agency	Costs	Notes
City of South Lake Tahoe	$1,050 per mile per year for basic maintenance of Class I paths	No snow removal.
Ski Run BID (City of South Lake Tahoe)	$14,000 per mile per year to maintain landscaping and Class I path $4,500 per mile for slurry seal	Includes snow removal.
Tahoe City Public Utility District	$11,000 per mile per year to maintain, repair, restripe and plow (once) paths	Annually, $5,000 to $6,000 is spent for snow removal and $25,000 to $30,000 for repairing cracks on the entire path system
North Tahoe Public Utility District	$8,000 per mile per year to maintain trail and blow snow	

Table 4: Costs of maintaining paths and sidewalks in the Tahoe Region (2008)

Strategies for Improving Maintenance

Many formulas can work to improve sidewalk and path maintenance. Successful models in Lake Tahoe and other regions seek to minimize costs overall, and to plan in a source of maintenance funding before paths are constructed. Maintenance funding should cover short and long-term costs, including snow removal, crack repair, sweeping and striping, and maintenance of adjacent infiltration devices.

Minimize costs by consolidating maintenance responsibilities.

Private property owners and jurisdictions can reduce expenditures by entering into cooperative maintenance agreements. Cooperative maintenance agreements allow for a single entity, such as the local public agency or a private contractor, to carry out snow removal and other maintenance. This can reduce the cost and time associated with individual property owners setting up separate maintenance contracts or doing the work themselves. The agreements also ensure that an entity with adequate staff, equipment and experience carries out the work. The Ski Run Business Improvement District in South Lake Tahoe is an example of this. Another way to consolidate maintenance responsibility is for private property owners to have the option to transfer responsibility to the local public agency. The City of Madison, WI, incentivizes this through a program whereby private property owners are charged only 50 percent of the cost to do repairs and snow removal if they allow the City to conduct the work. In other communities, such as Mammoth Lakes, CA, Davis, CA and Vail, CO, the Public Works Department is responsible for maintaining sidewalks and paths. Jurisdictions can also pool funds to cost-share special equipment purchases.

Pursue innovative funding sources for on-going and long-term maintenance that is linked to the mileage of the facilities.

Maintenance of paths and sidewalks is one of many community needs that must compete for scarce funds. Dedicated funding sources for maintenance can help address this. South Shore's Measure S--a property tax assessment passed in 2000 for construction and maintenance of recreation facilities--set aside $5,000 per year per mile for maintenance of 25 miles of planned shared-use paths in the City of South Lake Tahoe and El Dorado County. The two jurisdictions are able to use this funding as a local match when pursuing grant funds for path construction. Vail, CO, applies a 1 percent Real Estate Transfer tax to all real estate transactions, a portion of which is allocated to path maintenance. When establishing a funding mechanism to provide for sidewalk and path maintenance, it should be structured to reflect the average lifespan of sidewalks and paths, and allow for increases in inflation and the mileage of the facilities.

Permitting and granting agencies such as the TRPA, the CTC, and the North Lake Tahoe Resort Association (NLTRA), can assist this process by being diligent in requiring projects to show adequate maintenance funding as part of grant and permit applications and by assisting implementers to identify additional sources of maintenance funding. TRPA could also consider incentivizing maintenance of facilities by tying maintenance to its annual building allocation system.

For additional details on existing maintenance challenges and recommendations, please see Appendix I (Maintenance Memo, www.tahoempo.org).

Collision Analysis

Perceptions of safety directly influence the choice to bike or walk. Poor sight distances, crime or threats from motor vehicles may cause people to switch away from biking or walking. Overall, both accident and crime rates are low in Lake Tahoe compared to other areas. However, hazards to bicyclists and pedestrians do exist. Examples include:

- Areas where sidewalks are discontinuous or uncleared of snow, forcing pedestrians and wheelchair users into the street
- Where sight distances for crossing are poor, due to parked cars, signs, or roadway curvature
- Areas where shared-use paths or sidewalks cross multiple driveways and sidestreets

The BPP analyzes accident data and provides information on safety improvements.

Accident Data

LSC Transportation Consultants conducted an extensive analysis on pedestrian and bicycle collisions with vehicles between 2003 to 2007. A few improvements have been made since 2007, however the data from this period is still considered current. Table 5 shows the total accidents by regional jurisdiction. Table 6 on the following page shows accident rates at specific Basin locations. The data only includes accidents involving a motor vehicle.

Jurisdiction	Total Accidents (1)	Pedestrian	Bicycle	Injury (2)	Fatal
El Dorado County, CA	19	7	12	18	1
City of South Lake Tahoe, CA	155	67	88	157	3
Placer County, CA	77	33	44	72	7
Carson City, NV	0	0	0	0	0
Douglas County, NV	5	5	0	2	0
Washoe County, NV	7	6	1	0	4
Total	**263**	**118**	**145**	**249**	**15**

Note 1: Accident rates are not available at the time of printing the BPP, however in the future, accident rates, rather than total accidents, should be reported. Accident rates take into account bicycle and pedestrian collisions in comparison to the amount of overall activity by bicyclists, pedestrians, and motor vehicles.

Note 2: The sum of injuries and fatalities may be higher than total accidents because sometimes the number of people in the party was greater than 1.

Source: Reported accidents according to the California Statewide Integrated Traffic Records System (SWITRS) and Nevada Highway Patrol.

Table 5. Lake Tahoe Region bicycle and pedestrian accident summary 2003-2007

As Table 6 indicates, there were 29 locations with two or more accidents in the six year period. The most significant "hot spot" was the U.S. 50/Friday Avenue intersection, which has since been improved with a full intersection signal. Other intersections with relatively high accident rates include SR 28 and Fox Street, Bear Street, Coon Street and Grove Street on the North Shore, and U.S. 50 and Stateline and Park Avenue on the South Shore. It should also be noted that only one of the 29 high accident intersections is not on the state highway system.

	# Accidents				
Location (1)	Bicycle	Pedestrian	Total	Annual Average Daily Traffic (AADT), 2002-2007 (2)	Accident Rate per Average Daily Traffic
Pioneer Trail & Wildwood (unsignalized)	2	0	2	n/a	n/a
SR 28 & Fox Street (unsignalized)	0	4	4	14883	0.027%
SR 28 & Grove Street (unsignalized)	2	1	3	11733	0.026%
US 50 & Friday Ave (new signal)	1	7	8	33667	0.024%
US 50 & Stateline (signal)	0	7	7	33667	0.021%
SR 28 & Bear Street (unsignalized)	0	3	3	14883	0.020%
SR 28 & Coon Street (signal)	1	2	3	14883	0.020%
SR 28 & SR 267 (signal)	2	1	3	18100	0.017%
US 50 & Park Avenue (signal)	4	1	5	33667	0.015%
US 50 & Pioneer Trail (East) (signal)	4	1	5	33667	0.015%
US 50 & Blue Lake (unsignalized)	1	4	5	33833	0.015%
SR 28 & Southwood Blvd (signal)	0	2	2	13758	0.015%
SR 89 & Fountain (unsignalized)	2	0	2	14767	0.014%
SR 28 & Beaver Street (unsignalized)	0	2	2	14883	0.013%
US 50 & Edgewood Circle (unsignalized)	3	0	3	32116	0.009%
US 50 & Glorene (unsignalized)	1	2	3	33583	0.009%
US 50 & Herbert (unsignalized)	3	0	3	33833	0.009%
US 50 & Sierra (signal)	2	1	3	33833	0.009%
US 50 & 4H Camp Road (unsignalized)	2	0	2	23317	0.009%
US 50 & Kingsbury Grade (signal)	0	2	2	23317	0.009%
US 50 & Lake Tahoe Blvd (signal)	1	1	2	33583	0.006%
US 50 & Midway (unsignalized)	2	0	2	33667	0.006%
US 50 & 3rd Street (signal)	1	1	2	33833	0.006%
US 50 & Al Tahoe Blvd (signal)	2	0	2	33833	0.006%
US 50 & Lyons (signal)	1	1	2	33833	0.006%
US 50 & Ski Run (signal)	1	1	2	33833	0.006%
US 50 & Tahoe Keys (signal)	1	1	2	33833	0.006%
US 50 & Tallac (signal)	0	2	2	33833	0.006%
US 50 & Truckee Drive (unsignalized)	1	1	2	33833	0.006%

Note1: Locations with more than one recorded bicycle or pedestrian accident, including accidents within 100 ftt of intersection

Note 2: Annual Average Daily Traffic Count taken from nearest intersection with available data. See "August Traffic Volumes", www.tiims.org.

Source: California Statewide Integrated Traffic Records System, and NDOT

Table 6. High accident locations in the Tahoe Region

Other data of interest include the type of location where accidents happen. As shown in Table 7, the majority of accidents occurred at unsignalized locations, or at mid-block crossings without a Class I/Shared-Use Path crossing. Only 17 percent of total accidents occurred at signalized intersections.

Location Type	Pedestrian		Bicycle		Total	
	Number	Percent	Number	Percent	Number	Percent
Public Street Intersection Unsignalized	51	52%	64	46%	115	49%
Public Street Intersection Signalized	16	16%	25	18%	41	17%
Midblock Location Without Class I/Shared-Use Path	27	28%	49	35%	76	32%
Midblock Location With Class I/Shared-Use Path	1	1%	1	1%	2	1%
Public Street Intersection Signalized With Trail Crossing	3	3%	0	0%	3	1%
Total	**98**	**100%**	**139**	**100%**	**237**	**100%**
Note: Intersection accidents include all accidents within 100 feet						
Source: California Statewide Integrated Traffic Records System, and NDOT						

Table 7. Accident location type

Since this data was collected, two marked shared-use path crossings have not been re-painted along the SR 89 West Shore Trail due to safety concerns. These locations could be good candidates for the installation of enhanced crossing treatments. It will be important to note any change in collision rates at these locations in the next update of the BPP if these crossings are not re-marked or otherwise enhanced.

Safety issues can be addressed in multiple ways. Intersections can be improved through enhanced pedestrian treatments. Another solution includes increasing driver, bicyclist and pedestrian awareness. Several states have incorporated bicycle and pedestrian safety into their driving tests. At Lake Tahoe, possible education activities, in addition to those shown in Table 3 on page 43 could include bicycle safety classes through Parks and Recreation Departments or Barton Health Extension. Bicycle rental and retail shops can distribute safety information and maps and encourage safe riding. In addition,
police need to enforce traffic laws for drivers, bicyclists and pedestrians, creating a safe atmo sphere for all.

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Section 5: Analysis of Demand / Bike Trail User Model

Actual use of the bicycle and pedestrian network is perhaps the most important indicator of the quality of the system, although biking and walking rates are also closely tied to land use, population density, and visitation. A quality biking and walking network to support surrounding land uses is critical to achieving increased biking and walking levels. This section analyzes both existing use and future demand for the system.

Population and Employment Trends

The following discussion contains estimates and forecasts of existing and future population and employment levels that can be used to determine trends and how they affect demand for bicycle and pedestrian facilities.

Existing Population and Employment

According to the 2000 census, the Region had an estimated total population of approximately 60,000 and an estimated total employment level of about 49,500. Table 8 shows updated population estimates by County based on the Tahoe Transportation Model.

Future Resident Population, Visitor Population, and Employment

According to the U.S. Census Bureau, the resident population of the Region increased by approximately 7,000 between 1990 and 2000. While the 2010 census data is not yet available, indicators such as school enrollment, gaming employment and traffic volumes indicate that population in the Tahoe Region has declined since 2000 (*Mobility 2030*). With the current recession (2009-2010) and a shift away from gaming as a primary economic driver, accurately estimating population and employment levels for the coming decade is difficult. A major focus of the TRPA Regional Plan Update, and of planning in general in Lake Tahoe, is on how to re-make the Region into a thriving residential and tourist attraction. Improved bicycle and pedestrian facilities play a strong role in this shift. "Smart growth" principles that support bikeable and walkable communities are central in this planning effort.

As part of the TRPA Regional Plan Update, several alternative planning scenarios are under study. The population, employment and travel estimates associated with these scenarios will be analyzed in 2010 and 2011.

Future growth and changes in population and employment are important to bicycle and pedestrian planning for two reasons. First, new developments often require upgrades to existing roadways, which may create an opportunity to construct new bicycle and pedestrian facilities. Second, changes in land-use patterns can make bicycling or walking more convenient.

Jurisdiction	Population	Percent of Total
City of South Lake Tahoe	22854	42%
El Dorado County (Tahoe portion)	9484	17%
Placer County (Tahoe portion)	8874	16%
Washoe County (Tahoe portion)	7765	14%
Douglas County (Tahoe portion)	5370	10%
Total:	**54347**	**100%**
Note: From population synthesizer in the Tahoe Transportation model based on Census 2000 population		

Table 8. Tahoe Region population, 2005 Census.

Bicycle and Pedestrian Travel Demand

Bicycle and pedestrian trips are not easily measured or projected for an entire region without extensive data collection efforts. While data is still somewhat limited, the TRPA has recently undertaken a monitoring program and development of a Bicycle Trail User Model. Both of these efforts increase understanding of current use of the bicycle and pedestrian network, and also help project future use as more links are completed. Available data includes the 2000 Census, user surveys and user counts, and Basin-wide mode share surveys.

Mode	Percent of Work Trips
Drive Alone	77%
Carpool	12%
Transit	2%
Bicycle or Walked	3%
Worked at Home	4%
Other	2%
Total	**100%**

Source: 2000 Census Journey-to-Work

Table 9: Existing journey-to-work mode split summary for the Lake Tahoe Region

Existing Demand

A common term used in describing demand for bicycle and pedestrian facilities is "mode share" or "mode split." Mode split refers to the percentage of people who choose to take different forms of transportation including walking, bicycling, public transit, or driving. From the 2000 Census, mode split information is available for the journey-to-work trip. Table 9 presents this information for the Lake Tahoe Region. As shown in Table 9, bicycle and pedestrian trips represent approximately 3 percent of home-based work trips for Lake Tahoe residents. These numbers are fairly consistent with mode splits across California and Nevada. However, many other tourist-based mountain resort areas have higher bicycle and walking rates, as shown in Figure 3 below.

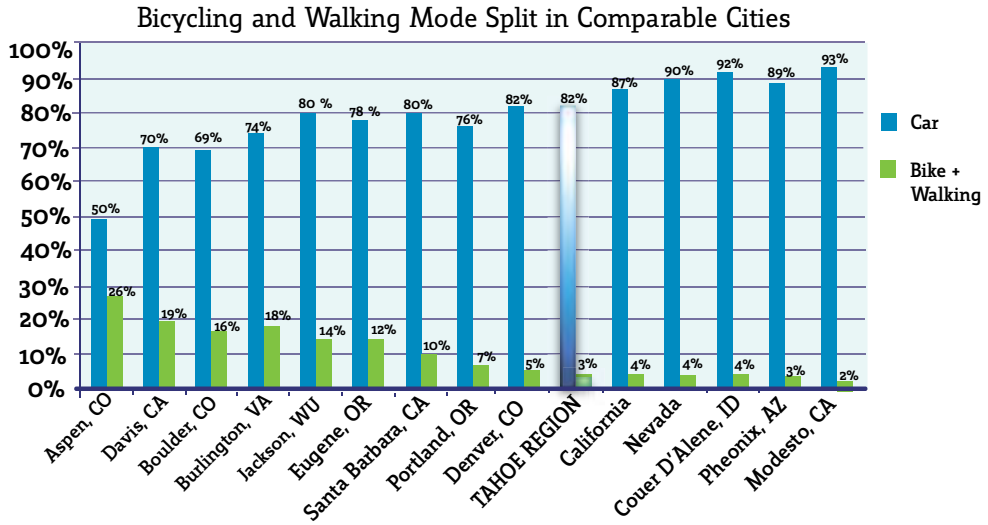

Figure 3. Bicycling and walking journey-to-work comparison among other regions and cities (2000 census)

As mentioned in the Benchmarks and Progress section, journey-to-work data does not tell the whole story for Lake Tahoe. According to local surveys, over 70 percent of visitors participate in walking activities while almost 40 percent bicycle on paved paths. TRPA mode split surveys of both residents and visitors show overall biking and walking rates to recreation and commercial areas to be about 13 percent in winter and 16 percent in summer.

Another way of understanding existing usage is to review user counts. While user counts can fluctuate annually based on external factors such as visitation, economy, or weather, they are still a useful tool for identifying popularity of the bicycle and pedestrian network. Combined with written user surveys, the TRPA/TMPO has begun to establish a body of knowledge on how and why people use the bikeways and sidewalks in Lake Tahoe.

Usage on the monitored facilities ranges from a low of around 200 passes per day on an on-street bicycle route to over 1,000 passes per day on popular shared-use paths. A sidewalk near Stateline, NV, attracts over 5,000 pedestrians on a busy summer day. A sum of the existing usage on all monitored facilities yields over 16,000 users per day.

Table 10 on the following page shows per day usage estimates by facility based on 2007 and 2009 TRPA/TCORP surveys and counts. Note that the totals are for Class I/Shared-Use Paths only. The counts need to be repeated in the coming years as part of TRPA's on-going monitoring effort.

			Estimated Peak Summer Daily Use (7AM to 7PM) on Facility											
			Total	Bicyclists				Walker/Other						
Facility	Location	Facility Type	Total	Total	Resident: Bike to Trail	Visitor: Bike to Trail	Drive to Trail	Total	Resident: Walk to Trail	Visitor: Walk to Trail	Drive to Trail	Daily Bicyclists on Adjacent Street	Total Daily Bicyclists in Corridor	Total Peak Hour Facility Use
North Shore Trail	State Recreation Area, E. of Lighthouse Center	Class I	606	377	186	146	45	229	113	89	28	51	428	91
North Shore Trail	Lake Forest, at N. End of Lake Forest Rd.	Class I	546	366	211	83	72	180	104	41	35	50	416	79
West Shore Trail	64 Acres, S Boundary	Class I	916	797	142	241	415	118	21	36	62	16	813	147
West Shore Trail	Kaspian, at Restrooms	Class I	792	640	344	181	114	152	82	43	27	14	654	106
Truckee River Trail	64 Acres, Near Bike Bridge	Class I	1,246	1,000	172	258	570	246	42	63	140	16	1,016	219
El Dorado Beach	US 50 150 feet east of Lakeview, on the bike path	Class I	693	541	303	202	36	152	85	57	10	--	--	120
Camp Richardson	Camp Richardson Resort sign	Class I	1,685	1,260	383	401	476	425	129	135	161	--	--	273
Elks Point Road	Northwest corner of Elks Point Road/U.S. 50	Class I	357	171	71	71	28	186	78	78	31	--	--	49
Incline Lakeshore Path	In front of Incline Beach	Class I	1,856	364	184	46	133	1,492	756	189	547	--	--	253
National Ave.	At TV Rec Area at National Ave./SR28	None	231	--	--	--	--	--	--	--	--	231	--	0
US 50 (1)	At Santa Fe Drive in Meyers (Sawmill Bike Path)	Class I	70	56	15	30	11	14	4	8	2	46	102	12
Helen Avenue Trail	Behind McDonalds Near South Y	Class I	183	117	--	--	--	66	--	--	--	--	--	16
Pioneer Trail	Trout Creek	Class II	293	161	--	--	--	132	--	--	--	0	161	26
Pioneer Trail	Stateline S. of US 50	Class II	611	70	--	--	--	541	--	--	--	300	370	61
SR 89	N. of US 50 (Alpina Café)	Class III	205	205	--	--	--	0	--	--	--	0	205	--
US 50	West of Stateline	Sidewalk	5,952	238	--	--	--	5,714	--	--	--	80	318	910
US 50	S. of Airport	None	--	--	--	--	--	--	--	--	--	27	27	--
Total: Existing Tahoe Region Class I Facilities			**8,950**	**5,690**	**2,055**	**1,694**	**1,941**	**3,260**	**1,443**	**753**	**1,064**	**--**	**--**	**--**

Source: Table A in Appendix B of the Impacts Memorandum, based in turn on MOST RECENT surveys and counts conducted by TCORP, TCPUD and TRPA.

Note 1: Counts on the Sawmill Bike Path were conducted before the trail was officially open to the public. Note 2: Daily figures for many locations are estimates based upon limited available hourly counts, as shown in Table A of Appendix B of the Impacts Memorandum.

Table 10. Estimated bike trail, lane, route, and sidewalk use on existing facilities

Future Demand/ Bicycle Trail User Model

Future bicycle and pedestrian trips will depend on a number of factors such as demographics, availability of well-connected facilities, and location, density, and type of future land development. For many years the TRPA has maintained a transportation model that estimates future vehicle trips based on different land use scenarios. The model does not estimate changes in bicycling and walking, however. Bicycling and walking are increasingly part of the solution to reduce greenhouse gas emissions, improve mobility, and create more community-oriented places. The ability to estimate the number of trips that will occur via these modes is also becoming more important. A few general models exist to predict bicycle path use, but most rely on journey-to-work data, and none are geared toward the unique tourist environment of Lake Tahoe. To inform both the TRPA Regional Plan and the BPP, a simple model was created that can predict both regional bicycling and walking rates and expected use on individual facilities in the Lake Tahoe Region. [1]

Using the Tahoe Bicycle Trail User Model, TRPA/TMPO estimated future daily and annual use for a complete regional network, assuming high quality, well-maintained Class I/Shared-Use Paths on all major corridors in the Tahoe Region (Figure 4, next page). This yielded approximately 40,000 trips on the entire network on a peak summer day (2.5 percent of all trips), and almost 6 million annual trips assuming no winter path maintenance. The estimated 40,000 daily trips represent a four-fold increase over current bicycling and walking rates on Class I/Shared-Use Paths.[2] Assuming the same rates of commuting that were reported in the 2007 TRPA/TCORP surveys, approximately 40 percent (16,000) of these daily trips would be for commute purposes.

[1] For more details on how to use the Tahoe Bicycle Trail User Model, and for the interactive model itself, please see Appendix F. You may link to the interactive model documents from the Tahoe Metropolitan Planning Organization website, http://www.tahoempo.org.

[2] Current rates are probably higher than the 9,000 mentioned in Table 10 on the previous page, since not all existing paths were monitored.

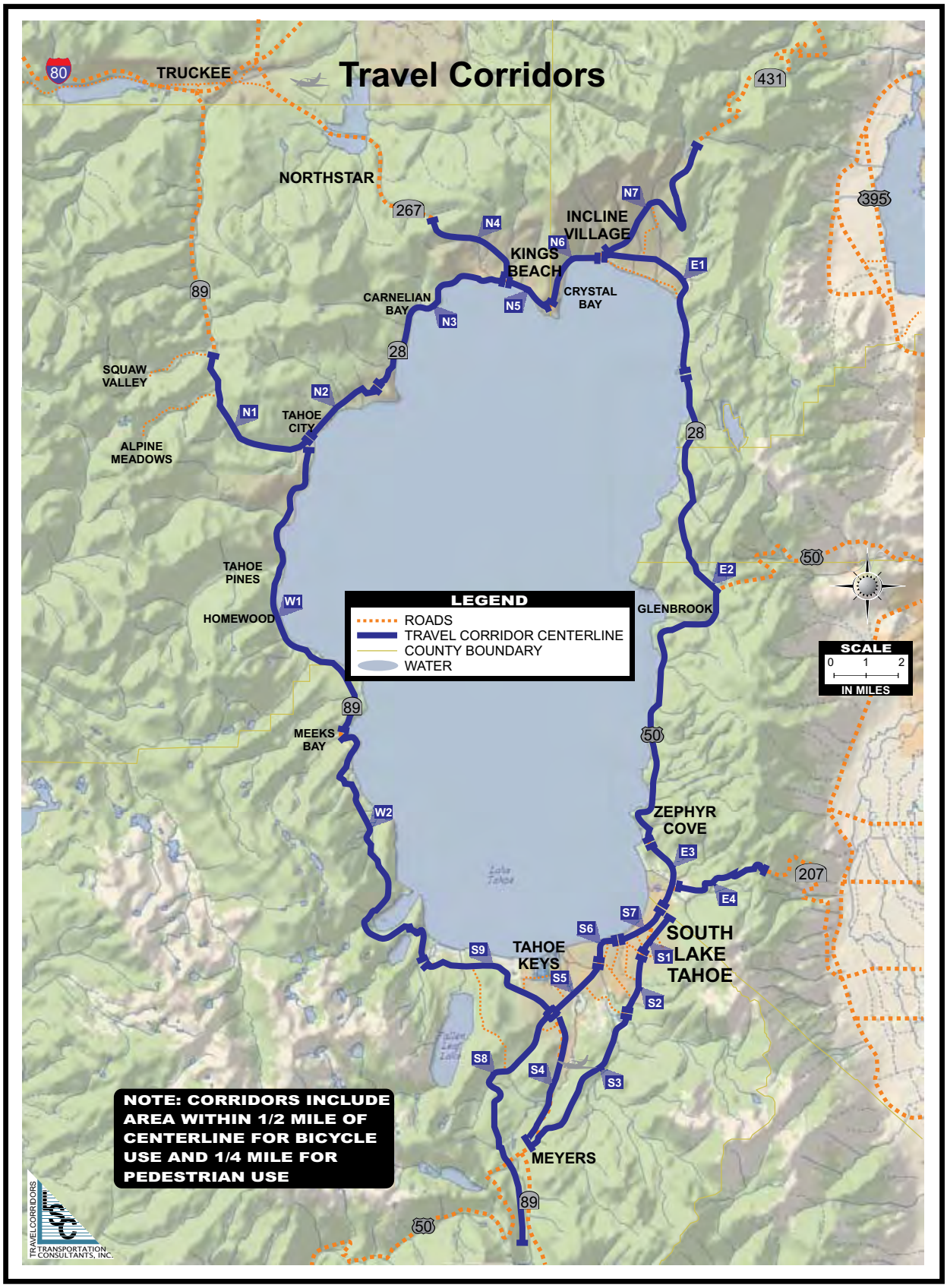

Figure 4. Bicycle Trail User Model corridors

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Section 6: Goals, Policies and Actions

The goals, policies, and actions of the BPP are intended to provide specific direction on how the Tahoe Regional Planning Agency, the Tahoe Metropolitan Planning Organization, and other local, state, regional, and federal agencies and organizations can improve bicycling and walking in Lake Tahoe.

THREE MAJOR GOALS OF THIS PLAN

GOAL 1: **Complete a bicycle and pedestrian network that provides convenient access to Basin destinations and destinations outside the basin**

GOAL 2: **Raise awareness of the bicycle and pedestrian network and encourage safe and increased bicycling and walking**

GOAL 3: **Provide environmental, economic, and social benefits to the Region through increased bicycling and walking.**

The Goals, Policies, and Actions in this Bicycle and Pedestrian Plan follow these guidelines:

Goals are a statement of a target, an ambition, or an end state toward which the TRPA and other agencies and organizations are working.

Policies provide direction for the TRPA and other agencies on how to meet the goals. The policies often describe critical activities in which local agencies are already engaged as part of their day-to-day work.

Actions are specific tasks that TRPA or other agencies will or could do to implement the goals and policies in the BPP. In some cases, actions refer to a one-time plan or project (such as the adoption of a change to the TRPA's code); in others, the action is on-going and will occur over a period of years. The actions specified here are generally new actions that should be undertaken to meet the benchmarks specified in the BPP.

Each goal is followed by several focused goals, which express various aspects of the goal in more detail. Each focused goal is accompanied by policies.

The goals of the Lake Tahoe Bicycle and Pedestrian Plan expand on the more general transportation goals of the Tahoe Regional Planning Compact (Public Law 96-551), the TRPA Regional Plan, and the TMPO Regional Transportation Plan, *Mobility 2030*. *Mobility 2030* identifies the following overarching vision for the future of transportation in the Tahoe Region:

Transportation Vision

An innovative multi-modal transportation system is in place that gives priority to viable alternatives to the private automobile, appeals to users and serves mobility needs, while improving the environmental and socioeconomic health of the Basin.

The role of the BPP is to provide the goals, policies and actions necessary to support the bicycling and walking aspect of this Region-wide vision. Several of the BPP goals, policies, or actions were derived from *Mobility 2030*, and these are indicated with "M2030."

Once the BPP is approved by the TRPA, the policies in this section will become part of the Regional Plan. These policies will be implemented through the Code of Ordinances.

Several policies and actions refer to recommendations or requirements that may vary with circumstances. An example is the amount of bicycle storage--such as racks or lockers--recommended with new development. In these cases, readers are referred to another section or appendix (such as Appendix A, Design and Maintenance Recommendations).

While many actions are currently underway or will be underway soon, not all actions are listed. The BPP highlights the highest priority actions.

Finally, the goals, policies and actions listed on the following pages are intended to help the TRPA and other agencies address the 5 "E's" promoted by the League of American Bicyclists in its "Bicycle-Friendly Communities" initiative.

The 5 "E's" represent a comprehensive approach to bicycle and pedestrian planning.

The 5 E's

Engineering	**Goal 1: Complete a bicycle and pedestrian network that provides convenient access to Basin destinations and destinations outside the Basin.**
Encouragement **Education** **Enforcement**	**Goal 2: Raise awareness of the bicycle and pedestrian network and encourage safe and increased bicycling and walking**
Evaluation	**Goal 3: Provide environmental, economic, and social benefits to the Region through increased bicycling and walking.**

Goal 1: Complete a bicycle and pedestrian network that provides convenient access to Basin destinations and destinations outside the Basin

Focused Goal: A complete bicycle and pedestrian network

Construct, upgrade, and maintain a complete regional network of bicycle and pedestrian facilities that connects communities and destinations. (M2030)

Policies

1.1 To the extent possible, accommodate all users, encompassing a wide range of abilities and travel objectives, by the bicycle and pedestrian network.

1.2 Encourage the adoption of the Lake Tahoe Bicycle and Pedestrian Plan by local agencies and work collaboratively to achieve implementation. (M2030)

1.3 All hard-surface bicycle and pedestrian facilities should conform to the most recent design standards adopted by Caltrans and the Nevada Department of Transportation (NDOT), except where unique standards have been established by TRPA in consideration of environmental conditions and regional consistency.

1.4 Prioritize constructing pedestrian and bicycle facilities in urbanized areas of the Region, facilities that increase connectivity of the bicycle network, and facilities that can be constructed concurrently with other projects. (M2030) (See Table 19, Prioritization Criteria, in Appendix B.)

1.5 Projects should go forward, regardless of where they are on the priority list, when an opportunity or eminent loss of an opportunity makes implementation favorable or necessary.

1.6 The bicycle and pedestrian network shall conform to the requirements of the Americans with Disabilities Act (ADA).

1.7 Design shared-use paths to support emergency vehicle access where possible.

1.8 Actively pursue funding for priority projects and programs.

1.9 To facilitate cost savings, coordinate project construction with the needs of utility providers, particularly water suppliers and communications providers. (Note: For a list of water suppliers, refer to Appendix C)

1.10 Pursue "experimental status" for unique designs from the Federal Highway Administration where adherence to published standards is not feasible, or where different standards would provide safety, economic, environmental, or social benefits.

Focused goal: Bicyclist and Pedestrian Accommodation

Create and maintain bikeable, walkable communities through existing and new development. (M2030)

Policies

1.11 Include pedestrian and bicycle access equal to or greater than private vehicle access as a feature of new development and redevelopment projects proposed in proximity to major bicycle and pedestrian routes. (M2030)

1.12 Incorporate segments of the bicycle and pedestrian network into new and redeveloped commercial, tourist, multi-family, public service and recreation projects consistent with the Lake Tahoe Region Bicycle and Pedestrian Plan. Implementation of the facilities will be through construction, easements, or in-lieu fees as appropriate to the scale of development. (M2030)

1.13 Increase bicycle and pedestrian support facilities, such as sidewalks, bicycle racks, bicycle lockers, and bike-share programs at commercial and tourist centers, recreational areas, transit centers, lodging properties, and government buildings. (M2030) (See the Design and Maintenance Recommendations)

1.14 In addition to those bicycle and pedestrian facilities shown in the BPP, consider shared-use paths and sidewalks where a connection to the existing network is needed to provide improved safety or convenience.

1.15 Accommodate bicyclists and pedestrians as described in the Lake Tahoe Bicycle and Pedestrian Plan in all roadway improvement projects. Include specialized pedestrian crossing treatments, traffic calming, and bicycle-activated signals as appropriate to the scale of the project. (M2030) (See the Design and Maintenance Recommendations)

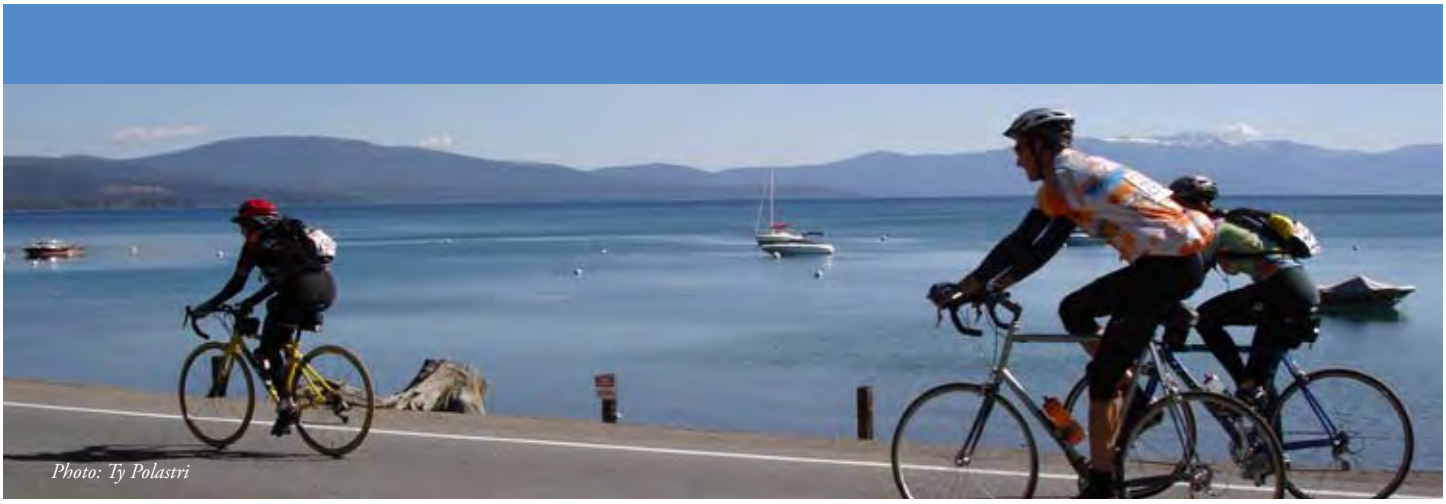
Photo: Ty Polastri

1.16 Construct, upgrade, and maintain pedestrian and Class II bicycle facilities (bike lanes) meeting AASHTO standards where feasible along major travel routes when the edge of roadway[1] is altered or improved. Where bicycle lanes are not feasible due to environmental or land ownership constraints, provide as much shoulder area as possible for safe bicycle passage.

[1] *curbline*

1.17 Implement a "Lake Tahoe Scenic Bike Loop" with the widest possible shoulder on the Lake side of the highways circling Lake Tahoe where bicycle lanes are not feasible or have not yet been constructed. (See the Design and Maintenance Recommendations)

1.18 Where shared-use paths intersect with driveways or roadways, give priority to bicyclists in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). (M2030)

1.19 Consider innovative shared roadway treatments (e.g. off-peak only parking/bike lanes that can be used for vehicles during peak flows, sharrows, etc.) in constrained areas where roadway is limited.

Focused goal: Transit Integration

Integrate the transit, bicycle and pedestrian networks to provide seamless transitions and stimulate both increased transit ridership and increased use of the bicycle and pedestrian network. (M2030)

Policies

1.20 Provide secure bicycle storage on all transit vehicles and at all major transit stops and stations.

1.21 Maximize bicycle carrying capacity on new transit vehicles using best available technology. (M2030)

1.22 Prioritize sidewalk improvements that provide pedestrian access to transit stops
(See Table 19, Prioritization Criteria, in Appendix B.)

Focused goal: Maintenance

Maintain the bicycle and pedestrian network to a high standard that encourages ridership and improves the safety of all users. (M2030) (See Design and Maintenance Recommendations section)

Policies

1.23 Where feasible, maintain the year-round use and condition of identified sidewalks and bike facilities. (M2030) (Note: See Figure 12, Shared-Use Path and Sidewalk Maintenance Map, in Appendix B).

1.24 Pursue innovative funding that covers the costs of on-going and long-term maintenance and that increases as the mileage of facilities to be maintained increases. (See Appendix I, Maintenance Memo)

1.25 Require a maintenance plan before issuing a permit or funding for any bicycle and pedestrian facilities. The maintenance plan shall specify a strategy for long and short-term funding for the life of the project.

1.26 Up to 25 percent of a Air Quality Mitigation Funds may be set aside for operations and maintenance of completed or future EIP projects, including EIP bicycle path projects.

1.27 Consider creative funding mechanisms for bicycle path and sidewalk maintenance. Examples include, but are not limited to: non-profit maintenance partnerships, bicycle registration programs, renting conduit under shared-use paths to utility companies, or forming business improvement districts (See Appendix I, Maintenance Memo)

1.28 Encourage jurisdictions and private property owners to minimize maintenance costs by consolidating maintenance responsibilities. (See Appendix I, Maintenance Memo)

1.29 Design and construct all portions of the bicycle and pedestrian network to reduce long-term maintenance costs and encourage efficient operation. (see Design and Maintenance Recommendations)

1.30 Maintain and upgrade infiltration devices along paths as appropriate over time.

1.31 Encourage jurisdictions and roadway agencies to snow-clear, sweep, and stripe bicycle routes where needed before major cycling events.

5-Year supportive actions for Goal 1

The following actions should be pursued within a 5-year time frame to support Goal 1. The actions are organized by responsible party.

TRPA/TMPO Actions:

- Collaborate with local agencies and organizations to implement the BPP, focusing on high priority projects. Facilitate workshops to highlight new BPP elements.

- Incorporate priority BPP projects into the Regional Transportation Plan (RTP), the Environmental Improvement Program (EIP), the TMPO Transportation Improvement Program (TIP), and the Statewide Transportation Improvement Program (STIP).

- Update the TRPA Code of Ordinances to provide detailed specifications on bicycle and pedestrian accommodation in new and re-development and roadway projects.

- Incorporate Appendix A, Design and Maintenance Recommendations, Appendix B, Maps and Project Lists, and Goal 1 and associated policies into TRPA project review.

- Conduct annual training with TRPA permit review staff and Memorandum of Understanding (MOU) partners on how to incorporate the BPP into development project design.

- Support research on the impact of raised boardwalks on vegetation and SEZ function, with a goal of reducing coverage mitigation requirements for boardwalks if they are shown to have reduced impacts compared to hard coverage.

- Meet with NDOT, Caltrans and local jurisdictions to develop plans to incorporate striping and regular maintenance of bicycle lanes and wide shoulders into all roadway improvement projects, including routine maintenance.

State and Local Jurisdiction Actions

To meet Goal 1, state and local jurisdictions could consider undertaking the following actions:

- Identify specific locations in need of pedestrian crossing improvements and determine appropriate crossing treatment. Include specific crossing improvement locations as projects on the "proposed project list."

- Maintain an up-to-date inventory of the condition of sidewalks and paths to facilitate budgeting for future repair work and to prioritize improvements. (Local jurisdictions)

- Consider ordinances that address snow storage on bicycle paths, such as specifying a "use period" when bicycle paths must be cleared of snow. (Local jurisdictions)

- Work with property owners responsible for sidewalk maintenance to establish a plan of action for restoration and on-going maintenance of sidewalks. (Local jurisdictions)

- Enforce sidewalk maintenance by responsible property owners. Where enforcement is not possible, develop voluntary maintenance programs with positive publicity for participants. (Local jurisdictions)

Goal 2: Raise awareness of the bicycle and pedestrian network and encourage safe and increased bicycling and walking.

Focused Goal: Education and Outreach

Cultivate enthusiasm for bicycling and walking at Lake Tahoe and awareness of the bicycle and pedestrian network through education, outreach, and signage. (M2030)

Policies

2.1 Encourage and support all Basin communities to seek recognition as League of American Bicyclists' "Bicycle Friendly Communities."

2.2 Provide clear and consistent signage to help bicyclists identify the best routes to reach their destination safely, quickly, and easily.

2.3 Use signage and traffic control devices consistent with the Manual on Uniform Traffic Control Devices (MUTCD) and those established by federal, state, and local standards to ensure a high level of safety for bicyclists, pedestrians, and motorists.

2.4 Promote National "Bike to Work" and International "Walk to School" days and other events to encourage biking and walking. (TRPA, local jurisdictions, local advocacy groups)

Focused Goal: Enforcement

Encourage safe bicycling and walking through enforcement of traffic and parking violations.

Policies

2.5 Encourage all state and local law enforcement agencies to cite drivers, cyclists, and pedestrians who create unsafe and unlawful cycling and walking conditions.

2.6 Encourage all state and local law enforcement agencies to enforce parking restrictions at recreation destinations, especially where nearby bicycle or pedestrian facilities provide a convenient alternative to driving.

5-Year Supportive Actions for Focused Goal 2

The following actions should be pursued within a 5-year time frame to support Goal 2. The actions are organized by responsible party.

TRPA/Multiple Entity Actions:

- Develop a Region-wide bike route numbering or naming system consistent with local wayfinding signage and the U.S. Bicycle Route System that directs cyclists onto the best possible route for bicycle travel to their destination. Consider naming routes after historic Washoe Tribe routes where information is available. (TRPA, local jurisdictions)

- Meet with local school officials to develop safe routes to schools programs. Help apply for funding where needed. (TRPA, TMPO, CA & NV Safe Routes to Schools Coordinators, LTBC, local jurisdictions, health departments, others)

- Convene a multi-agency group that meets with local law enforcement and district attorneys to provide training updates on applicable bicycle and pedestrian laws, determine what enforcement actions will be supported, and encourage increased enforcement that supports BPP goals. (TRPA)

- Develop employer incentive programs to encourage biking and walking to work. (TRPA)

- Conduct public workshops on "Complete Streets" and new strategies for land use and transportation integration.

- Continue and expand the current bicycle education program for school children. Coordinate efforts by the California Highway Patrol, Nevada Highway Patrol, the state DOTs and local law enforcement agencies with Safe Routes to School and Bike Week activites.
  (Local schools, law enforcement, DOTs, LTBC)

- Continue and expand adult bicycle education programs through the local colleges, parks and recreation departments or other local agency departments that teach adults how to ride defensively. (Bicycle advocacy groups, local parks and recreation departments, adult educational institutions)

- Include bicycle and pedestrian safety information as part of visitor packages offered through the visitor centers, hotels, resorts, and bicycle rental shops. (TRPA, LTBC, chambers of commerce)

- Support distribution and updating of Lake Tahoe Bike Trail Maps. (TRPA, local jurisdictions)

- Conduct outreach to minority and non-English speaking communities about safe bicycling and walking practices. (TRPA, local jurisdictions, LTBC)

Local Jurisdiction Actions

To meet Goal 2, local jurisdictions could consider undertaking the following action:

- Integrate bicycle route numbering or naming system into wayfinding signage plans.

Goal 3:Provide environmental, economic, and social benefits to the Region through increased bicycling and walking.

Focused goal: Reduced Environmental Impacts

Reduce vehicle miles traveled (VMT), emissions, erosion, runoff, and other environmental impacts through careful implementation of the bicycle and pedestrian network.

Policies

3.1 Minimize roadway capacity or parking facilities where they can be effectively replaced by transit, bicycling and/or walking facilities.

3.2 Seek partnerships and opportunities for environmental restoration in conjunction with BPP facility implementation.

3.3 Include design features, landscaping, signage, or barriers on shared-use paths through sensitive environmental areas to discourage pets and humans from leaving the path.

3.4 Incorporate Best Management Practices (BMPs) into bicycle and pedestrian facility design to filter all sheet flow associated with project improvements.

Focused goal: Evaluation

Attain bicycle and pedestrian goals and environmental thresholds through performance measures consistent with the Regional Transportation Plan and the Regional Plan for the Lake Tahoe Basin.

3.5 Conduct biannual monitoring of the bicycle and pedestrian network to track use levels over time. This data will be provided to local operational authorities to aid in prioritizing construction, maintenance and enforcement.

3.6 Develop measures for tracking bicycling and walking impacts on local economies. (M2030)

3.7 Track bicycle and pedestrian accident rates and identify high-priority locations for safety improvements with each update of the BPP.

5-Year supportive actions for goal 3

The following actions should be pursued within a 5-year time frame to support Goal 3. The actions are organized by responsible party.

TRPA/TMPO Actions:

- Conduct non-auto mode share surveys every four years to determine the change in bicycling and walking as a portion of total mode split Region-wide. (TRPA)
- Report on the results of the monitoring program with every update of the BPP, and through the biannual TMPO Transportation Monitoring Report. (TRPA)
- Evaluate monitoring and act on results to further advance the policies contained herein, up to and including amending the BPP, as appropriate.
- Update project maps and lists every 2 years. Provide an annual progress report to interested groups, such as the Lake Tahoe Bicycle Coalition or TRPA/TMPO Governing Board.
- Update the entire BPP every 5 years, emphasizing improvements called for in survey/monitoring reports.
- Assist employers in meeting requirements associated with TRPA Code Chapter 97 "Employer-Based Trip Reduction Program."

Local Jurisdiction Actions (on-going)

To meet Goal 3, local jurisdictions could consider undertaking the following actions:

- Provide plastic doggie-bags at strategic locations along popular paths to encourage path users to pick up after their pets.
- Provide for trash receptacles and associated trash collection along paths.

Section 7: Proposed Network

This section describes the proposed bicycle and pedestrian network for the Region, including paths, lanes, routes and sidewalks. This network was developed based on previous planning efforts and direct input from the public and interested agencies and groups.

All proposed alignments identified in the BPP are conceptual, with only the beginning and the end of the proposed path being project specific. As projects go into detailed planning and design, more precise alignments will be developed. For more information on how projects progress from a line on the map to a constructed facility on the ground, see Section 9, Implementation, page 84.

Proposed shared-use paths, bicycle lanes, bicycle routes, and sidewalks

Recognizing the needs of different bicycling user groups, the proposed network focuses on providing both a strong off-street network of shared-use paths and sidewalks as well as on-street bicycle lanes on all major highways and collectors. Where bicycle lanes cannot be constructed due to topographic constraints, shoulder widening and signage are called for.

New signed bicycle routes are included on the project list, particularly in South Lake Tahoe. Bicycle routes can be implemented quickly and easily. With good directional signage, these routes can provide an excellent network, particularly for bicycle commuters.

New sidewalks are called for in all Lake Tahoe communities, but particularly in South Lake Tahoe and Kings Beach. Figure 11, Existing and Proposed Bicycle and Pedestrian Network, in Appendix B shows proposed sidewalks where sidewalks are currently missing or in extremely poor condition.

Maps and Project Lists

The combined existing and proposed bicycle and pedestrian network map is shown in Figure 11, in Appendix B. Table 18, also in Appendix B, shows the full list of proposed projects, including project mileage and project costs. The proposed network includes a total of 162 miles of new bicycle and pedestrian shared-use paths, bicycle lanes, bicycle routes, and sidewalks, and 80 miles of non-standard facilities (Table 11). A breakout of proposed mileage by jurisdiction is shown in Table 11, below.

To facilitate timely construction of the network, the complete project list and map show all currently planned projects. While it is highly unlikely that these projects will all be constructed within the next twenty years, including them on the list highlights where important linkages are needed, and makes projects eligible for funding should an opportunity arise to construct. The proposed network includes all Environmental Improvement Program (EIP) bicycle and pedestrian projects. However, not all of the proposed projects in the BPP are EIP projects.

All projects on the BPP proposed list underwent an initial screening process. Projects that are included on the proposed list are determined to be important links in the network and feasible to construct. See Table 12, below, for the screening criteria. Projects that were proposed but that were screened out are listed on the "Proposed Projects, Screened Out" list (Table 21, Appendix B).

Jurisdiction	Class I Path	Class II Bike Lane	Class III Bike Route	Sidewalk	Other (1)	Total
El Dorado County, CA	22	9	14	0	39	84
City of South Lake Tahoe	8	10	8	7	0.1	33
Placer County, CA	16	15	1	4	28	62
Douglas County, NV	14	1	1	2	15	34
Washoe County, NV	12	12	0	6	10	40
Carson City, NV	4	0	0	0	5	9
Total	**76**	**47**	**24**	**20**	**98**	**262**

Note 1: Includes shoulder widening, path upgrades, and Bicycle Ferry

Table 11. Length of Proposed Network by Class

For a project to be included in the "proposed project list" of the Bicycle and Pedestrian Plan, at least one of the following must be true:		
Number	**Criteria**	**Explanation**
1	Needed because of high existing or predicted use and does not duplicate another route	Existing or predicted use to be verified using the TRPA Bicycle and Pedestrian Use Models. The threshold for "high" use is 100 or more users on any day (roughly 8 users per hour). Of the corridors monitored in the Tahoe Basin, the 20% with the lowest usage had under 100 riders per day.
2	Planning or design already started	
3	Can be built concurrently with another project	
4	Provides safe route to school	A safe route to school may be a route identified in a school's "Safe Routes to School" plan, or, in the absence of a plan, any route within a 1-mile radius of a school.
5	Fills a gap in existing network	Does the project connect two facilities that were not linked before? Does the project fix a section that deterred pedestrians and bicyclists from using another, complete path, for example due to lack of maintenance? Does the project upgrade a section that was not built to current design standards?
And all of the following must be true:		
6	There is reasonable belief that right-of-way (ROW) acquisition is possible	
7	Environmental impacts can be mitigated	
8	Design can meet Federal, State, and/or Tahoe-specific design standards	As specified in the "Design Guidelines" section of the BPP, AASHTO, MUTCD, and the California Highway Design Manual.

Table 12. Screening Criteria

Prioritized Project List

The BPP includes a limited prioritized project list, in addition to the full list of projects. While the prioritized list is by no means cast in stone, it should serve as a general guide for local jurisdictions, TRPA/TMPO staff, granting agencies, and local advocacy groups as to which projects best serve the stated needs of local communities. Recognizing funding limitations, it is not mandated to build the paths in the BPP by a certain date, nor in the order in which they appear on the list. In fact, there are certain instances when projects that are not high on the prioritized list should be constructed ahead of those that are:

- When an opportunity, such as a road widening or re-paving, makes implementation favorable
- When an eminent loss of an opportunity, such as the sale of a right-of-way, makes implementation necessary
- When resolution of a major obstacle, such as access to flood channel right-of-way, makes implementation necessary

The prioritization process was developed over time with input from the local jurisdictions and the public. TRPA/TMPO developed a set of prioritization criteria and asked public workshop attendees to weight these criteria at two public workshops. These weights, with some adjustments, were applied to eight prioritization criteria for each individual project. TRPA staff and the local jurisdictions then scored each project and sorted by highest score. The public's weighting can be seen in Appendix H, Comments on Draft BPP, on the TMPO website at www.tahoempo.org.

Since jurisdictions are likely to work simultaneously on projects that are at different stages of development, the TRPA/TMPO split projects into two categories:

- "Planning-Level"--projects that have not undergone any level of planning to date
- "Design-Level"--projects for which some level of planning has already been started.

The prioritized list includes the top six-eight projects from each of the jurisdictions around the Lake: Douglas County, South Lake Tahoe, El Dorado County, TCPUD, NTPUD, and Washoe County. Projects on the prioritized list are incorporated by reference into the RTP, which makes them eligible to move onto the annual Federal Transportation Improvement Program (FTIP) list.

Criteria for prioritizing proposed projects:

- **Closing gaps** – Closing gaps between existing facilities improves functionality of the existing network.
- **Estimated Use and Cost/Benefit** -- High-priority bicycle and pedestrian facilities should reflect use levels that are commensurate with the level of investment required for construction and maintenance. Predicted use levels were based on the Bicycle Trail User Model (Appendix F). For a full explanation of how predicted use was developed for project prioritization, see Appendix K, Use Estimation (www.tahoempo.org).
- **Improves network** – Proposed facilities should not closely parallel existing facilities, unless they are providing for a different user group.

- **Multi-modal connectivity** – New facilities should support transit and walking modes.

- **Safety** - The network should provide the highest level of safety possible while eliminating major safety concerns such as narrow roadways. Projects that can address a location where accidents have occurred receive higher points.

- **Connectivity** - The network should provide connections to major activity centers, multi-modal transfer locations, and to routes that provide access to neighboring counties. This is captured through the "Estimated Use" criterion.

- **Environmental Impact** – While environmental impacts must be mitigatable for projects to pass the initial screening, projects that are in more sensitive areas will face more challenges. Projects that cross more than 5 percent of stream environment zones, are within a wildlife habitat buffer, or have other known environmental issues receive negative points.

- **Timeline (design-level projects only)** – Projects which are further along in the planning and design process receive higher scores, recognizing the investment in time and resources.

- **Regional Equality** – The network should provide balanced access from all portions of the Region's population centers for both commuting and recreation routes.

Table 19 in Appendix B shows the detailed prioritization criteria and weights. Table 20 in Appendix B shows the scored, prioritized project lists.

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Section 8: Cost and Funding Analysis

Implementation of the proposed bicycle and pedestrian network will require funding from local, state, and federal sources and coordination with multiple agencies. To facilitate funding efforts, this section presents conceptual construction cost estimates for the proposed network.

Cost Estimates

Table 14, below contains a unit cost summary for the construction of bicycle and pedestrian facilities in the Region. These cost estimates are based on actual costs experienced in the Region and similar communities in California and Nevada. However, they should be used only to develop conceptual construction cost estimates. More detailed estimates should be developed after preliminary engineering as individual projects advance to implementation.

The total cost of the network is higher than that expected for bicycle facilities in communities with level terrain. Higher unit cost estimates were used given the unique topographic characteristics and environmental constraints of the Region.

A summary of the network costs by jurisdiction and type of facility is presented in Table 15 on the following page. Conceptual construction cost estimates for individual routes are contained in Table 17, Proposed Bicycle and Pedestrian Project List in Appendix B. Conceptual construction costs for Lake Tahoe's proposed network were based on the highest unit costs for Class II/Bike Lane facilities, the moderate unit costs for Class I/Shared-Use Path, and the low unit costs for Class III/Bike Route facilities. This approach results in unit costs for Class II/Bike Lanes that include some roadway widening. Additionally, certain unit costs were adjusted based on known project costs.

Facility Type	Estimated Cost per Mile
Class III/Bike Route	
signing only	$5,000
signing plus minor road improvements	$40,000
signing plus moderate roadway improvement	$150,000
signing plus major roadway improvement	$300,000
Class II/Bike Lane	
signing and striping only	$5,000
signing and striping plus minor roadway improvement	$50,000
signing and striping plus moderate roadway improvemen	$300,000
signing and striping plus major roadway improvement	$500,000
Class I/Shared Use Path	
construct asphalt path on graded right of way with drainage and new sub-base	$1,000,000
construct asphalt path on un-graded right of way with drainage and new sub-base	$2,000,000
construct asphalt path with some boardwalking and/or bridges	$4,000,000
Sidewalk	
Five-foot wide sidewalk	$1,000,000

Table 14. Conceptual unit cost estimates for bikeway construction

Jurisdiction (Lake Tahoe portion)	Class I/Shared Use Path	Class II/Bike Lane	Class III/Bike Route	Sidewalk	Other (1)	Total
El Dorado County, CA	$50,196,100	$6,098,109	$69,694	$0	$42,372,584	$98,736,487
City of South Lake Tahoe, CA	$19,064,561	$35,898,343	$476,519	$38,344,179	$200,000	$93,983,601
Placer County, CA	$36,186,317	$3,375,957	$4,201	$10,240,513	$16,734,677	$66,541,665
Douglas County, CA	$50,038,538	$641,922	$3,240	$11,845,721	$15,604,125	$78,133,546
Washoe County, CA	$43,600,894	$8,851,323	$0	$10,797,488	$5,966,526	$69,216,232
Carson City, NV	$16,014,259	$0	$0	$0	$0	$16,014,259
Total	**$215,100,670**	**$54,865,653**	**$553,653**	**$71,227,902**	**$80,877,912**	**$422,625,790**
Note 1: Includes shoulder widening, path upgrades, and Bicycle Ferry						

Table 15. Total cost of proposed network by jurisdiction

Table 15 shows a total cost for constructing the proposed network of approximately $423 million. This total consists of approximately $163 million for new facilities in Nevada and approximately $259 million for new facilities in California.

The Tahoe Scenic Bike Loop was assigned the cost of a Class III/Bicycle Route in places where there is currently no facility. This is most likely the first step in creation of the route. In places where there is already a Class III/Bicycle Route, or where the responsible agency is already planning a Class II/Bike Lane, the bicycle lane cost was assigned.

Funding Strategy

Much of the existing bicycle and pedestrian network was constructed by local agencies. With an approximate total length of 98 miles, the existing network represents a substantial investment. To add approximately 95 miles of high priority facilities to this network will require an investment close to $200 million, which equates to an annual cost of $10 million per year over 20 years in constant 2009 dollars (Table 20, Prioritized Project List, in Appendix B).

Although some of the proposed network will be constructed as part of future development and roadway projects, a substantial portion of the total cost will rely on public funding. Descriptions of and links to known available funding sources, including state bond funding, federal planning grants, and smaller grants such as the California Bicycle Transportation Account and the National Scenic Byways Program, are provided in Appendix E, Funding Memo.

Reasonably foreseeable revenue sources are identified in Table 16, on the following page. All priority projects which are to be carried over from the BPP to the RTP must have an identified reasonably foreseeable revenue source.

The following options should be considered by the Region for fulfilling the funding commitment necessary to complete and maintain the proposed network:

- Prepare joint applications with other local and regional agencies for competitive funding programs at the state and federal levels
- Use existing funding sources as matching funds for state and federal funding
- Include bicycle and pedestrian projects in local traffic impact/mitigation fee programs
- Include proposed bikeways as part of roadway projects involving widening, overlays, or other improvements.

Local jurisdictions should also take advantage of private contributions, if appropriate, in developing the proposed network. This could include a variety of resources such as volunteer labor during construction, or monetary donations towards specific improvements.

Local Sources	**Assumptions**	**Type**	**2010-2012**	**2013-2017**	**2018-2022**	**2023-2030**
North Lake Tahoe Resort Association Transient Occupancy Tax	Approximately 1/3 of tota	planning, cons	$3,000,000	$7,000,000	$7,000,000	$10,000,000
Tahoe-Douglas Transportation District Transient Occupancy Tax			$30,000	$50,000	$50,000	$50,000
Washoe County Regional Transportation Commission	$50K per year		$150,000	$250,000	$250,000	$400,000
TRPA Air Quality Mitigation Fund	$250K per year during recession, increasing to $500K/year then to $750K/year in later years		$750,000	$2,500,000	$3,750,000	$6,000,000
Placer County Development Fees	$50K per year during recession, increasing to $100K/year		$150,000	$500,000	$500,000	$800,000
Other Local Sources	$855K/year		$2,565,000	$4,275,000	$4,275,000	$6,840,000
State Sources	**Assumptions**		**2010-2012**	**2013-2017**	**2018-2022**	**2023-2030**
California Tahoe Conservancy		planning, cons	$3,227,000	$4,000,000	$4,000,000	$8,000,000
Nevada Bond Sales (Question 1)		planning, cons	$4,000,000			
State Transportation Improvement Program (STIP)	50% of allocation	construction	$1,000,000	$1,000,000	$1,000,000	$1,000,000
California Bicycle Transportation Account			$250,000	$500,000	$500,000	$800,000
Recreational Trails Program	$200,000 every two years		$200,000	$400,000	$600,000	$400,000
Safe Routes to Schools			$50,000	$150,000	$150,000	$200,000
Transportation Planning Grant program	$200,000 every two years		$200,000	$400,000	$400,000	$800,000
Other State Sources	$500K/year		$1,500,000	$2,500,000	$2,500,000	$4,000,000
Federal Sources	**Assumptions**		**2010-2012**	**2013-2017**	**2018-2022**	**2023-2030**
Federal Lands Highway Program (1/2 percent)			$2,500,000	$2,500,000	$2,500,000	$2,500,000
Congestion Mitigation and Air Quality Program (CMAQ)	60% for bike/ped		$744,000	$1,500,000	$1,500,000	$1,500,000
Regional Surface Transportation Program	60% for bike/ped		$650,000	$1,320,000	$1,320,000	$1,320,000
National Scenic Byways Program		planning, cons	$400,000	$1,000,000	$400,000	$1,000,000
Transportation, Community, and System Preservation (TCSP)			$50,000	$100,000	$100,000	$200,000
Alternative Transportation in Parks and Public Lands (ATPPL)			$0	$250,000	$250,000	$250,000
Transportation Enhancement (TE)			$200,000	$200,000	$200,000	$200,000
Other Federal Sources	$500K/year		$1,500,000	$2,500,000	$2,500,000	$4,000,000
Private or Concurrent Sources						
Caltrans			$12,000,000	$12,000,000	$12,000,000	$12,000,000
Other Private or Concurrent Sources	$550K/year		$1,650,000	$2,750,000	$2,750,000	$4,400,000
Total			**$36,766,000**	**$47,645,000**	**$48,495,000**	**$66,660,000**
Total to 2030						**$199,566,000**
Note: Not all revenue sources can be used for all projects.						

Table 16: Bicycle and pedestrian facility funding sources for the Lake Tahoe Region

Section 9: Implementation

The previous sections have described the process for identifying needed bicycle and pedestrian improvements, and have highlighted the conceptual alignments of new facilities. Physical implementation of projects is the next step, and can face significant obstacles. These obstacles include securing funding and right-of-way, working with property owners to come to agreement on route alignment and property acquisition, and meeting environmental standards and other permitting requirements. In Lake Tahoe, the mountain topography and complicated regulatory environment can make implementation of projects difficult.

The following pages describe the basic steps needed to implement projects in Lake Tahoe. The other sections in the BPP offer some strategies for overcoming obstacles, such as funding.

Project Implementation

The primary responsible implementing entities for the bicycle and pedestrian facilities in Lake Tahoe are the local jurisdictions and other special districts. This includes the City of South Lake Tahoe, El Dorado County, Placer County, Douglas County, Carson City, Washoe County, California State Parks, Nevada Division of State Parks, United States Forest Service, Tahoe City Public Utility District and North Tahoe Public Utility District. The California Tahoe Conservancy (CTC), while administering major funding sources, is not typically a project implementer. In the case of the South Tahoe Greenway, however, the CTC is implementing planning, design, and environmental review. Other project implementers include Caltrans, NDOT, and private developers, who may construct projects from the BPP concurrently with roadway improvements, new, or re-development.

The flow-chart in Figure 5, below shows how bicycle and pedestrian projects are implemented. Project implementers usually start by pursuing planning funds for high priority projects listed in the BPP. Next, they conduct initial feasibility, design, property acquisition (where needed) and environmental review of the project, including necessary public outreach. During this time they also pursue funding for the construction of the project. After these steps are complete, the implementer submits the project to TRPA and other local agencies for the necessary permits. Once construction funds are secured, construction begins. After project completion, the implementing agency is responsible for maintaining the project over time, unless maintenance agreements have been made with other agencies.

Funding for different stages of project planning, construction, and maintenance are available from different sources. Planning funding is often available from federal and state sources, while construction funding is most often found from state sources, such as California and Nevada bond measures. Maintenance funding is almost never available from state and federal sources, and must be obtained at the local level, through local sales taxes, assessment districts, or other local sources. For more details on funding sources, see Appendix E, Funding Memorandum.

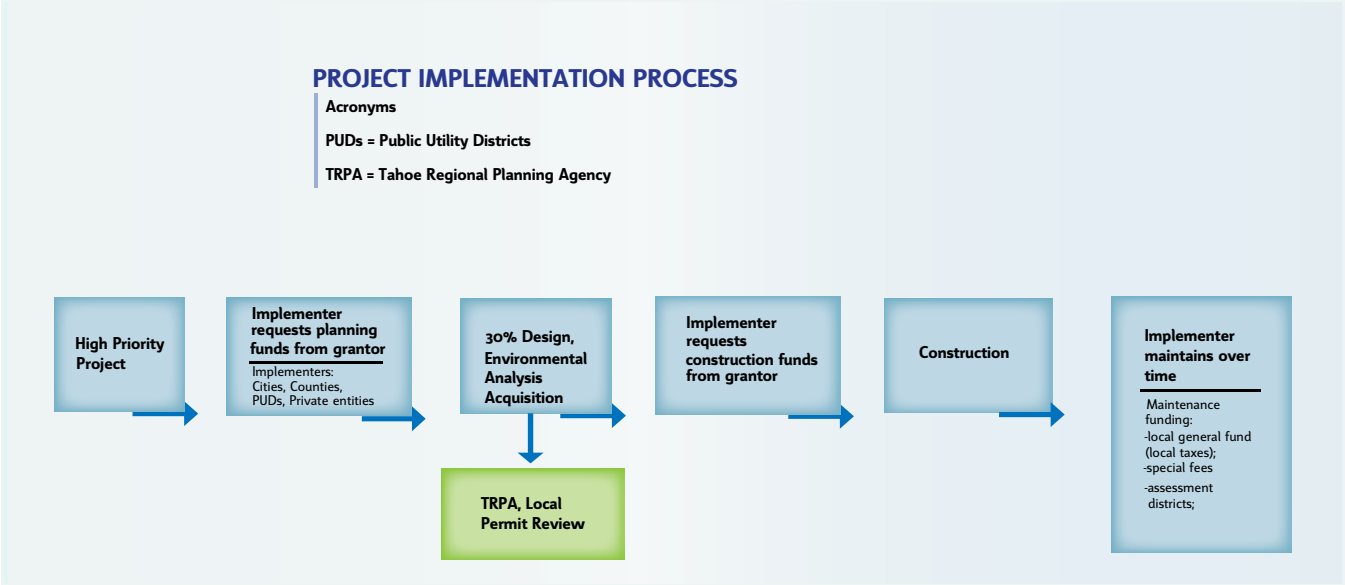


Figure 5.

Federal Funding Process

Most grant sources require that bicycle and pedestrian projects be listed in an approved bicycle or pedestrian plan before they can be eligible for funding. This can be a stand-alone bicycle and pedestrian plan, or a bicycle and pedestrian element of a regional transportation plan. Some funding sources, particularly federal sources, also require that projects be listed in other plans, such as the Lake Tahoe Environmental Improvement Program (EIP), and the TMPO Regional Transportation Plan (*Mobility 2030*). The BPP priority project list will directly populate the RTP[1] and the EIP project lists. Amendments to the BPP priority project list will trigger amendments to the corresponding documents for consistency.

The RTP is a 20-year, financially-constrained document. Therefore, the RTP must show reasonably projected revenues for all projects. This rule of financial constraint helps planning and implementing agencies to be realistic about the sequencing and prioritization of projects, and can spur agencies to increase funding efforts. The RTP is updated every four years, but can be amended as needed.

Once a project has received federal funding, it is listed in the Federal Transportation Improvement Program (FTIP). This is the document that programs, or commits, specific funds to specific transportation projects. This commitment is particularly important for flexible funding sources, which can be used for multiple projects. The FTIP is the authorization to use federal funds, not to exceed the amount programmed. A project cannot commence use of federal funds unless it is listed in the FTIP. The FTIP is a four-year funding document, but it is updated every two years, and amended as needed. Figure 6, below shows the federal funding process.

[1]Projects from the BPP priority list that can show reasonably forseeable funding will be transferred into the RTP.

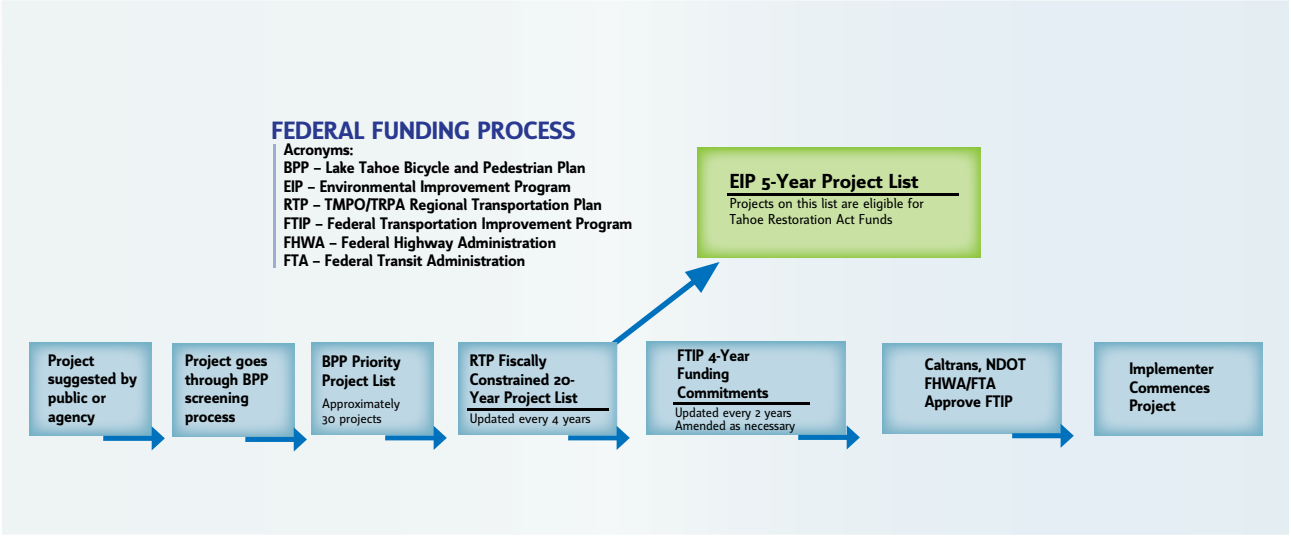


Figure 6.

TRPA Project Review Process

Part of the project implementation process includes project review for consistency with local and regional ordinances. The TRPA is responsible for ensuring that projects are consistent with the Regional Plan by reviewing them and issuing permits for construction. In addition, projects--particularly development projects--may need permits from local jurisdictions to ensure consistency with local policies and building codes.

Depending on the scale of the project, implementers complete between 30 and 90 percent design and the necessary environmental review as required by TRPA, California Environmental Quality Act (CEQA), and the National Environmental Protection Act (NEPA). Early coordination with permitting entities is recommended to identify potential issues in the preliminary design phase, preventing costly changes later. Figure 7 below illustrates this process. The process is similar for varying types of projects, including bicycle paths, new development, or roadway improvement projects. Some projects are exempt from project review because the activity is routine or has a minor impact. Road overlays often fall into this category.
Once TRPA has received the project application, staff reviews the project for consistency with the Regional Plan, including the BPP. In the case of new, redevelopment, or roadway improvement projects, staff reviews projects to ensure that they incorporate elements of the BPP, such as providing appropriate levels of bicycle parking, and constructing or maintaining proposed or existing facilities.

Depending on the scale of the project, staff may either approve the project, or take it to the Hearings Officer or Governing Board for approval. Requirements for when a project must go to the Hearings Officer or the Governing Board are explained in the TRPA Code of Ordinances, Chapter 4. Projects that go to the Hearings Officer or Governing Board require a public notice that includes notification of property owners within 300 feet of the project, as well as notice in local newspapers. Conditions may be imposed upon the project during the staff, Hearings Officer, or TRPA Governing Board review. Examples of these conditions include features to increase safety for bicyclists and pedestrians, or modifications to bicycle paths to ensure protection of the surrounding environment.

After approval of the project at the staff, Hearings Officer, or Governing Board level, a permit is issued and the project may begin construction. A more detailed summary of the project review process can be found in the TRPA Code of Ordinances, Chapter 4, Project Review and Exempt Activities.

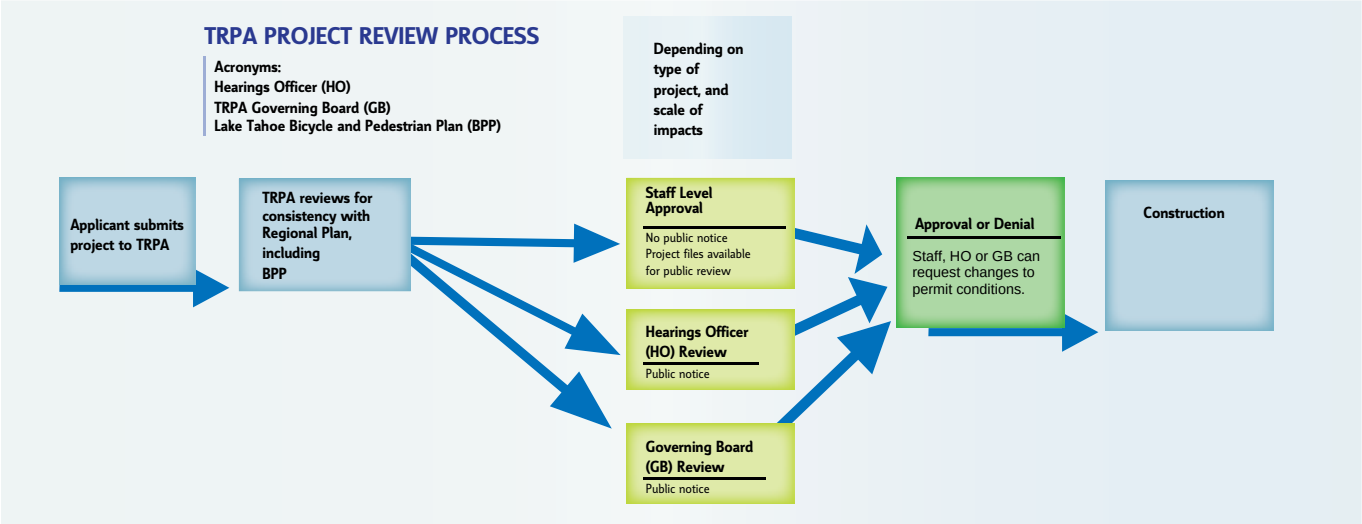
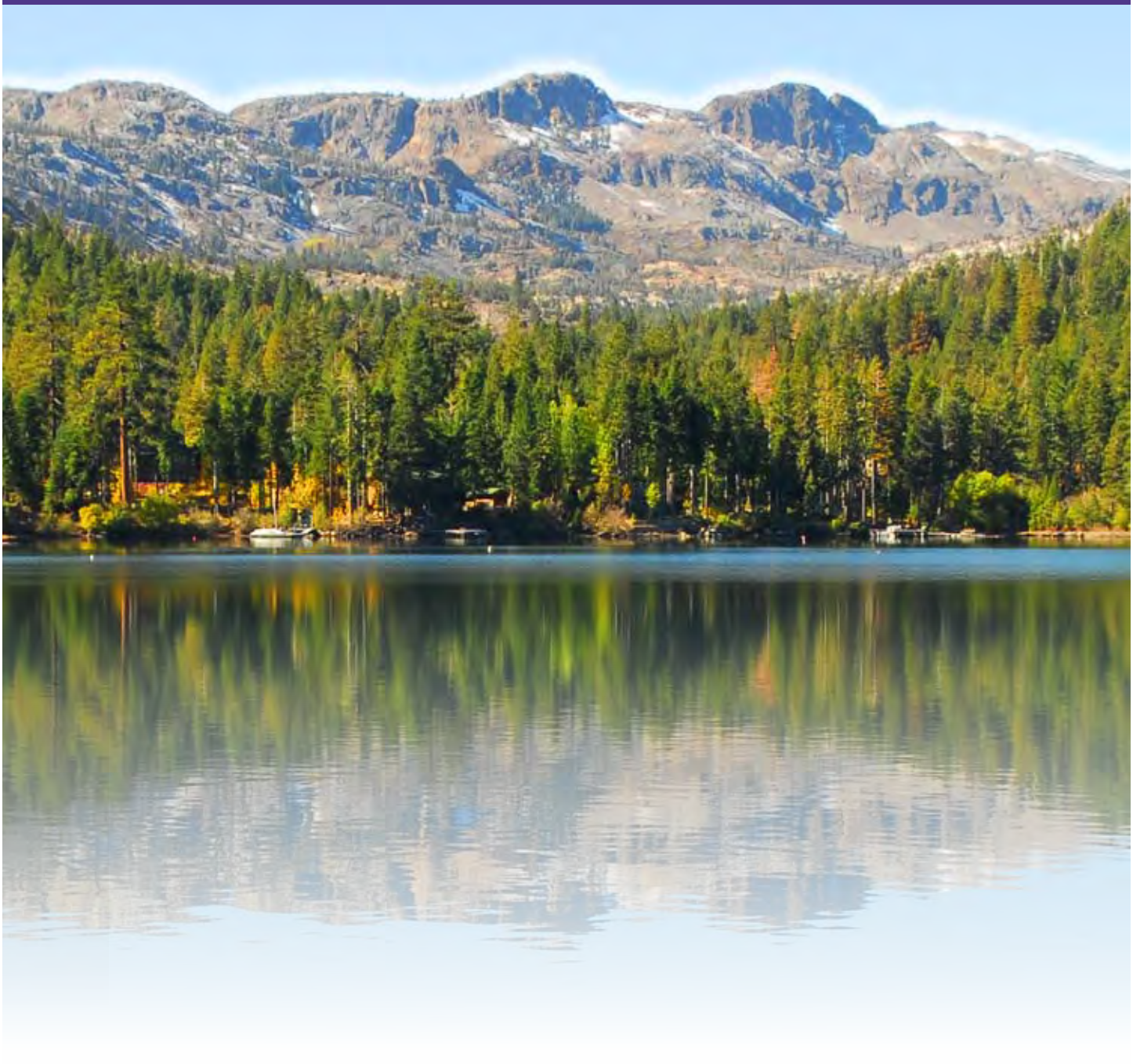


Figure 7.

Section 10: Useful Links



There are many other agencies and organizations, both within and outside of the Lake Tahoe Region that provide valuable resources regarding biking and walking. A few of them are listed here.

Tahoe Metropolitan Planning Organization (TMPO)

www.tahoempo.org

The TMPO website provides links to the websites for current projects in the planning phases around Lake Tahoe, including the South Tahoe Greenway, the North Tahoe Bike Trail, and the Nevada Stateline to Stateline Bikeway. There are also links to bicycle and pedestrian monitoring studies, as well as other transportation plans and studies. The TMPO website includes a link to an interactive GIS map of the bicycle and pedestrian network.

Lake Tahoe Region Bicycle and Pedestrian Plan

www.tahoempo.org/bikeplan_update.aspx?SelectedIndex=2

Link to the on-line version and see up-to-date project lists and project status.

Interactive Bicycle Map

gis.trpa.org:82/BIKEMAP

The direct link to the interactive GIS map of existing and proposed bicycle and pedestrian facilities in Lake Tahoe.

Lake Tahoe Bicycle Trail User Model

www.tahoempo.org/bike_trail_model.aspx?SelectedIndex=2

Download and use this model to estimate existing and future use of individual bicycle paths in Lake Tahoe, or the network as a whole.

Lake Tahoe Bicycle Coalition

www.tahoebike.org

The Lake Tahoe Bicycle Coalition's website provides links to a printable map of the Region's bicycle network, local events, and ways to get involved in promoting bicycling in Lake Tahoe.

Tahoe Transportation District

www.tahoetransportation.org

The Tahoe Transportation District is the lead agency for several regional projects, including the Nevada Stateline to Stateline Bikeway, the U.S. Highway 50 Stateline Core Project, and the Lake Tahoe Waterborne Ferry.

Lake Tahoe Water Trail

www.laketahoewatertrail.org

The Lake Tahoe Water Trail provides an opportunity to plan a custom paddle trip around the 72-mile shoreline of Lake Tahoe.

US Forest Service Lake Tahoe Basin Management Unit (LTBMU

www.fs.fed.us/r5/ltbmu

The LTBMU manages over 450 miles of unpaved trails for hikers, mountain bikers, and equestrians.

Definitions and Acronyms

AASHTO – American Association of State Highway and Transportation Officials
ADA – Americans with Disabilities Act
ADT – Average Daily Traffic
AMBBR – America's Most Beautiful Bike Ride

Bicycle and pedestrian network – shared-use paths, bicycle lanes, bicycle routes, wide shoulders, and sidewalks.

Bicycle and pedestrian facilities – shared-use paths, bicycle lanes, bicycle routes, wide shoulders, and sidewalks plus all other bicycle and pedestrian support facilities such as bicycle storage racks, lockers, crossing treatments and street markings.

Bikeway – shared-use path, bicycle lane, bicycle route or wide shoulder.

Bicycle storage – bicycle racks, locker, or other location for safely and securely storing bicycles.

BID – Business Improvement District
BPMP – 2003 Lake Tahoe Bicycle and Pedestrian Master Plan
BPP – 2010 Lake Tahoe Region Bicycle and Pedestrian Plan
BTA – California Bicycle Transportation Act, California Bicycle Transportation Account
CA MUTCD – California Manual on Uniform Traffic Control Devices
Caltrans – California Department of Transportation
CDC – Centers for Disease Control and Prevention
CEQA – California Environmental Quality Act
CFDs – Community Facilities Maintenance Districts
CHP – California Highway Patrol

Class I/Shared-Use Path – Provides a completely separated right of way for the exclusive use of bicycles and pedestrians with cross-flow from vehicles minimized.

Class II/Bike Lane – Provides a striped lane for one-way bicycle travel on a street or highway.

Class III/Bike Route – Provides for shared use with bicycle or motor vehicle traffic on streets and highways.

CTC – California Tahoe Conservancy
EIP – Environmental Improvement Program
Facilities – shared-use paths, lanes, routes, sidewalks, bicycle storage, lockers, showers, crosswalks, street furniture, and other bicycle and pedestrian amenities.

FHWA – Federal Highway Administration
FTIP – Federal Transportation Improvement Program
HAWK – High-Intensity Activated Crosswalk

Jurisdictions – includes all agencies responsible for constructing and maintaining routes, including cities, counties, public utility districts, and the USDA Forest Service.

LAB – League of American Bicyclists
Lake Tahoe Scenic Bike Loop – envisioned to provide bicycle lanes meeting AASHTO standards on the highways encircling Lake Tahoe. Where lanes cannot be constructed, or until they can be constructed, the loop should provide 3-5 feet of shoulder on the lake side where possible.

LTVA – Lake Tahoe Visitors Authority
LTBC – Lake Tahoe Bicycle Coalition
M2030 – Lake Tahoe Regional Transportation Plan, Mobility 2030 (TMPO Plan)

Measure S – a bond measure for the City of South Lake Tahoe and Lake Tahoe portion of El Dorado County that pays for a variety of maintenance activities, including maintenance of bike paths.

Mobility 2030 – Lake Tahoe Regional Transportation Plan (TMPO Plan)

Mode split or mode share -- percentage of people who choose to take different forms of transportation, such as walking, bicycling, transit, or driving.

MOU – Memorandum of Understanding
MUTCD – National Manual on Uniform Traffic Control Devices
NDOT – Nevada Department of Transportation
NEPA – National Environmental Policy Act
NHP – Nevada Highway Patrol
NHTS – National Household Travel Survey
NLTRA – North Lake Tahoe Resort Association

NTPUD – North Tahoe Public Utility District

PAL – Police Activities League

PBID – Parcel and business improvement district

Pedestrian -- someone who travels by foot or by wheelchair

PPP – Public Participation Plan

PUDs – Public Utility Districts

RET – Real Estate Transfer Tax

Routes – shared-use paths, lanes, routes, and sidewalks.

RTP – Lake Tahoe Regional Transportation Plan (Mobility 2030)

RTPA – Regional Transportation Planning Agency

RTTPC – Resort Triangle Transportation Planning Coalition

SAFETEA -LU – Safe Accountable Flexible, Efficient Transportation Equity Act: A Legacy for Users (the Federal Transportation Bill)

SEZ – Stream environment zone

Sharrow – a street marking that can be used to indicate that bicyclists and vehicles share the road

SLT – South Lake Tahoe

SNPLMA – Southern Nevada Public Lands Management Act

SSTMA – South Shore Transportation Management Association

STIP – Statewide Transportation Improvement Program

SWITRS – California Statewide Integrated Traffic Records System

TAC – Lake Tahoe Bicycle and Pedestrian Plan Technical Advisory Committee

TART – Tahoe Area Regional Transit

TCORP – Tahoe Coalition of Recreation Providers

TCPUD – Tahoe City Public Utility District

TIP – Transportation Improvement Program

TMPO – Tahoe Metropolitan Planning Organization

TNT-TMA - Truckee North Tahoe Transportation Management Association

TOT – Transient Occupancy Tax

TRPA – Tahoe Regional Planning Agency

TWSA – Tahoe Water Suppliers Association

VMT – Vehicle Miles Travelled

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References

American Association of State Highway and Transportation Officials (August, 1991). *Guide for the Development of Bicycle Facilities*.

Bureau of Transportation Statistics, U.S. Department of Transportation. 1990 Census Transportation Planning Package.

California Department of Transportation (2001). Chapter 1000: Bikeway Planning and Design, Highway Design Manual. http://www.dot.ca.gov/hq/oppd/hdm/pdf/chp1000.pdf.

California Department of Transportation (2006). California Manual on Uniform Traffic Control Devices. http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd.htm.

California Statewide Integrated Traffic Records System (SWITRS).

Centers for Disease Control and Prevention. Overweight and Obesity>Data and Statistics>Trends by State, 1985-2008. http://www.cdc.gov/obesity/data/trends.html#State.

City of South Lake Tahoe, California (2008). Bicycle Friendly Communities Application to the League of American Bicyclists.

Colorado Dept. of Transportation and the Center for Research in Economic and Social Policy at the Univ. Colorado – Denver (1999). The Economic Impact of Bicycling in Colorado. http://atfiles.org/files/pdf/CObikeEcon.pdf

Fitzpatrick, Kay, Shawn Turner, Marcus Brewer, Paul Carlson, Brooke Ullman, Nada Trout, Eun Sug Park, and Jeff Whitacre (2006). "Improving Pedestrian Safety at Unsignalized Crossings." Transportation Research Board, Washington, D.C.

Frank, Andresen, and Schmid (2004). Obesity Relationships with Community Design, Physical Activity, and Time Spent in Cars. *American Journal of Preventative Medicine, 2004;27(2).*

Haskell, W. L., I. Lee, R. R. Pate, K. E. Powell, S. N. Blair, B. A. Franklin, C. A. Macera, G. W. Heath, P. D. Thompson and A. Bauman (2007). Physical Activity and Public Health: Updated Recommendation for Adults From the American College of Sports Medicine and the American Heart Association. *Journal of the American Heart Association*, 116, 1081-1093. http://circ.ahajournals.org/cgi/reprint/CIRCULATIONAHA.107.185649

Karadeniz, D. (2008). The Impact of the Little Miami Scenic Trail on Single Family Residential Property Values. Unpublished master's thesis, University of Cincinnati. http://atfiles.org/files/pdf/LittleMiamiPropValue.pdf

Kerr, J. of Active Living Research (Spring 2008). *Designing for Active Living Among Adults: Research Summary.* http://www.activelivingresearch.org/files/Active_Adults.pdf

Krizek, El-Geneidy, and Thompson (2007). A detailed analysis of how an urban trail system affects cyclists' travel. *Transportation, September 2007*.

Lake Tahoe Bicycle Coalition (2009). Lake Tahoe Survey of Cycling Visitors. http://www.tahoebike.org/index.php?option=com_content&view=article&id=139&Itemid=238

Lake Tahoe Visitors Authority (2008). Economic Impact Analysis of Tourism on the Lake Tahoe Region.

Lawrie, J., J. Guenther, T. Cook, M. P. Meletiou, S. W. O'Brien (2004). The Economic Impact of Investments in Bicycle Facilities: A Case Study of the Northern Outer Banks.
Institute for Transportation Research and Education for the North Carolina Department of Transportation.

League of American Bicyclists. "Ride for the Environment" page. http://www.bikeleague.org/resources/why/environment.php.

Lindsey, G., J. Man, S. Payton, & K. Dickson (2004). Property Values, Recreation Values, and Urban Greenways. *Journal of Park and Recreation Administration*, 22(3), 69-90. http://www.sagamorepub.com/ebooks/jprabackissues/jpra223555/Article5.pdf

Los Angeles County Metropolitan Transportation Authority (2007). Bicycle Paths: Safety Concerns and Property Values. http://www.greenway.org/pdf/la_bikepath_safety.pdf

Maine Department of Transportation (2001). *Bicycle Tourism in Maine: Economic Impacts and Marketing.*

National Household Travel Survey (2009). http://nhts.ornl.gov/tables09/fatcat/2009/aptl_TRPTRANS_WHYTRP1S.html.

Nevada Department of Transportation Accident Database.

North Lake Tahoe Resort Association (2009). The Economic Significance of Travel to the North Lake Tahoe Area, 2003-2008p Detailed Visitor Impact Estimates. Dean Runyan Associates. August 2009.

Rails-to-Trails Conservancy (2004). Economic Benefits of Trails and Greenways.
http://www.railstotrails.org/resources/documents/resource_docs/tgc_economic.pdf

Roberts, Dave and Reuter (2001). Lake Tahoe Total Maximum Daily Load Technical Report California and Nevada. September 2001.

South Lake Tahoe and North Lake Tahoe Bicycle Friendly Communities applications, 2008 and 2010

Tahoe Regional Planning Agency (1987). Code of Ordinances, Chapter 97, Trip Reduction Ordinance.

Tahoe Regional Planning Agency (1987). Regional Plan.

Tahoe Regional Planning Agency (2001). Recreation User Preference Survey and Focus Group Research.

Tahoe Regional Planning Agency (2006). Summer 2006 Travel Mode Share Survey. http://www.tiims.org.

Tahoe Regional Planning Agency (2007). August Traffic Volumes, 1974-2007. www.tiims.org.

Tahoe Regional Planning Agency (2008). Winter 2008 Travel Mode Share Survey. http://www.tiims.org.

Tahoe Regional Planning Agency (2009). Bike to Work, School, Play post-event survey.

Tahoe Regional Planning Agency (2009). Environmental, Economic, and Public Health Impacts of Shared Use Paths in Lake Tahoe. http://tahoempo.org/documents.aspx?SelectedIndex=5.

Tahoe Regional Planning Agency/Tahoe Coalition of Recreation Providers (2008). Lake Tahoe Basin Bike Trail Survey: July 2007. http://www.tiims.org.

Tahoe Regional Planning Compact, Public Law 96-551.

U.S. Department of Transportation, Federal Highway Administration (1994). The National Bicycling and Walking Study: Transportation Choices for a Changing America, Publication No. FHWA-PD-94-023.

U.S. Department of Transportation, Federal Highway Administration (2009). Manual on Uniform Traffic Control Devices. http://mutcd.fhwa.dot.gov/.

U.S. Environmental Protection Agency (2010). Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle. http://www.epa.gov/otaq/climate/420f05004.htm.

Williams, L.A. (April, 1994). Pedestrian Safety, Special Report, Technology Transfer Program, Institute of Transportation Studies, University of California.

APPENDIX A
DESIGN AND MAINTENANCE RECOMMENDATIONS

CHAPTER 1 - Introduction

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

Bicycle and Pedestrian Design Standards

The Lake Tahoe Bicycle and Pedestrian Plan Design and Maintenance Guidelines present standards and recommendations that specifically provide for consistency in the Lake Tahoe Region, or where details are needed beyond what is provided by state and federal design standards. All projects must also meet state and federal design standards, as well as other TRPA design guidelines including scenic requirements and best management practices. Therefore, in addition to these Lake Tahoe Design Guidelines, planners and designers should also refer to the following documents and their subsequent updates when planning and designing bicycle and pedestrian facilities.

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

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

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

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

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

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

Caltrans Design Information Bulletins
http://www.dot.ca.gov/hq/oppd/dib/dibprg.htm
including:
DIB 80-01 Roundabouts
DIB 82-03 Design Information Bulletin 82-03 "Pedestrian Accessibility Guidelines for Highway Projects"

Caltrans Standard Plans

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

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

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

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

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

Tahoe Regional Planning Agency Code of Ordinances
http://www.trpa.org/default.aspx?tabindex=2&tabid=172

Disclaimer
This appendix is not intended to replace existing state or national mandatory or advisory standards, nor the exercise of engineering judgment by licensed professionals. The facts and circumstances of a specific project may warrant different designs or standards than are specified here.

Cost estimates cited in the document reflect 2008 dollars and are included for reference only. All costs are for equipment and materials, and do not include labor. Actual costs to construct the facilities may vary depending on market fluctuations, design specifications, engineering requirements and availability of materials.

CHAPTER 2 - Bikeway Classifications

2.1 Bikeway Classification Overview

Discussion

Caltrans has defined three types of bikeways in Chapter 1000 of the Highway Design Manual: Class I/Shared Use Path, Class II/Bike Lane, and Class III/Bike Route. Nevada does not have similar class designations, but uses the AASHTO terms, which include "shared use path", "bike lane" and "signed shared roadway". For consistency with other regional and prior plans, this document uses the generic terms "shared use path", "bike lane" and "bike route". Both AASHTO and Caltrans have similar design standards for these facilities. Facilities using federal or state funding will generally be required to meet the standards below. TRPA recommends that all facilities, regardless of funding source, meet the standards below.

Design Summary

Path Width:

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

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

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

Bike Lane Width with Adjacent On-Street Parking:

5' minimum recommended when parking stalls are marked

Bike Lane Width without Adjacent Parking:

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

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

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

Lane Width for Bicycle Route With Wide Outside Lane:

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

Design Example

Figure 2-1: Shared Use Path

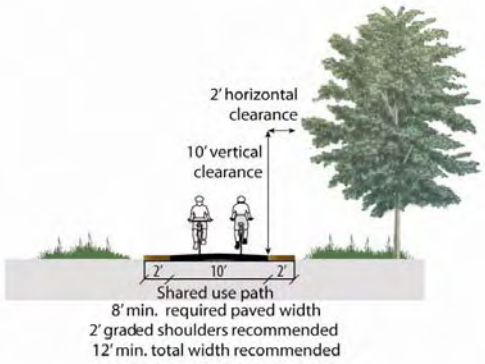
Figure 2-2: Bike Lane

Figure 2-3: Bike Route/Signed Shared Roadway

Recommended Design

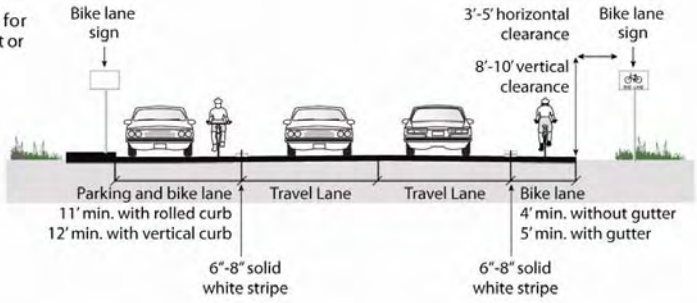
Shared Use Path
(Class I)

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



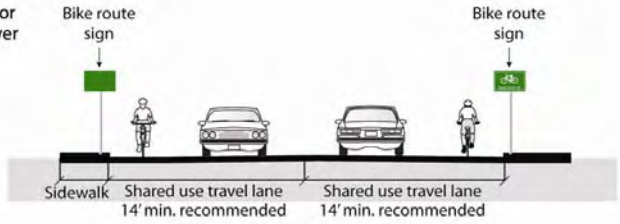
Bike Lane
(Class II)

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



Signed Shared Roadway
(Class III/Bike Route)

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



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

CHAPTER 3 - Shared Use Paths

3.1 Pathway Design

A shared use path allows for two-way, off-street bicycle use and also may be used by pedestrians, skaters, wheelchair users, joggers and other non-motorized users. Within the Lake Tahoe Basin, shared use paths are often found in urbanized areas and connecting urbanized areas to popular recreation sites or other population centers. Shared use paths can also include amenities such as lighting, signage, and fencing (where appropriate).

General Design Practices:

Shared use paths can provide a desirable facility for users of all skill levels preferring separation from traffic. Some of the elements that enhance off-street path design include:

- Frequent access points from the local road network;
- Placing directional signs to direct users to and from the path;
- Limiting the number of at-grade crossings with streets or driveways;
- Identifying and addressing potential security problems up front;
- Whenever possible, and especially where heavy use by bicycle users can be expected, separate pedestrian ways should be provided to reduce conflicts.

Both the California Highway Design Manual Chapter 1000 and the AASHTO Guide for the Development of Bicycle Facilities generally recommend against the development of shared use paths directly adjacent to roadways, although at Lake Tahoe, due to geographical constraints, this is often necessary. Also known as "sidepaths", these facilities create a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic. This can result in an unsafe situation where motorists entering or crossing the roadway at intersections and driveways do not notice bicyclists coming from their right, as they are not expecting traffic coming from that direction.

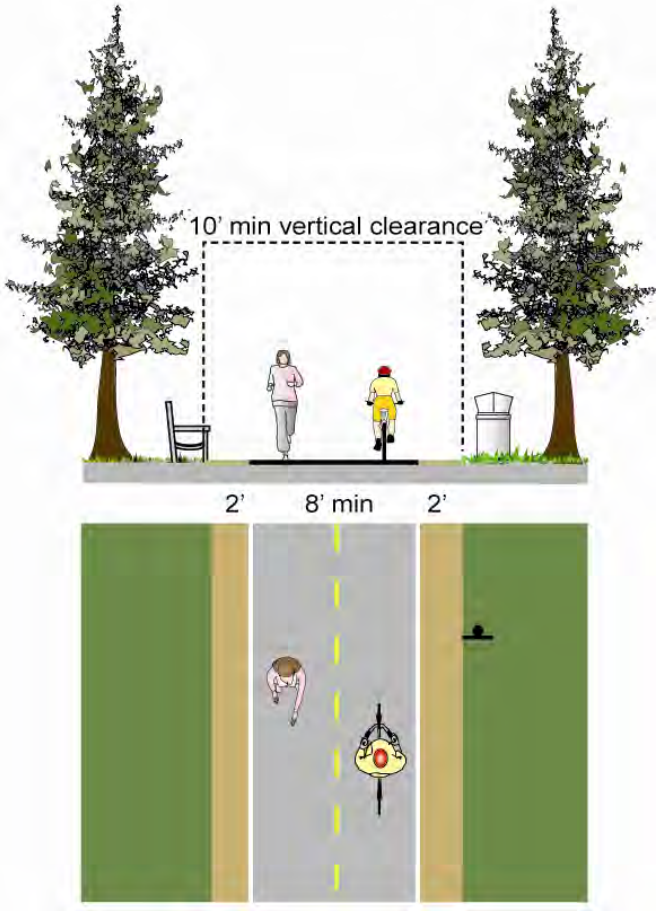
Shared use paths may be considered along roadways under the following conditions:

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

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

Bicycle paths must also include the proper "Best Management Practices" (BMPs) for treating runoff from the facility. These designs are not included here, but path designers can find more information on the TRPA's BMP website at: http://www.tahoebmp.org.

3.1.1 Pathway Design

Discussion	Recommended Design
Ten-foot wide paths are usually best for accommodating all uses, and better for long-term maintenance and emergency vehicle access. When motor vehicles are driven on shared use paths, their wheels often will be at or very near the edges of the path. Since this can cause edge damage that, in turn, will reduce the effective operating width of the path, adequate edge support should be provided. Edge support can be either in the form of stabilized shoulders, a concrete "ribbon curb" along one or more edges of the path, or constructing additional pavement width or thickness. Constructing a typical pavement width of 10 feet, where right-of-way and other conditions permit, lessens the edge raveling problem. TRPA supports 8-foot wide paths where there is moderate anticipated usage or where it can reduce SEZ impacts. Facilities using federal or state funding will generally be required to meet the AASHTO and/or Caltrans standards. TRPA recommends that all facilities, regardless of funding source, meet the standards in this section. **Surfacing and Path Construction** Thicker surfacing and a well-prepared sub-grade will reduce deformation over time and reduce long-term maintenance costs. At a minimum, off-street paths should be designed with sufficient surfacing structural depth for the sub-grade soil type to support maintenance and emergency vehicles. Asphalt and concrete are the most common surface treatment for multi-use paths, however the material composition and construction methods used can have a significant determination on the longevity of the pathway. Concrete is not as durable in cold climates and may not be suitable on a large scale for Lake Tahoe. Alternative surface materials such as decomposed granite may be appropriate in some circumstances. Each jurisdiction needs to consider durability and snow removal needs (grooming vs. clearing) when selecting an alternative surface material such as decomposed granite. Surface selection should take place during the design process. The following pathway construction design is recommended for improved durability and low maintenance at Lake Tahoe: • Asphalt Option: 4 inches of type B asphalt over a minimum of 9 inches of 1.5 inch minus crushed gravel base material. An asphalt path has the advantage of melting out more quickly after a snowfall under sunlight than a concrete path. If trees are adjacent to the path, a root barrier should be installed along the path to avoid root uplift.	

Discussion (continued)

Snow Removal/Grooming
Multi-use paths can serve non-motorized uses year-round. In the winter months these paths can be cleared of snow for pedestrian and bicycle use, or groomed to serve as cross-country ski routes. During these months it is important that snow removal and grooming equipment have ease of access to these paths. Any gates, bollards, or other access control measures that restrict access to the paths should be removable for winter maintenance equipment. Path access points and at-grade crossings should be kept clear of snow accumulations and burming from adjacent on-street snow removal operations. In times of heavy snow accumulations, snowblower vehicles should be employed to move the snow as far from the multi-use path as possible. Where large snowpack elevation differentials exist, effort should be made to provide a smooth transition.

Design Summary

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

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

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

Separation From Highway
When two-way shared use paths are located adjacent to a roadway, wide separation between a shared use path and the adjacent highway is desirable. Bike paths closer than 5 feet from the edge of the shoulder shall include a physical barrier to prevent bicyclists from encroaching onto the highway (Caltrans). Where used, the barrier should be a minimum of 42 inches high (AASHTO).

Snow Storage: If a facility is to be plowed or blown in the winter, shoulder width should be increased to provide adequate snow storage. In constrained locations, snow many need to be trucked out instead of stored on-site. As an alternative to snow clearance, a facility may be groomed to allow cross-country skiers and snowshoers to use it.

Design Example

Guidance

- Caltrans Highway Design Manual (Chapter 1000 Section 1003.1(1) and (2), and 1003.5)
- AASHTO Guide for the Development of Bicycle Facilities, Chapter 2
- California MUTCD Chapter 9B. Signs Guidelines for Accessible Public Rights-of-Way

Cost

- Shared Use Path: $350,000 - $2,000,000 per mile (Note 1: This assumes an asphalt or concrete path (not including boardwalks or bridges. Note 2: The concrete option is likely to cost 50 percent more than a standard asphalt pathway.)

3.1.2 Boardwalks

Discussion

Boardwalk construction may be used in sensitive areas such as stream environment zones and in areas of steep slopes. Boardwalk construction is typically much more expensive than standard paved paths. Cyclists may prefer paved paths over boardwalks because of the smoother surface and better traction typically associated with paved applications. Boardwalks should be considered in relation to environmental needs, budget, and potential use needs and management issues.

Design Summary

Design Criteria
Design criteria for boardwalks must meet AASHTO design recommendations for paved shared-use paths. Paths should also be designed to structurally support the weight of a small truck or a light-weight maintenance vehicle.

Width
Path width should be a minimum of 10 feet when no rail is used. A 12 foot width is preferred in areas with high anticipated use and whenever rails are used. AASHTO recommends carrying the clear area (or 2 foot space on either side of path) across the structure. This provides an appropriate horizontal shy distance from the railing and allows for maneuvering space to avoid conflicts with users stopped on the structure. A 10 foot width is recommended only for low-use areas.

Height from Ground
Path height should be set to allow for small animal movement under the structure, a minimum of 6” above grade.

Railings
Paths less than 30” above grade may not require a railing according to current building standards. Six inch curb rails may be used. Paths higher than 30” above grade require a 42” high rail. It should be noted that AASHTO recommends 42” high railings on any structured path.

Design Example

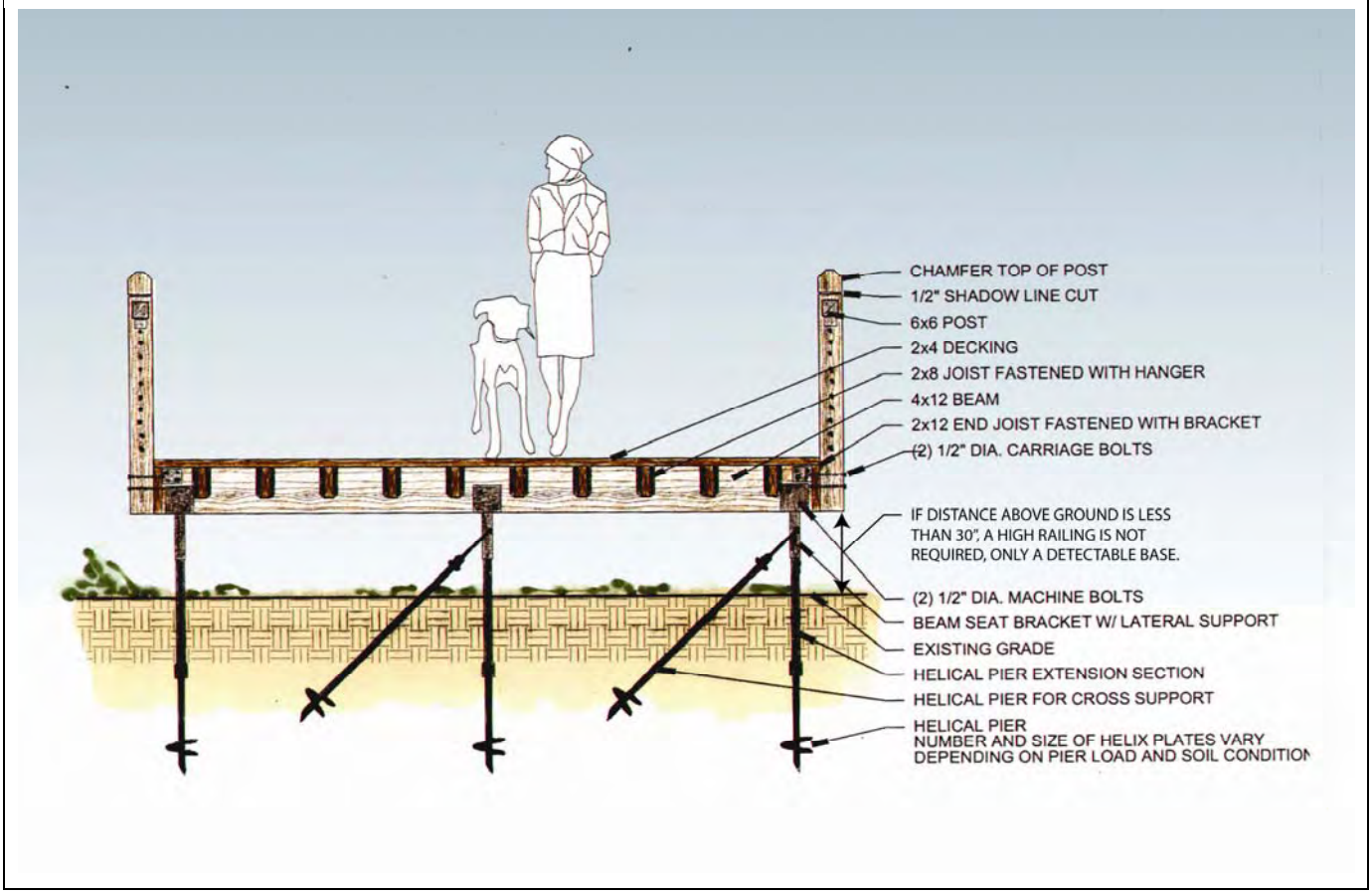
Guidance

- AASHTO Guide for the Development of Bicycle Facilities Chapter 2
- ADAAG Sections 4 and 15

Cost

Dependent on use of railings, materials, width, height, and anticipated loads. Can vary between $2.25 and $4 million per mile for a 10 foot wide path.

Recommended Design

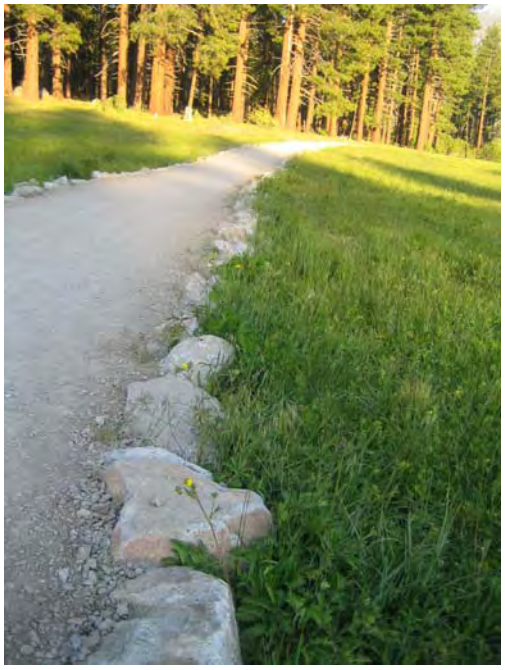


3.1.3 Causeways

Discussion

Causeways or “burm” type path construction may be used to minimize disturbance of water flow in stream environment zones. Paths are elevated above wet ground using a permeable fill material as a base. Path edges incorporate small boulders or a rock riprap to contain the permeable fill. Geotextile mats and other construction materials such as geocells can be incorporated to ensure a stable base on which asphalt or concrete paving may be applied. The path should be built up to an elevation no greater than 30 inches above natural grade.

Design Example



Design Summary

Design Criteria
Design criteria for causeways should meet AASHTO and Caltrans design recommendations for paved shared-use paths.

Base
Path construction and detailing depends on water table and surface flows through site. A stable base for paving must be established while allowing for water flow under path. Base materials should be designed so as not to be compromised by future water flows. Firm mineral soil, coarse-grained soils or granular material, or small, well-graded angular rocks are needed for fill.

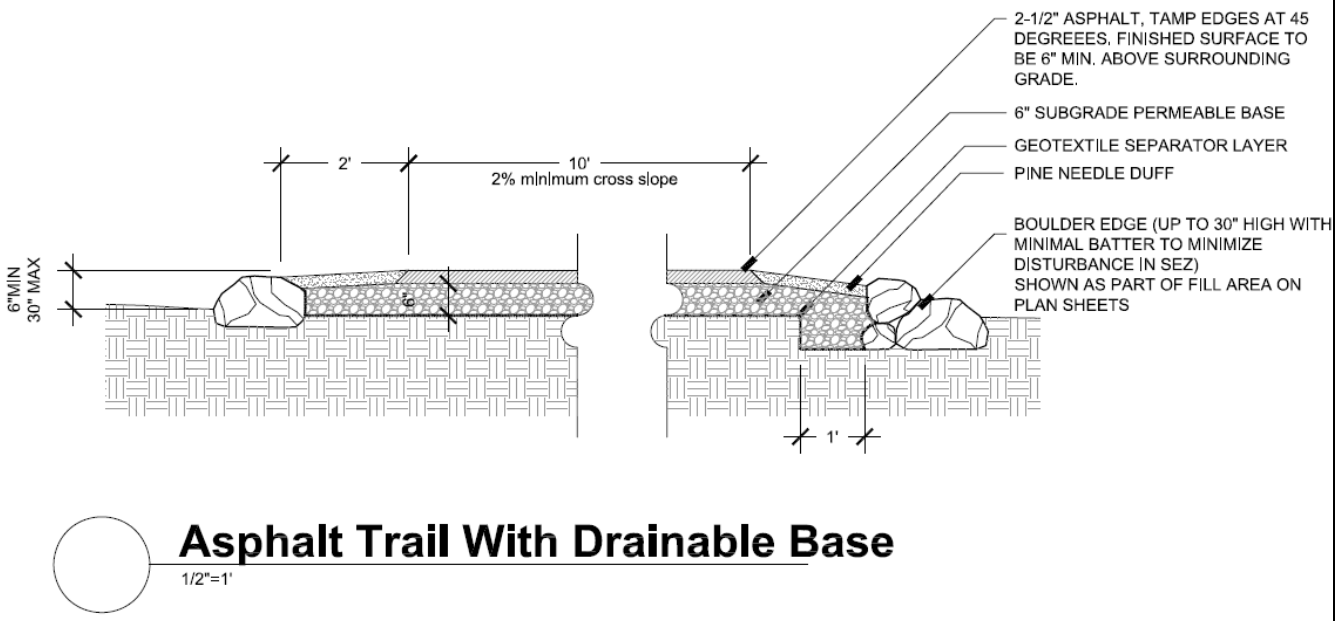
Guidance

- AASHTO Guide for the Development of Bicycle Facilities Chapter 2
- Trail Construction and Maintenance Notebook. 2007ed USFS
- Caltrans Highway Design Manual, Chapter 1000

Cost

Dependent on surface type. Native surface and decomposed granite surfaces are less expensive than paving. Paved applications would include the typical cost of a paved path plus the riprap edge support.

Recommended Design



3.1.4 Lighting

Discussion

Lighting improves the safety of the path user by increasing visibility during non-daylight hours. The fixtures should be installed near benches, drinking fountains, bicycle racks, trailheads, and roadway and path crossings. TRPA recommends lighting in urbanized areas only. Lighting must be downcast to minimize light pollution and must follow the recommendations in the applicable Community Plan or successor document to the Community Plan.

Design Summary

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

Guidance

- Lake Tahoe Community Plans Standards and Guidelines
- AASHTO Guide for the Development of Bicycle Facilities, Chapter 2

Design Example

3.1.5 Bollards

Discussion

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

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

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

The TRPA recommends flexible bollards or no bollards as opposed to solid posts.

Design Summary

- Where removable bollards are used, the top of the mount point should be flush with the path's surface so as not to create a hazard or potentially be damaged by snow removal devices when the bollard is not in place. At the time of this publication, flexible bollards that do not leave an anchored mounting device on the path or roadway surface when removed are not commercially available. Posts shall be permanently reflectorized for nighttime visibility and painted a bright color for improved daytime visibility.
- Striping an envelope around the post is recommended.
- When more than one post is used, an odd number of posts at 1.5m (5-foot) spacing is desirable. Wider spacing can allow entry by adult tricycles, wheelchair users and bicycles with trailers.

Guidance

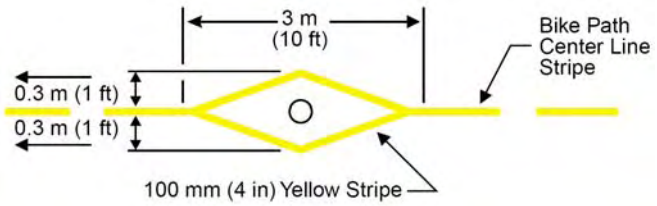
- CA MUTCD
- AASHTO Guide for the Development of Bicycle Facilities Chapter 2

Cost

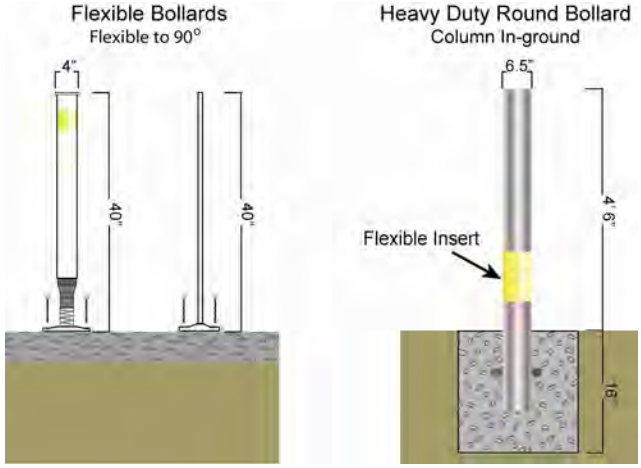
- Bollard, fixed: $220 - $800 each
- Bollard, removable: $680 - $940 each

Recommended Design

Barrier Post Striping



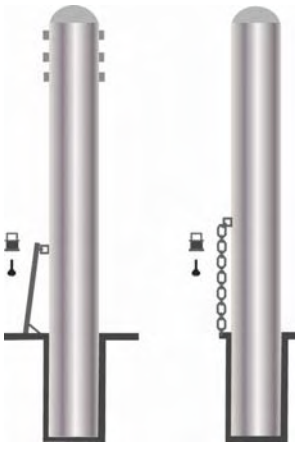
Flexible Bollards



Source: Lighthouse Bollards

Source: Andian Sales

Removable Bollards



Source: Reliance Foundry Co. Ltd

Design Example

Source: ferret.com.au

Flexible Bollard

Bollard Striping

3.1.6 Recommended Yield Policies

Discussion

Custom signage may be installed to guide path users on proper etiquette (see graphic), especially in areas where conflicts are likely to occur. Trail yield signage currently varies among Lake Tahoe communities. Because pedestrians typically travel at slower speeds than bicyclists, TRPA recommends that any signage direct pedestrians to walk on the right, however in situations of extreme overcrowding it may be appropriate to direct pedestrians to keep left. Signage similar to the examples to the right is recommended as ways to encourage path users to yield to each other and to keep the paths clear. TRPA recommends signage to inform users of proper trail etiquette in areas of high use or where conflicts have occurred.

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

Design Summary

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

Recommended Design

User Etiquette Signs along Multi-Use Paths

R9-7

Guidance

- MUTCD, Sections 9B.12 and 9C.03
- CA MUTCD
- AASHTO Guide for the Development of Bicycle Facilities, Chapter 2

Cost

- Signs, trail regulation: $150 each
- Signs, trail wayfinding / information: $500 - $2,000 each

3.1.7 Aggregate Surface Trails

Discussion

Aggregate surface trails are most applicable in non-urban environments and in multi-use areas where a variety of recreational use is anticipated. This includes hiking, biking, mountain biking, and equestrian use. Aggregate surface trails composed of crushed rock using pine tar or other trail stabilization techniques can fit in well with a natural setting and can cost less to construct than an asphalt trail.

Sustainable design must consider these forces – compaction, displacement, and erosion – that are caused by water and trail use. Compaction will deepen the heavily traveled portion of the trail. Displacement deepens the tread and raises the untraveled edges. Erosion follows and further deepens the tread. Understanding the site soils, topography, water movement, and anticipated use patterns should be considered during the trail design.

This type of trail may be considered for both permanent and temporary use. As a temporary facility, future phasing would then include returning to the site and paving the surface. This allows for major grading and stabilization to be completed during the first phase and paving completed during the second phase.

Design Example

Design Summary

Width
Trail widths vary depending upon anticipated type and volume of use.

Guidance

- Trail Management Handbook FSH2309.18
- Trail Planning, Design, and Development Guidelines. Minnesota Department of Natural Resources
- Trail Construction and Maintenance Notebook. 2007ed USFS

Cost

$75,000 - $150,000 per mile

3.1.8 Summary of Coverage Requirements

Discussion

Local jurisdictions have asked that all guidance related to coverage be summarized in the Lake Tahoe Bicycle and Pedestrian Plan. Coverage is regulated in Chapter 20 of the TRPA Code of Ordinances.

Summary

In the Lake Tahoe region, due to the need to maintain the natural filtration function of soils to reduce runoff into the Lake, there are limits on the amounts of new pavement, or "coverage" that may be constructed. Where the coverage limitation on a parcel or project area is exceeded, new coverage must be transferred in, and mitigated by removing other coverage within the same watershed, or by purchasing banked coverage. Depending on the land capability of the project area, new coverage must be mitigated by removing other coverage at a ratio of 1:1 or 1.5:1.

Since sidewalks, bicycle paths and bicycle lanes are public service facilities; there is generally no limit on the amount of coverage that may be transferred in, however coverage that exceeds the coverage limit of a parcel must still be mitigated.

In certain situations, private property owners will donate or sell easements for implementation of a bicycle path or sidewalk. In this case, any coverage used to construct the path within the easement does not count towards the property owner's total allowable coverage, since the easement area is effectively part of a "project area" that is separate from the parcel. However the property owner will experience a slight reduction in gross allowable coverage based on the fact that his parcel size has effectively been reduced.

Guidance

- TRPA Code of Ordinances, Chapter 20, Land Coverage Standards.

Detailed Guidance

TRPA Code of Ordinances, Section 20.3.A. Base Land Coverage Requirements

This section describes the amount of allowable coverage for different land capability districts. Lower land capability districts, such as wetlands or steep slopes, are allowed only 1% of their area to be covered by impermeable surfaces. The highest land capability districts, where water filtration is the best, may have up to 30% of their area covered by impermeable surfaces.

TRPA Code of Ordinances, Section 20.3.B. Transferred Land Coverage Requirements

Subsection (4), Linear Public Service Facilities, establishes that this use is eligible for transferring coverage. Bicycle paths, sidewalks, and bicycle lanes are linear public service facilities.

TRPA Code of Ordinances, Section 20.3.D(1). Determination of the Project Area

Subsection (iv) describes how the project area may be determined for projects not consisting of a single parcel, which generally applies to bicycle paths.

TRPA Code of Ordinances, Section 20.4. Prohibition of Additional Land Coverage in Land Capability Districts 1a, 1c, 2 and 3 and 1b (Stream Environment Zones)

Subsections 20.4.A(3) and 20.4.B(3) describe the conditions under which additional land coverage may be transferred into the most sensitive land capability districts for linear public service facility projects.

TRPA Code of Ordinances, Section 20.4.A(2)(e)

This subsection describes the mitigation requirements for any additional coverage in land capability districts 1a, 1c, 2, 3, and 1b.

3.2 Pathway Crossings

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

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

Treatments

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

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

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

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

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

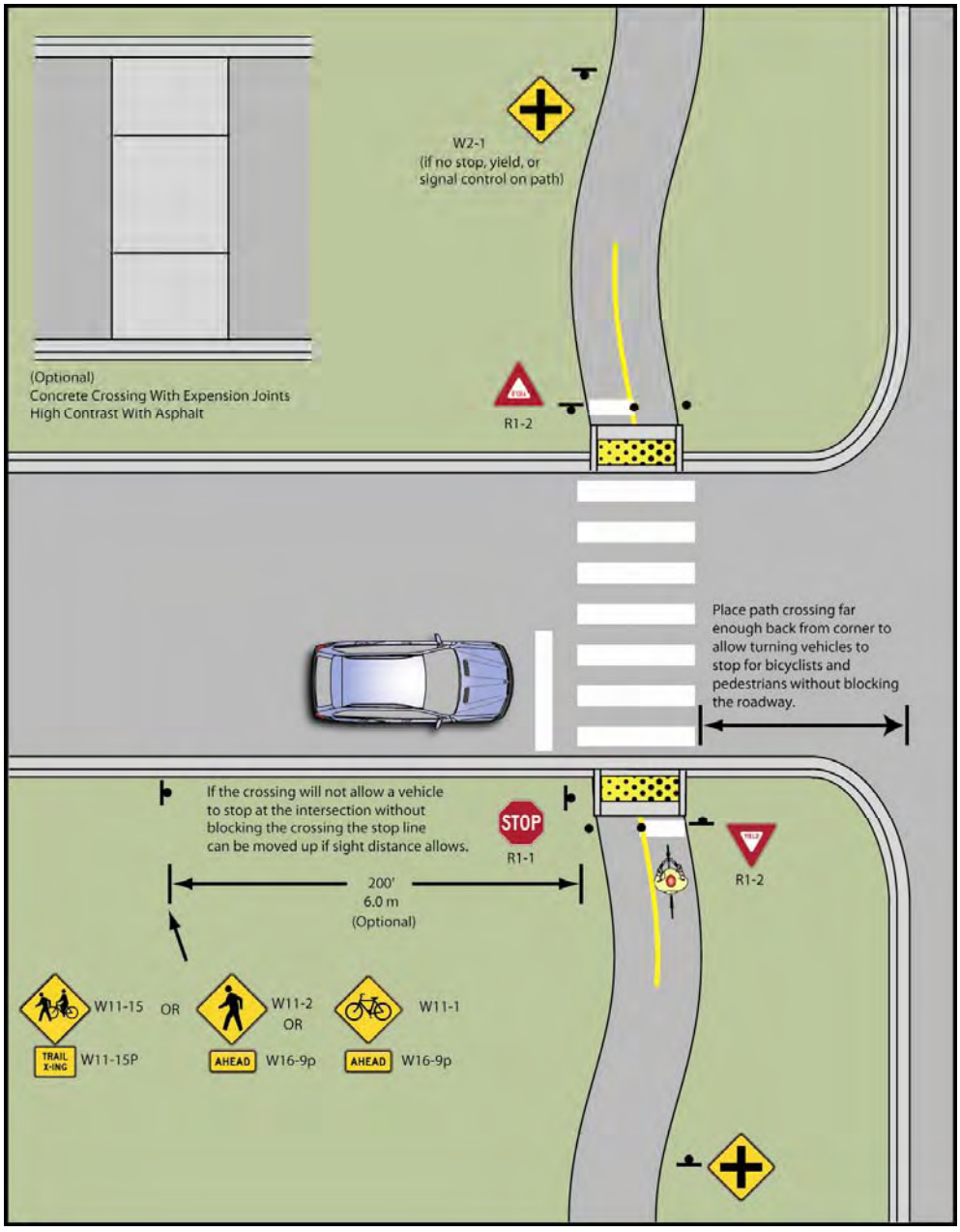
Given the use characteristics specific to the Tahoe area, it is likely that pathway users would either use the nearest at-grade controlled intersection crossing, a midblock crossing with traffic controls, or use an unprotected midblock crossing. This section addresses treatments at each of these three crossing types.

3.2.1 Path Crossing at Intersection

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

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

Recommended Design



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

Note: Clear sight lines should take precedence in determining path proximity to adjacent roadway.

Design Example

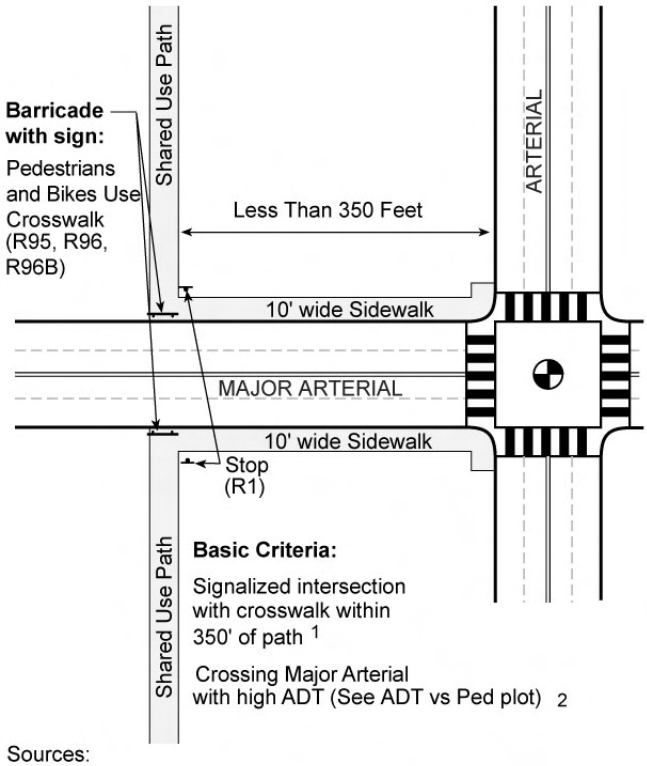
Guidance

- Caltrans Highway Design Manual (Chapter 1000 Section 1003.1(4))
- CA MUTCD, Part 9
- AASHTO Guide for the Development of Bicycle Facilities and "A Policy on the Geometric Design of Highways and Streets"
- FHWA-RD-87-038 Investigation of Exposure-Based Pedestrian Accident Areas: Crosswalks, Sidewalks, Local Streets, and Major Arterials.

Cost

- Crosswalk[2], Transverse (parallel) Lines: $320 - $550 each
- Crosswalk, Thermoplastic: $6 per square foot
- Stop bar: $210 each
- Stop Limit Bars / Yield Teeth: $210 - $530 each
- Stop Pavement Markings: $420 each
- Curb Ramps, Retrofit (diagonal, per corner): $800 – 5,340 each
- Curb Ramps, Retrofit (perpendicular, per corner): $5,340 - $10,000 each
- Signs, High-Visibility: $430 each
- Bollard, fixed: $220 - $800 each
- Bollard, removable: $680 - $940 each

Recommended Design (Continued)



Sources:
1. California MUTCD, 2006
2. Investigation of Exposure Based Accident Areas: Crosswalks, Local Street, and Arterials, Knoblauch, 1987

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

[2] Crosswalk types are discussed in Section 7.1.

3.2.2 Uncontrolled Mid-Block Crossing

Discussion

The National MUTCD requires yield lines and "Yield Here to Pedestrians" signs at all uncontrolled crossings of a multi-lane roadway. Yield lines are not required by the CA MUTCD. The National MUTCD includes a path crossing sign, shown to the right on the next page (W11-15 and W11-15P), which may be used where both bicyclists and pedestrians might be crossing the roadway, such as at an intersection with a shared-use path.

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

Design Summary

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

Yield Lines

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

Warning Signs

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

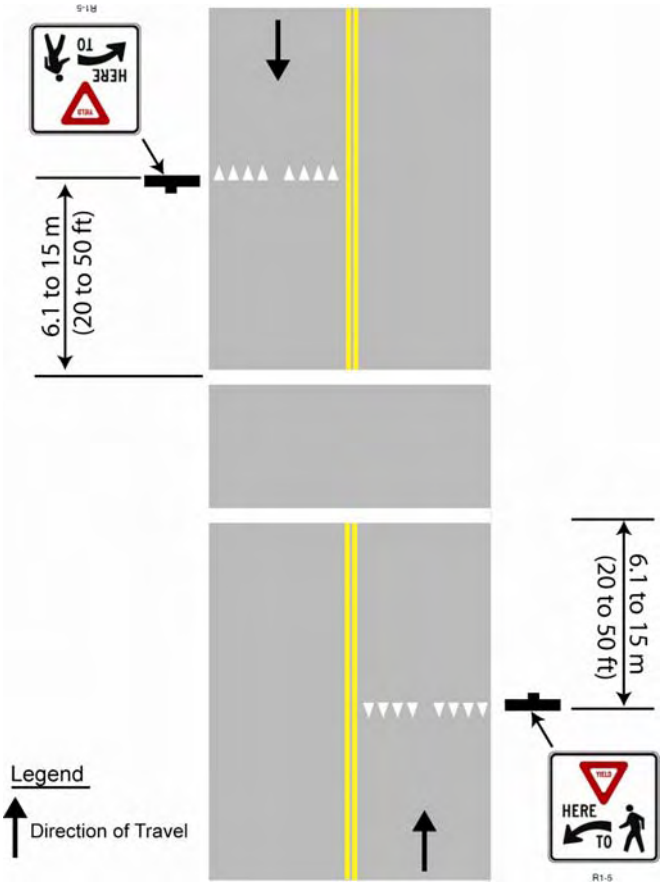
Pavement Markings
A ladder crosswalk should be used. Warning markings on the path and roadway should be installed.

Other Treatments

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

Beacons
See **Section 3.2.4** of this document

Recommended Design



Source: California MUTCD, Figure 3B-15

Note that TRPA recommends ladder-style crosswalks.

R1-5 R1-5a

Design Example	Recommended Design (continued)
	 **National MUTCD**
Guidance	**Cost**
• Caltrans Highway Design Manual (Chapter 1000) • CA MUTCD Parts 2 and 9 • MUTCD Chapter 2 and 9 • AASHTO Guide for the Development of Bicycle Facilities	• (See additional costing details in Section 3.2.1)

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

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

For each trail-roadway crossing, an engineering study is needed to determine the proper location. For each engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc. may be needed at other sites.

**Where the speed limit exceeds 40 mi/h (64.4 km/h), marked crosswalks alone should not be used at unsignalized locations.

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

1= Type 1 Crossings. Ladder-style crosswalks with appropriate signage should be used.

1/1+ = With the higher volumes and speeds, enhanced treatments should be used, including marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

1+/3 = Carefully analyze signal warrants using a combination of Warrant 2 or 5 (depending on school presence) and EAU factoring. Make sure to project usage based on future potential demand. Consider Pelican, Puffin, or Hawk signals in lieu of full signals. For those intersections not meeting warrants or where engineering judgment or cost recommends against signalization, implement Type 1 enhanced crosswalk markings with marked ladder style crosswalks, median refuge, flashing beacons, and/or in-pavement flashers. Ensure there are sufficient gaps through signal timing, as well as sight distance.

3.2.3 Stop versus Yield Markings at Crossings

Discussion

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

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

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

Design Summary

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

Recommended Design

Design Example

Guidance

- CA MUTCD Parts 2, 3 and 9
- Caltrans Highway Design Manual (Chapter 1000)
- AASHTO Guide for the Development of Bicycle Facilities

Cost

- Stop limit bars/yield teeth: $200-$530 per set
- Stop pavement markings: $420 each
- Pavement Markings (Thermoplastic): $3.39 per square foot
- Signs, Path Crossing: $780 each
- Signs, Path Stop/Path Yield: $520 each
- Signs, Path Regulation: $150 each

3.2.4 Crossing Beacons

Discussion

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

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

- Intersection control beacon - a beacon used only at an intersection to control two or more directions of travel
- Warning beacons - a beacon used only to supplement an appropriate warning or regulatory sign or marker
- Stop beacons - a beacon used to supplement a STOP sign, a DO NOT ENTER sign, or a WRONG WAY sign

Experimental Treatments

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

- The Rectangular-Shaped Rapid Flash LED Beacons, which have been shown to have an 80 to 90 percent compliance rate in the field; and
- The Pedestrian Hybrid Beacon, or High-Intensity Actuated Crosswalk (HAWK), has been incorporated into the National MUTCD, but is still experimental in California. The HAWK has a driver yielding rate of 97 percent and reduces pedestrian-motor vehicle crashes by 58 percent.

TRPA recommends pedestrian-actuated signals such as the HAWK where other methods are infeasible or ineffective.

Any application of experimental treatments within Nevada should follow the Federal Highway Administration (FHWA) approval process (see MUTCD Section 1A.10). The application of experimental treatments within California should follow the California Traffic Control Devices Committee's (CTCDC) approval process (http://www.dot.ca.gov/hq/traffops/signtech/newtech/). Jurisdictions within California can apply to the CTCDC for permission to use experimental treatments. Note that the CTCDC has not approved the HAWK treatment to date. (See CTCDC's October 11, 2007 agenda and meeting minutes available on the Committee's website.)

Recommended Design

HAWK Crossing

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

Design Summary

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

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

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

Guidance

- MUTCD, Sections 4F and 4L
- CA MUTCD Sections 4K and 4C
- ITE – Alternative Treatments for At-Grade Pedestrian Crossings

Cost

- Signs, Overhead Beacon: $15,000-$55,120 each
- Detection, Automated Beacon: $800 each
- Crossing, Hawk: $50,000 each
- Actuated Pedestrian Crossing: $40,000 each

3.2.5 Signalized Mid-Block Crossing

Discussion

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

Pedestrian volumes can also be used for warrants.

Experimental Treatment

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

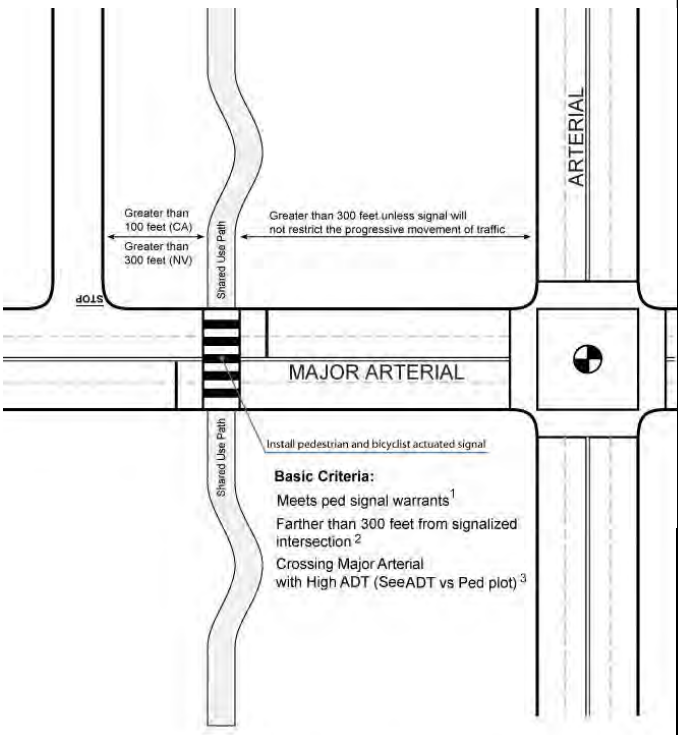
Design Summary

Warrants
Section 4C.05 in the MUTCD and CAMUTCD describes pedestrian volume minimum requirements (referred to as warrants) for a mid-block pedestrian-actuated signal. Note that California and Nevada have different warrants.

Signage
See **Section 5.1.5** (Bicycle Signals) and **Section 7.1.5** (Signalized Pedestrian Crossing).

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

Recommended Design



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

Design Example

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

Guidance

- MUTCD, Sections 4C.05 and 4D
- CA MUTCD, Chapters 3 and 9 and Section 4C.05 and 4D
- AASHTO Guide for the Development of Bicycle Facilities, Chapter 2

Cost

- Crossing, Toucan: $90,000 each

3.2.6 Path Crossings at Roundabouts

Discussion

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

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

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

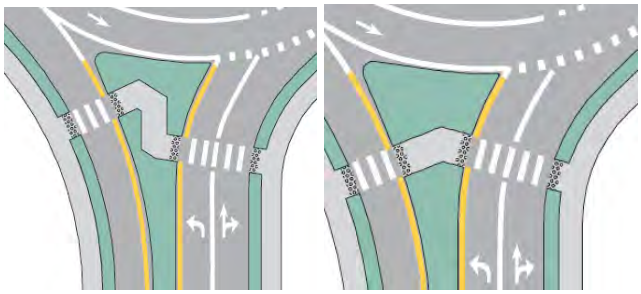
Design Summary

- Path users should be directed around the roundabout to cross at the crosswalks on the circulating legs.
- Bicycle ramps may be provided between the approach and exit legs and the path to allow bicyclists on the street to use the path and pedestrian crossings to navigate through the roundabout.
- Crosswalks shall be marked at roundabouts, including rural locations, on all legs where pedestrians will be crossing. (CA)
- The preferred type of crosswalk markings at roundabouts on the State Highway system is the "ladder" type. (CA)
- Ramps should be provided on each end of the crosswalk to connect the crosswalk to other crosswalks around the roundabout and to the sidewalk network.

Recommended Design

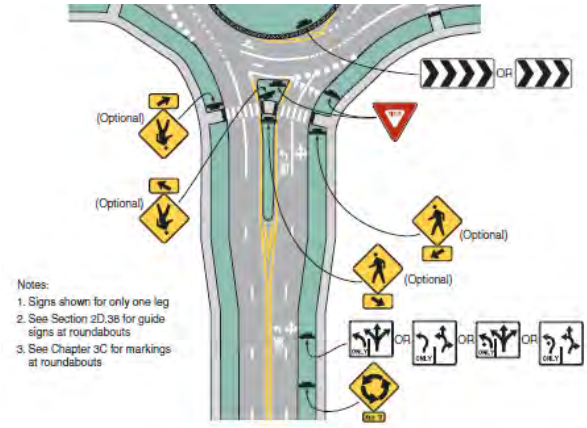
Example of Markings for Approach and Circulatory Roadways at a Roundabout

Source: MUTCD 2010 Figure 3C-1



Two Options for Crossing Splitter Islands

Adapted from: MUTCD 2010 Figure 3C-5



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

Adapted from: MUTCD 2010 Figure 2B-23

Guidance

- Caltrans Design Information Bulletin 80-01
- CA MUTCD and MUTCD
- FHWA Roundabouts: An Informational Guide (2006) and forthcoming 2010 edition.

Cost

Not available.

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

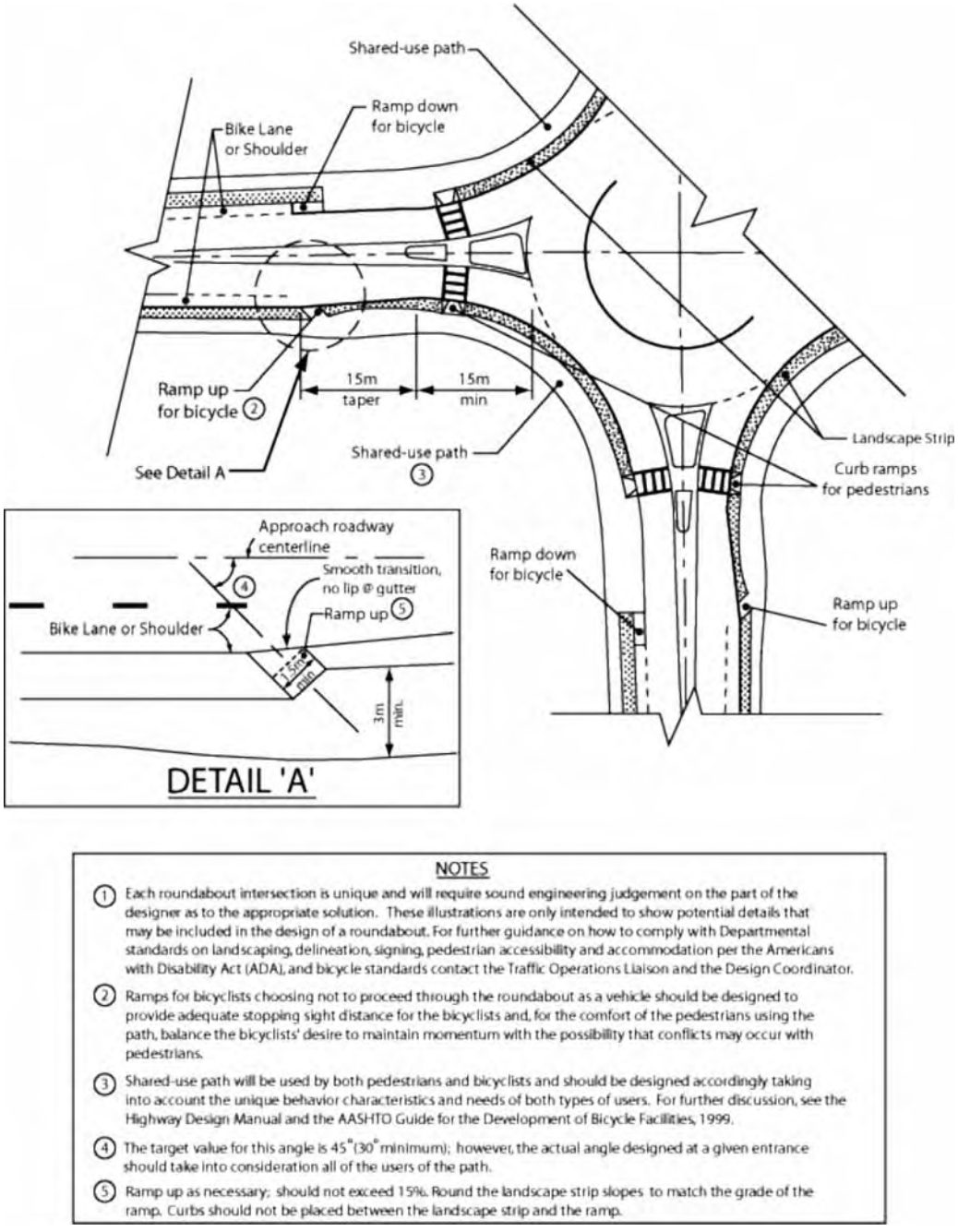
Recommended Design (Continued)

Cost

Not available.

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

Recommended Design (Continued)



NOTES

① Each roundabout intersection is unique and will require sound engineering judgement on the part of the designer as to the appropriate solution. These illustrations are only intended to show potential details that may be included in the design of a roundabout. For further guidance on how to comply with Departmental standards on landscaping, delineation, signing, pedestrian accessibility and accommodation per the Americans with Disability Act (ADA), and bicycle standards contact the Traffic Operations Liaison and the Design Coordinator.

② Ramps for bicyclists choosing not to proceed through the roundabout as a vehicle should be designed to provide adequate stopping sight distance for the bicyclists and, for the comfort of the pedestrians using the path, balance the bicyclists' desire to maintain momentum with the possibility that conflicts may occur with pedestrians.

③ Shared-use path will be used by both pedestrians and bicyclists and should be designed accordingly taking into account the unique behavior characteristics and needs of both types of users. For further discussion, see the Highway Design Manual and the AASHTO Guide for the Development of Bicycle Facilities, 1999.

④ The target value for this angle is 45°(30° minimum); however, the actual angle designed at a given entrance should take into consideration all of the users of the path.

⑤ Ramp up as necessary; should not exceed 15%. Round the landscape strip slopes to match the grade of the ramp. Curbs should not be placed between the landscape strip and the ramp.

Bicycle Access Ramp to Shared Use Path

Source: Caltrans Design Information Bulletin 80-01 Figure 4

CHAPTER 4 - On-Street Bicycle Facility Design

4.1 Bike Lanes

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

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

General Design Guidance:

Width:

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

Striping:

Line separating vehicle lane from bike lane (typically left sideline):		6 inches
Line separating bike lane from parking lane (if applicable):		4 inches

Dashed white stripe when:

• Vehicle merging area		Varies
• Delineate conflict area in intersections	(optional)	Length of conflict area

Signing:

Use R3-17 (NV) or R-81 (CA) Bike Lane Sign at:

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

R3-17

R-81 Sign (CA)

Pavement Markings:

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

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


Recommended Bike Lane Stencil

4.1.1 Bike Lane with No On-Street Parking

Discussion

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

Design Summary

Bike Lane Width:

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

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

Recommended Width:

6' where right-of-way allows

Design Example

Recommended Design

Guidance

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

Cost

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

4.1.2 Bike Lane With On-Street Parallel Parking

Discussion

Bicycle lanes adjacent to on-street parallel parking are not common in Lake Tahoe, but could be considered in the near future in several locations on the North Shore. Bike lanes adjacent to parallel parking should be designed to be wide enough to allow bicyclists to ride outside of the "door zone"--five feet minimum.

Design Summary

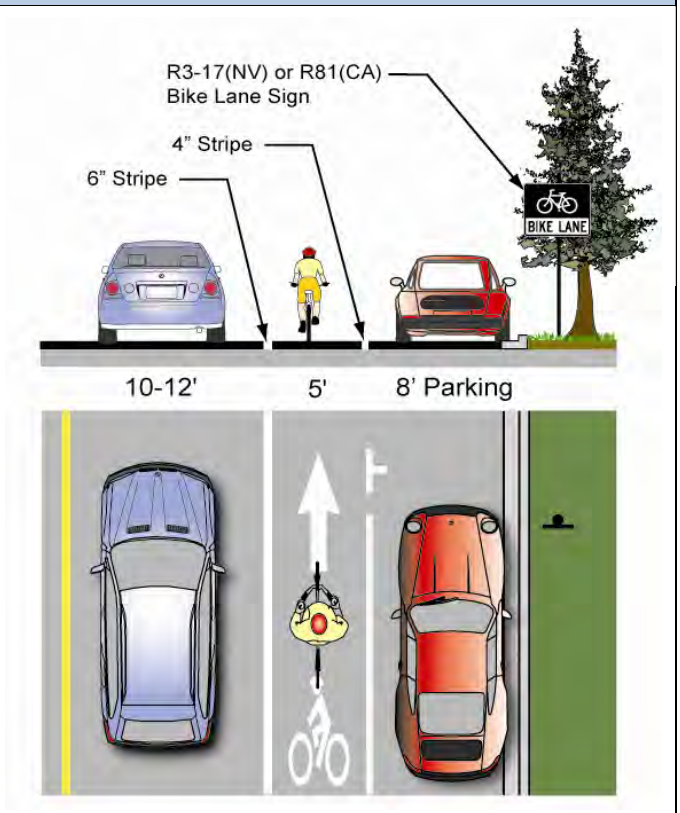
Bike Lane Width:

5 feet minimum recommended when parking stalls are marked

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

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

Recommended Design



Guidance

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

Cost

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

4.2 Bike Routes/Signed Shared Roadways

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

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

General Design Guidance:

Signing:

Use D11-1 Bicycle Route Sign at:

- Beginning or end of Bicycle Route (with applicable M4 series sign below)
- Entrance to shared use path - optional
- At major changes in direction or at intersections with other bicycle routes (with applicable M7 series sign below)
- At intervals along bicycle routes not to exceed ½ mile

D11-1 Sign

Pavement Markings:

Shared Lane Markings may be applied to Bicycle Routes per **Section 4.2.3**.

4.2.1 Bike Route on Low Volume Street

Discussion

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

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

Design Summary

Sign Placement:

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

Design Example

Guidance

- National MUTCD
- Caltrans Highway Design Manual (Chapter 1000)
- CA MUTCD
- AASHTO Guide for the Development of Bicycle Facilities

Cost

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

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

Recommended Design

4.2.2 Shoulder Bike Route

Discussion

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

Design Summary

Shoulder Width:

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

Sign Placement:

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

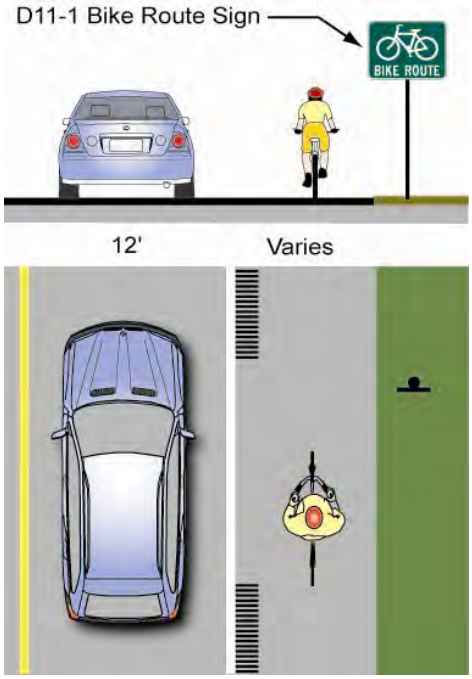
Guidance

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

Cost

- Bike Route with Shoulder Stripe: $20,000-60,000 per mile (assumes no major renovation is required)
- Rumble Strip: $0.10 to $0.50 per linear foot

Recommended Design



Bike Route with Wide Shoulder and Bicycle Friendly Rumble Strip

Bike Route with Shoulder Stripe

4.2.3 Shared Lane Markings (SLM)

Discussion

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

The National and California MUTCD include guidance for placement of the SLM. The City of South Lake Tahoe has installed the SLM on most of its Bike Routes.

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

Design Summary

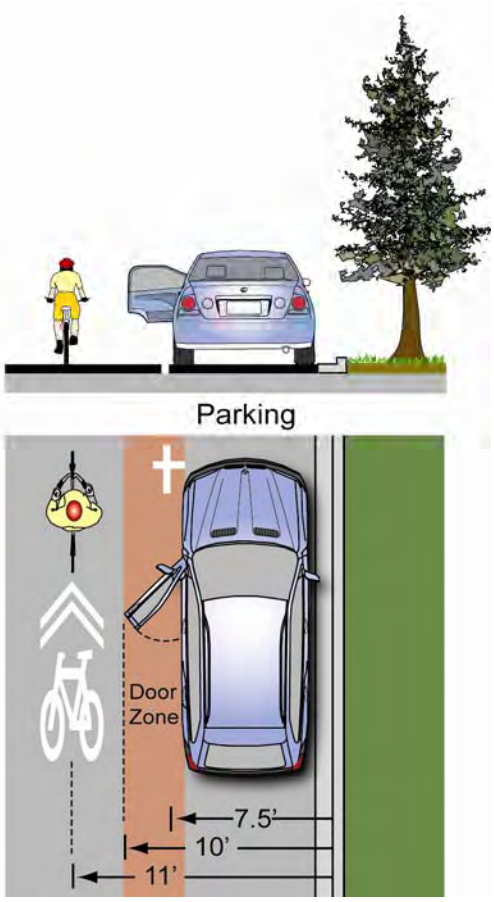
Door Zone Width:

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

Recommended SLM placement:

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

Recommended Design



Design Example

Local Example, not incorporating width recommendations

Guidance

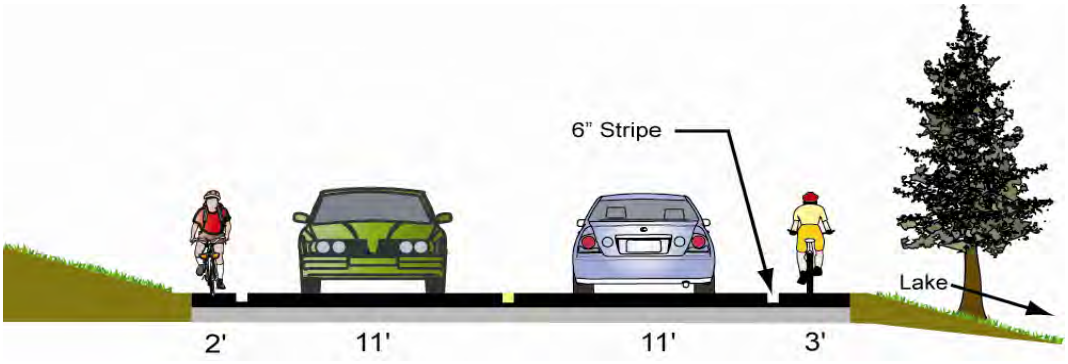
- MUTCD, Section 9C.07
- CA MUTCD
- , Section 9C.103

Cost

- Stencils only: $250 each

4.2.4 Lake Tahoe Scenic Bike Loop

Recommended Design



Design Summary	Discussion

The Lake Tahoe Scenic Bike Loop is envisioned to be a bi-directional, AASHTO standard bicycle lane on the highways encircling Lake Tahoe. For highway segments where bicycle lanes on both sides of the roadway are not planned for the near future, and in locations where the full AASHTO width (four feet) is extremely difficult to attain, the loop should provide 3-5 feet of striped shoulder on the lake side where possible, without compromising safety for riders using the mountain side. Due to the wide variety of conditions found on the highways encircling the Lake, there are several guidelines that NDOT, Caltrans, TRPA, and local jurisdictions should work together to follow during routine maintenance of roadways and other, more intensive roadway improvement projects. When following all of the guidelines below, designers must take into consideration that shoulder width may not always be moved from one side to the other based on sight distance, required turning radii, or other design and safety requirements.

- In locations where shoulder width can be moved, preference should be given to moving shoulder width to the lake side, while not compromising the safety of users travelling on the mountain side. For example, if only two feet of shoulder width is available, it should be split evenly between the two sides. If three feet are available, two feet should go to the lake side and 1 foot to the mountain side. If five feet are available, a minimum of three feet should go to the lake side.
- On long, steep downgrades, where bicycle speeds greater than 30 mph are expected, bicycle lanes or a wide shoulder are not always advised. In these locations, unless a swept shoulder width of greater than four feet can be provided on both sides, it is more important to provide shoulder width on the climbing side of the highway. In addition, regardless of whether bicycle lanes are present, “Bikes can use full lane” signage is recommended on the downhill side.
- Where shoulder widening is not possible or is minimal, use “sharrow” stencil.
- Where possible, travel lanes should be narrowed to provide additional width for bicycles.

Other treatments recommended in these design guidelines, such as “bicycles may use full lane” signage, or changeable traffic devices that indicate a cyclist is present, should be considered along very constrained roadway sections.

On steep downgrades, bicycle speeds will increase, and the width of a bicycle lane does not provide enough sight distance and maneuverability, particularly where there may be debris in the road.

Detailed descriptions of roadway conditions and the possibilities for widening between Cascade and Rubicon Bay on State Route 89 (south west shore of Lake Tahoe) are provided in the Caltrans report “SR-89 Cascade to Rubicon Bay Bikeway Study”.

4.2.5 Additional Bike Route Signage

Discussion

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

In urban areas, many cities around the country have been experimenting with a new type of signage that encourages bicyclists to take the lane when the lane is too narrow. This type of sign is becoming known as BAUFL (Bikes Allowed Use of Full Lane). This can be quantified to lanes being less than 14 feet wide with no parking and less than 22 feet wide with adjacent parallel parking. The 2009 update to the MUTCD recognizes the need for such signage and has designated the white and black sign at right (R4-11). The 2009 MUTCD states that Shared Lane Markings (which serve a similar function as Bikes May Use Full Lane signage) should not be placed on roadways that have a speed limit above 35 mph. Dedicated bicycle facilities are recommended for roadways with speed limits above 35 mph where the need for bicycle access exists.

Utah has a sign that illustrates the proper 3 feet minimum buffer between bicyclists and cars. This and similar signs would require experimental status in the Lake Tahoe region.

Design Summary

Placement:

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

Guidance

- MUTCD, Sections 9B.06, 9C.07
- CA MUTCD

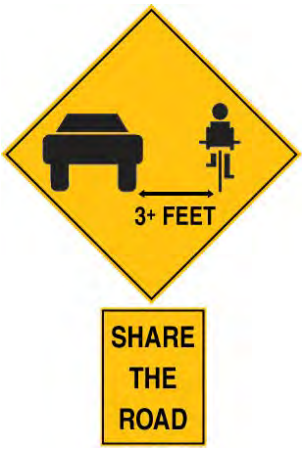
Cost

- Sign, regulation: $150 each

Recommended Design

R4-11

Share The Road Signs (National MUTCD)



Utah Share The Road Sign (Missouri Bicycle Federation)

4.2.6 Manholes & Drainage Grates

Discussion

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

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

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

The drop in-inlet shown to the right avoids all issues with grates in the bicyclists' line of travel. However, these drainage inlets are less efficient than grate inlets, and therefore require installing more closely spaced inlets, much longer inlets and perhaps supplemental means of capturing runoff. For this reason TRPA does not recommend replacing existing grate inlets with drop-in inlets, and suggests agencies weigh the additional costs of drop-in inlets in new construction with the possible benefits.

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

Design Summary

Placement:

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

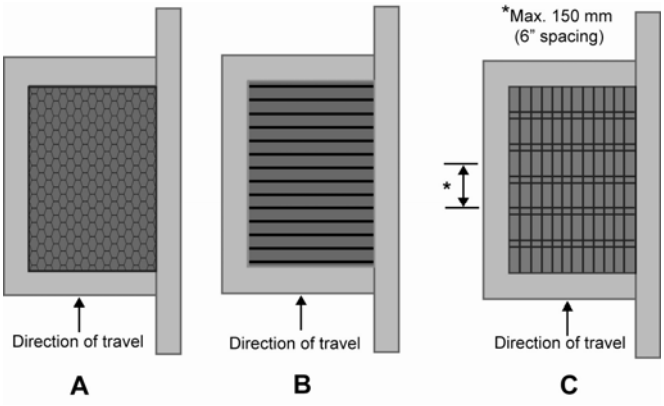
Guidance

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

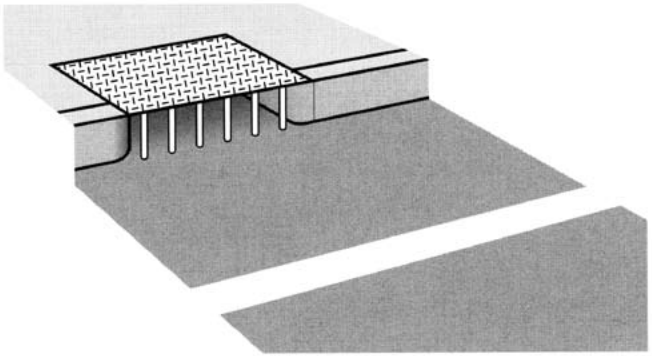
Cost

- Striping: $2 per linear foot
- Drainage grate: $500

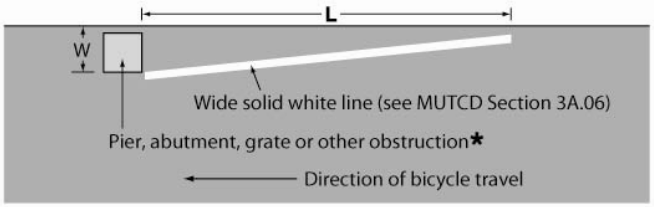
Recommended Design



Bicycle Compatible Drainage Grates



Drop-in inlet flush with in the curb face (Oregon DOT)
(Not approved for use on California Highways)



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

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

Figure 9C-8B (National MUTCD)

4.2.7 Bicycle Access during Construction Activities

Discussion

When construction impedes a bicycle facility, the provision for bicycle access should be developed during the construction project planning. Long detour routing should be avoided because of lack of compliance. Where there is no detour, provide for passage of bicyclists through or adjacent to the construction area, with signage or other indication of where cyclists should go.

Advance warning of the detour should be placed at appropriate locations and clear wayfinding should be implemented to enable bicyclists to continue safe operation along travel corridor. Traffic control signs should not be placed within bike lanes or road shoulders.

Design Summary

Construction Detour Signs

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

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

Recommended Design

M4-9a M4-9c

National MUTCD

Design Example

Guidance

- MUTCD (Section 6F.53)
- CA MUTCD
- California Highway Design Manual

Cost

- Sign, regulation: $150 each

CHAPTER 5 -Bicycle Intersection Design

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