CITY OF BERKELEY BICYCLE DLAN

Approved May 2, 2017 by Berkeley City Council



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CITY OF BERKELEY BICYCLE DLAN

Executive Summary

Berkeley is a bicycle city.

According to the US Census 2014 American Community Survey, Berkeley has the fourth highest bicycle commute mode share (8.5 percent) of any city in the United States. In practical terms, this means that nearly one out of every 10 Berkeley residents rides a bicycle to work as their primary transportation mode.

As nearly any Berkeleyan can tell you, getting to work is not the only reason people ride bicycles in this city. In Berkeley, people ride bikes for a myriad of purposes – to shop at the store or the farmer's market, to drop off or pick up their kids from school or day care, to visit the UC Berkeley campus, to go to concerts, restaurants, and social events, and for exercise. Cycling in Berkeley is not only an efficient, environmentally-friendly utilitarian mode of transport, but it is also a source of health and enjoyment. A central focus of this updated Bicycle Plan is how to improve the comfort, enjoyment, convenience, and fun of cycling as a viable strategy for achieving many of the City's health and wellness goals.

For nearly five decades, Berkeley has been a leader in the effort to promote the use of the bicycle for pleasant transportation and recreation. The first Berkeley Bicycle Plan—created in 1971—laid out a citywide network of bikeways which are still in use today.

The purpose of this updated Bicycle Plan is to make Berkeley a model bicycle-friendly city where bicycling is a safe, comfortable, and convenient form of transportation and recreation for people of all ages and abilities. Because this plan is being produced by the Public Works Department, the focus is on physical infrastructure changes that support cycling as a way to achieve the City's safety, health, and environmental goals.

VISION AND GOALS

Berkeley will be a model bicycle-friendly city where bicycling is a safe, comfortable, and convenient form of transportation and recreation for people of all ages and abilities.

GOALS

The Berkeley Bicycle Plan has three overarching goals which frame all of the policies, actions and recommendations in the plan:

GOAL 1: SAFETY FIRST

- Performance Measure: Zero bicycle-involved fatalities by 2025.
- Performance Measure: Zero bicycle-involved severe injuries by 2035.

GOAL 2: STRENGTH IN NUMBERS

• Performance Measure: Increase Berkeley's bicycle mode share by 50 percent by 2025, from approximately 10 percent to 15 percent. • Performance Measure: Increase Berkeley's bicycle mode share by 100 percent by 2035, from approximately 10 percent to 20 percent.

GOAL 3: ALL AGES AND ABILITIES

- Performance Measure: Complete the Tier 1 Bikeway Network, including high-priority Bicycle Boulevards, Milvia Street Bikeway, Complete Street Corridor Studies (including Downtown and UC Berkeley Campus perimeter streets and the Southside Pilot Project), and the Ohlone Greenway, by 2025.
- Performance Measure: Complete the Tier 2 and Tier 3 Bikeway Network, including remaining Bicycle Boulevards, Complete Street Corridor Studies, and other bikeways by 2035.



EXISTING BIKEWAYS

Class I bikeways are multi-use or shared-use paths. They provide completely separated, exclusive right-of-way for bicycling, walking, and other nonmotorized uses.

Class II bicycle lanes are striped, preferential lanes on roadways for one-way bicycle travel. Some Class II bicycle lanes include striped buffers that add a few feet of separation between the bicycle lane and traffic lane or parking aisle.

Class III bicycle routes are signed bicycle routes where people riding bicycles share a travel lane with people driving motor vehicles. May include shared lane markings (sharrows) or other pavement stenciling. Because they are mixedflow facilities, Class III bicycle routes are only appropriate for low-volume streets with slow travel speeds.

A **Class IV bikeway**, also known as a cycle track or separated/protected bikeway, is an on-street bicycle lane that is physically separated from motor vehicle traffic by a vertical element or barrier, such as a curb, bollards, or parking aisle.



Table ES-1: Existing Bicycle Boulevard Network

BIKEWAY TYPE	MILEAGE
Class IA: Paved Paths	13.9 miles
Ohlone Greenway	1.2 miles
San Francisco Bay Trail	7.4 miles
Aquatic Park Path	2.5 miles
9th Street Path	0.1 miles
West Street Path	0.5 miles
Other Paths	2.2 miles
Class IB: Unpaved Paths	5.3 miles
Class IIA: Standard Bicycle Lane	11.7 miles
Class IIB: Upgraded Bicycle Lane	0.3 miles
Buffered Bicycle Lanes	0.3 miles
Class IID: Contraflow Bicycle Lane	0.4 miles
Class IIIA: Signage-only Bicycle Route	4.5 miles
Class IIIC: Standard Sharrows	2.7 miles
Class IIIE: Bicycle Boulevard	11.9 miles
Class IVA: One-way Cycle Track/ Protected Bikeway	0.1 miles
Total	50.8 miles
Berkeley Bicycle Boulevard Network	15.8 miles

*Berkeley's Bicycle Boulevard network comprises segments of Class I, II and III facilities.

BICYCLE BOULEVARDS

Berkeley's existing bikeway network includes nearly 16 miles of Bicycle Boulevards. A Bicycle Boulevard is a roadway intended to prioritize bicycle travel for people of all ages and abilities. The first seven Bicycle Boulevards in Berkeley were developed through community workshops in 1999 with the goal of providing safe, convenient, and low stress bikeways on pleasant neighborhood streets. In order to achieve this goal, Bicycle Boulevards are sited only on appropriate streets without large truck or transit vehicles, and where traffic volumes and speeds are already low, or can be further reduced through traffic calming. For convenience, Bicycle Boulevard routes should not require people bicycling to stop any more frequently than they would on a parallel major street.

Elements of Bicycle Boulevards





DISTINCT VISUAL IDENTITY

Unique pavement markings and wayfinding signs increase visibility of Bicycle Boulevard routes, assist with navigation, and alert drivers that the roadway is a priority route for people bicycling.



SAFE, CONVENIENT CROSSINGS

Traffic controls, warning devices, and/or separated facilities at intersections help facilitate safe and convenient crossings of major streets along the Bicycle Boulevard network.



BICYCLE PRIORITY

Traffic calming treatments such as traffic circles, diverters, and chicanes, sometimes in place of existing stop signs, can help prioritize bicycle through-travel and discourage cut-through motor vehicle traffic.

PUBLIC OUTREACH

The project involved an extensive public engagement process which included two public open houses, regular updates to the Bicycle Subcommittee of the Transportation Commission, information tables at nearly a dozen local community events (e.g., farmers' markets, street fairs), outreach at the 2015 and 2016 Bike to Work Day events, a project website with an ongoing comment page, and a bicycling preference survey. Over 1,000 comments were received throughout the process from gathering existing conditions through review of the public draft plan document. The main themes public input indicated support for include:

- Safer crossings at major streets along the Bicycle Boulevard network
- Designated bikeways along major street corridors, especially those serving downtown and campus area
- Physical separation in bikeway design along major streets, along corridors and at intersections
- Improved pavement quality along the entire bikeway network



BERKELEY RESIDENT SURVEY

As part of the public outreach, a survey was conducted of Berkeley residents asking about their interests, current habits, concerns, and facility preferences around bicycling. The survey used address-based random sampling to ensure responses were representative of the Berkeley population. Survey staff interviewed 660 Berkeley residents between March 2 and March 28, 2015, yielding a margin of error of +/- 4 percent and a confidence level of 95 percent.

From the survey results, the general population of Berkeley was classified into categories of transportation bicyclists by their differing needs and bicycling comfort levels given different roadway conditions, using typologies originally developed by Portland City Bicycle Planner Roger Geller. Geller's typologies have been carried forward into several subsequent studies in cities outside Portland at the national level, and were used in the City of Berkeley analysis for consistency with national best practices and comparison to other top cycling cities. Under Geller's classification, the population of a city can be placed into one of the four following groups based on their relationship to bicycle transportation: "Strong and Fearless," "Enthusiastic and Confident," and "Interested but Concerned." The fourth group are nonbicyclists, called the "No Way No How" group.

These categories are meant to guide efforts to assess an area's market demand for bicycling as a means of transportation, such as commuting to work and running errands.

The survey found that three percent of Berkeley residents are Strong and Fearless bicyclists, 16 percent are Enthusiastic and Confident, 71 percent are Interested but Concerned, and 10 percent fall into the No Way No How category. In other words, 90 percent of Berkeley residents already bicycle or would consider bicycling if the right bikeway facility or roadway conditions were available. That is a larger percentage than any other city that has conducted a similar study, including Portland, as shown at right.

TYPE OF BICYCLIST	DESCRIPTION
Strong and Fearless	This group is willing to ride a bicycle on any roadway regardless of traffic conditions. Comfortable taking the lane and riding in a vehicular manner on major streets without designated bicycle facilities.
Enthusiastic and Confident	This group consists of people riding bicycles who are confident riding in most roadway situations but prefer to have a designated facility. Comfortable riding on major streets with a bike lane.
Interested but Concerned	This group is more cautious and has some inclination towards bicycling, but is held back by concern over sharing the road with cars. Not very comfortable on major streets, even with a striped bike lane, and prefer separated pathways or low traffic neighborhood streets.
No Way No How	This group comprises residents who simply are not interested at all in bicycling, may be physically unable, or don't know how to ride a bicycle. They are unlikely to adopt bicycling in any way.

Table ES-2: Four Types of Bicyclists

LEVEL OF TRAFFIC STRESS ANALYSIS

Building on the bicycling preference survey and user typologies, a Level of Traffic Stress (LTS) analysis was conducted for Berkeley's roadway network. Traffic stress is the perceived sense of danger associated with riding in or adjacent to vehicle traffic; studies have shown that traffic stress is one of the greatest deterrents to bicycling. The less stressful – and therefore more comfortable – a bicycle facility is, the wider its appeal to a broader segment of the population.



Roger Geller's "Four Types of Transportation Cyclists" distribution for Berkeley, Portland, OR, Edmonton, AB, and Austin, TX.

A bicycle network will attract a large portion of the population if it is designed to reduce stress associated with potential motor vehicle conflicts and if it connects people bicycling with where they want to go. Bikeways are considered low stress if they involve very little traffic interaction by nature of the roadway's vehicle speeds and volumes (e.g., a shared, low-traffic neighborhood street) or if greater degrees of physical separation are placed between the bikeway and traffic lane on roadways with higher traffic volumes and speeds (e.g., a separated bikeway or cycletrack on a major street). An LTS Analysis is an objective, data-driven evaluation model which identifies streets with high levels of traffic stress, gaps in the bicycle network, and gaps between streets with low levels of traffic stress.

The level of traffic stress scores were mapped to illustrate the low stress connections and gaps throughout Berkeley. It is important to note that people tolerate different levels of stress; a strong and fearless bicyclist will feel less stress than an interested but concerned bicyclist. The LTS results map approximates the user experience for the majority of Berkeley residents, however people may have differing opinions of traffic stress depending on their own experiences.

LEVEL OF TRAFFIC STRESS ANALYSIS

Traffic stress is the perceived sense of danger associated with riding in or adjacent to vehicle traffic.



*According to the Berkeley Bicycle Plan Public Survey

LEVEL OF TRAFFIC STRESS FINDINGS

Figure ES-1 on the following page depicts low stress (LTS 1 and 2) streets and intersections on Berkeley's existing on-street bicycle network, along with high stress (LTS 4) gaps. This map helps illustrate how low stress streets in Berkeley's bikeway network are often disconnected by high stress roadways and intersections. A continuous low stress network is essential for bicyclists of all abilities to travel easily throughout the network.



FIGURE ES-1: LOW STRESS NETWORK & INTERSECTIONS WITH HIGH STRESS NETWORK & INTERSECTION GAPS



INTERSECTIONS

- LTS 1 ALL AGES AND ABILITIES
- LTS 2 INTERESTED BUT CONCERNED

INTERSECTION GAPS

- LTS 3 ENTHUSIASTIC AND CONFIDENT
- LTS 4 STRONG AND FEARLESS

BART STATION



PROJECT RECOMMENDATIONS

As each project is taken up for possible implementation, stakeholder constituencies will be consulted and have the opportunity to provide input. In addition, in commercial and manufacturing districts, particularly in West Berkeley, the special needs and hazards associated with these uses, including frequent passage and parking, loading and unloading of trucks of all sizes, shall be considered such that everyday functioning and economic vitality of these areas are not unduly burdened. Furthermore, for the network to work, it must be complete, without gaps. Completing the low stress network is a priority for the city to meet our Climate Action Plan goals.

This Plan's recommended bikeway network supports a vision for Berkeley where bicycling is safe, comfortable, and convenient for people of all ages and abilities. These recommendations were guided by the Plan's goals and policies, a data-driven safety and demand analysis, and extensive community input. An overarching bikeway network vision emerged through this process: a continuous and connected system of Low Stress bikeways that provide safer and more comfortable travel for all users and link to all key destinations in Berkeley. Figure ES-2 illustrates how the Low Stress Bikeway Network Vision of low-traffic Bicycle Boulevards, protected majorstreet bikeways, and separated shared-use paths, all with safer intersection crossings, can form a network on which 79 percent of Berkeley's population would feel comfortable bicycling.

Safe bikeway connections are especially important for parents riding with their children, or for older children riding independently. And in terms of the potential for reducing traffic congestion and helping to achieve the City's climate action goals, school trips account for a significant portion of morning auto traffic, and yet are often less than a mile in length. Therefore it was important that the Low Stress Network connect to as many schools in Berkeley as possible to provide parents and children the option of a completely low stress bicycle trip from their residence to school. Figure ES-3 illustrates the Low Stress Network in relation to Berkeley's schools; nearly all the city's schools are within one-eighth of a mile (approximately one block) from a Low Stress facility.

This Plan recommends nearly \$34.5 million in infrastructure recommendations to help Berkeley achieve its vision of becoming a model bicyclefriendly city. **Figure ES-4** displays the complete recommended bikeway network. **Table ES-3** on the next page breaks down the recommended network by facility type, with corresponding cost estimates.

ТҮРЕ	MILEAGE	COST ESTIMATE
Class 1A: Paved Path	1.5 miles	\$5,285,700
Class 2A: Standard Bike Lane	0.1 miles	\$10,700
Class 2B: Upgraded Bike Lane	3.0 miles	\$541,500
Class 3C: Sharrows	13.9 miles	\$71,600
Class 3E: Bicycle Boulevard	12.4 miles	\$621,900
Class 4: Cycletrack	18.4 miles	\$9,903,300
Complete Street Corridor Interim Treatments	17.0 miles	\$1,181,400
Intersection and Traffic Calming Improvements	-	\$16,855,000
Total	66.3 miles	\$34,471,100

Table ES-3: Summary of Project Recommendations and Cost Estimates

COMPLETE STREET CORRIDOR STUDIES

As defined by the Berkeley Complete Streets Policy, "Complete Streets" describes a comprehensive, integrated transportation network with infrastructure and design that allows safe and convenient travel along and across streets for all users, including people walking, people bicycling, persons with disabilities, people driving motor vehicles, movers of commercial goods, users and operators of public transportation, emergency responders, seniors, youth, and families. Providing a complete network does not necessarily mean that every street will provide dedicated facilities for all transportation modes, but rather that the transportation network will provide convenient, safe, and connected routes for all modes of transportation within and across the City. For the purposes of bikeway planning, the City of Berkeley considers both the major/ collector street and parallel streets part of a Complete Street Corridor; potential bikeways on both the major/collector street bikeway and on parallel streets should be evaluated as part of a Complete Street Corridor Study. Of the major and collector streets shown in **Figures** ES-2, ES-3, and ES-4 as requiring a Class IV Cycletrack to meet LTS 1 or 2, most of them will require further study in order to evaluate their suitability for this treatment and impacts on

other modes of transportation. These major and collector streets provide access to local Berkeley businesses. Some facilitate direct cross-town or interjurisdictional travel not duplicated by a parallel street. They currently serve multiple modes of transportation and on-street parking, requiring further consideration above and beyond that of bicycle travel. These streets are therefore labeled as "Complete Street Corridor Studies" on **Figure ES-2** and other figures within the Bicycle Plan.

Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without these Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan. Studies to consider the inclusion of bikeways will be coordinated with proposed improvements to transit performance on Primary Transit Routes, such as bus boarding islands, transit-only lanes, transit signal priority/queue jump lanes, far-side

bus stop relocations, and other improvements as described in the AC Transit Major Corridor Study. In addition, these studies should approach Secondary Transit Routes as opportunities for transit improvements, such as bus stop optimization and relocation, among other potential improvements. At the conclusion of the Complete Streets Corridor Study process, design alternatives which have a significant negative effect on transit on Primary Transit Routes will not be recommended. Criteria to define what constitutes a significant negative effect on transit will be developed and applied during the Study process for each corridor. Example criteria for evaluating transit impacts are provided in Section 5.7 of this Plan. Consideration of how to allocate limited public right-of-way among various travel modes will be made consistent with Alameda County Transportation Commission modal priorities and the City of Berkeley General Plan.

These corridors may have interim treatments installed while the corridor study and final recommended design are being completed. Interim treatments are those that do not require a full Complete Streets Corridor Study. Interim or phased treatments may still require traffic study, interagency coordination, and public process if they impact roadway capacity, parking, or transit operations. Interim or phased treatments should not negatively impact existing transit operations; mitigations should accompany interim treatments to ensure no degradation of transit service. For example, Shared Roadway Bicycle Markings may be installed, or existing bike lanes may first be colored green, then later converted into a Class IV Cycletrack if feasible without negatively impacting existing or planned transit operations on Primary or Secondary Transit Routes.

For more information about future Complete Street Corridor Studies, see Section 5.7, Section 6.7, Appendix E, and Appendix F.



FIGURE ES-2: LOW-STRESS BIKEWAY NETWORK VISION

PAVED PATH

BICYCLE BOULEVARD NETWORK

CYCLETRACK [4]

COMPLETE STREET CORRIDOR STUDIES - LOW STRESS BIKEWAY RECOMMENDATION

STUDY CYCLETRACK [4]*

PRIMARY TRANSIT ROUTE -STUDY CYCLETRACK [4]*

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FIGURE ES-3: LOW-STRESS BIKEWAY NETWORK VISION WITH BERKELEY SCHOOLS

		0	SCHOOL WITH
PAVED PATH	COMPLETE STREET CORRIDOR STUDIES -		I/8 MILE BUFFER
	LOW STRESS BIKEWAY RECOMMENDATION		
NETWORK	STUDY CYCLETRACK [4]*		ENROLLMENT
CYCLETRACK [4]	PRIMARY TRANSIT ROUTE - STUDY CYCLETRACK [4]*		BOUNDARIES

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SUPPORT FACILITIES

Bicycle Detection

Detection of bicyclists at actuated (not pretimed) traffic signals is important for safety of bicyclists and motorists. The California Manual on Uniform Traffic Control Devices (CA MUTCD) requires that all new and modified traffics signals be able to detect bicyclists with passive detection (rather than having to push a button). This Plan recommends that the City of Berkeley continue to adhere to this requirement by ensuring passive detection of bicyclists at all signalized intersections.

Bicycle Parking

Bicycle parking is available throughout Berkeley, but many locations do not provide an adequate amount of bike parking to meet demand. As such, many bicyclists instead lock their bikes to street fixtures such as trees, telephone poles, and sign poles.

RECOMMENDED TYPES AND QUANTITIES OF BICYCLE PARKING

Bicycle parking can be categorized into shortterm and long-term parking. Sidewalk bicycle racks or bicycle corrals are preferred for shortterm bike parking (less than two hours), serving people who leave their bicycles for relatively short periods of time – typically for shopping, errands, eating or recreation. Short-term bicycle racks provide a high level of convenience but relatively low level of security. Long-term bike parking includes bike lockers, bike rooms, or Bike Stations. Long-term parking serves people who intend to leave their bicycles for longer periods of time and is typically found at workplaces and in multifamily residential buildings, transit stations, and other commercial buildings. These facilities provide a high level of security but are less convenient than bicycle racks. Berkeley has bike lockers available citywide at BART and Amtrak stations.





Inverted U-Rack Post & Ring

Circle

The City has developed specifications to assist architects, engineers and contractors with bicycle rack placement and installation. These are available at www.ci.berkeley.ca.us/ uploadedFiles/Public_Works/Level_3_ Transportation/Bike_Rack_Specs_Installation_ Sept2008.pdf.

Expanded Bicycle Parking Design Guidelines and recommended quantities by land use can be found in **Appendix F: Design Guidelines**.

IMPLEMENTATION

Project Prioritization

The project recommendations were divided into three implementation tiers based on a set of evaluation criteria that included safety, community support and equity factors. **Figure ES-6** shows the recommended project network by tier.

Tables that show the projects in each corridor are included in **Appendix E: Project Recommendations and Prioritization Tables.** **Table ES-4** shows the planning-level costestimates to implement each tier.

Table ES-4: Planning-Level Capital Cost Estimates

TIER	PLANNING LEVEL COST ESTIMATE			
Tier 1	\$26,318,900			
Tier 2	\$4,658,400			
Tier 3	\$3,493,800			
Total	\$34,471,100			

Pilot Projects

"Pilot projects" are a way to test the impacts of changes to the transportation network by temporarily constructing improvements using non-permanent materials, in place for a specified, limited amount of time. These projects enable the City to study the real-world efficacy of such changes, often at a relatively modest cost due to the short-term materials used. Utilizing before and after data collection, they are monitored to understand benefits and tradeoffs, with the goal of adjusting the final design before committing to a more expensive permanent capital project. Short-term demonstration projects, sometimes called tactical urbanism or temporary installations, are typically for a few days in order to quickly evaluate a project and to gather feedback from the public. Demonstration projects usually use cones, temporary marking tape, moveable planters, and other nonpermanent materials that can easily be installed, modified, and removed, as needed. Longer-term pilot projects can be installed for a longer period of time, typically weeks or months, prior to potential permanent implementation. This allows for extensive data collection and public input, especially for complex multi-modal projects. Materials such as traffic paint, flexible traffic delineator posts, and moveable planters are often used during pilot projects and then may be later upgraded to permanent treatments such as thermoplastic, asphalt, concrete, and rigid bollards.

Both Demonstration and Long-term Pilots should be approached from a Complete Street design perspective, in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan. Pilot Projects should integrate improvements for all modes of transportation whenever possible, including consideration of people walking, biking, riding

transit, and driving. For example, pilot projects on Primary or Secondary Transit Routes should seek to test transit operations and access improvements whenever possible, utilizing the latest national design best practices such as the National Association of City Transportation Officials (NACTO) Transit Street Design Guide and Urban Street Design Guide. Local guidance such as the forthcoming AC Transit Design Standards and Guidelines Manual for Safe and Efficient Multimodal Transit Stops and Corridors will also be consulted.



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OPERATIONS AND MAINTENANCE

The primary maintenance policy of this Plan is to "maintain designated bikeways to be comfortable and free of hazards to bicycling," which includes incorporating a higher standard of care for bikeways into guidelines and timetables for maintenance activities, including repaving. Specific actions under this policy include developing and implementing an

appropriate minimum paving surface standard for Bicycle Boulevards and other low stress bikeways, and updating the repaving project selection methodology to prioritize Bicycle Boulevards and other low stress bikeways to ensure that the minimum paving surface standard is maintained.

Plan Implementation and Staffing Costs

Capital project costs only capture a portion of the resources needed to fully implement this Plan. In addition to base capital costs, contingencies are added to capture unanticipated increases in the cost of project materials and/or labor. The City will need to utilize a combination of staff and consultant resources for project delivery phases that include Planning (conceptual project development and funding); Preliminary Engineering (environmental clearance and design); Final Design; and Construction Management (contractor oversight, inspection, and invoicing). **Table ES-5** provides a planninglevel estimate of these "soft costs" associated with delivering Tier 1, 2, and 3 projects.

Table ES-5: Total Planning-Level Implementation Cost Estimate

TIER	YEARS	CAPITAL COST	CAPITAL CONTINGENCY (10%)	CAPITAL TOTAL
Tier 1	2016-2025	\$26,318,900	\$2,631,890	\$28,950,790
Tier 2	2025-2035	\$4,658,400	\$465,840	\$5,124,240
Tier 3	2025-2035	\$3,493,800	\$349,380	\$3,843,180
Totals		\$34,471,100		\$37,918,210

Table continues below

TIER	PLANNING (25%)	PRELIMINARY ENGINEERING (25%)	CONSTRUCTION MANAGEMENT (15%)	TOTAL "SOFT COSTS"	TOTAL COST ESTIMATE
Tier 1	\$7,237,700	\$7,237,700	\$4,342,600	\$18,818,000	\$47,768,800
Tier 2	\$1,281,100	\$1,281,100	\$768,600	\$3,330,800	\$8,455,000
Tier 3	\$960,800	\$960,800	\$576,500	\$2,498,100	\$6,341,300
Totals				\$24,646,900	\$62,565,100

INTRODUCTION

5 8-390 al-lessors

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III

REAL ESTATE

Berkeley is a bicycle city.

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For nearly five decades, Berkeley has been a leader in the effort to promote the use of the bicycle for pleasant transportation and recreation. The first Berkeley Bicycle Plan—created in 1971—laid out a citywide network of bikeways which are still in use today.

The purpose of this updated Bicycle Plan is to make Berkeley a model bicycle-friendly city where bicycling is a safe, comfortable, and convenient form of transportation and recreation for people of all ages and abilities. Because this plan is being produced by the Public Works Department, the focus is on physical infrastructure changes that support cycling as a way to achieve the City's safety, health, and environmental goals.





Berkeley has been a leader in the effort to promote the use of the bicycle for pleasant transportation and recreation for nearly five decades. Many of Berkeley's bicycle lanes date from the 1970s, the era of the "Bicycle Boom." In 1970, the City of Berkeley conducted a survey of existing bicycle usage patterns, asking respondents to draw their most common bike trip route on a map to help the City understand where cyclists were riding at that time. This survey was the basis for the first Berkeley Bicycle Plan of 1971, which laid out a citywide network of bikeways that are still in use today. One of the goals of this Plan was to replicate this outreach in the digital age, using a door-todoor tablet-based survey in order to understand where and why Berkeley residents are cycling - and what it would take to get them to bicycle more or to try cycling for the first time.

This Plan recommends a core network of "Low Stress" bikeways, a continuous and connected system of safe and comfortable bikeways that serve all types of people riding bicycles in Berkeley. The core Low Stress network is part of a larger overall bikeway system in Berkeley that is supported by wayfinding signage, bike parking, a high standard of maintenance, and education, encouragement and outreach programs. The Plan is organized as follows:

Chapter 2 Goals and Policies – from high-level goals to nuts-and-bolts actions, this chapter captures the vision and policy framework for Berkeley's Bicycle Program. The chapter includes performance metrics because what fails to be measured fails to get done.

Chapter 3 Existing Conditions – an inventory of present-day bicycling in Berkeley, including physical conditions like bikeways as well as education, enforcement, and encouragement programs.

Chapter 4 Needs Analysis – what is it like to bicycle in Berkeley? What are the barriers to cycling? This chapter uses both stated preference data—a statistically significant public survey—and observational data—an innovative Level of Traffic Stress analysis as well as data about collisions, land use, and a geographic Demand Model—to help us answer these questions.

Chapter 5 Recommendations – proposals to support Berkeley residents who already ride a bicycle, eliminate barriers to bicycling more, and to encourage others to try cycling for the first time. **Chapter 6 Implementation –** a practical roadmap for implementing the proposals in this Plan, including project details, cost estimates, and project bundles grouped for the purpose of successful grant funding applications, and evaluation and staffing needs for a measurable and successful Bicycle Program.

Appendices – resources critical to the implementation of the proposed projects, including detailed Design Guidelines based on the latest State and Federal guidelines and national best practices from organizations such as the National Association of City Transportation Officials; a thorough Collision Analysis based on State of California data; complete Level of Traffic Stress methodology; and recommendations for the Enforcement, Education, and Encouragement programs necessary to support the physical infrastructure recommendations of this Plan.

GOALS & POLICIES

1

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The Berkeley Bicycle Plan is organized around a Vision Statement, three overarching goals, and a series of specific policies and actions.



2.1 VISION STATEMENT

Berkeley will be a model bicycle-friendly city where bicycling is a safe, comfortable, and convenient form of transportation and recreation for people of all ages and abilities.

2.2 GOALS

The Berkeley Bicycle Plan has three overarching goals that frame all of the policies, actions and recommendations in the plan.

Goal 1: Safety First

Performance Measure: Zero bicycle-involved fatalities by 2025.

Performance Measure: Zero bicycle-involved severe injuries by 2035.

Goal 2: Strength in Numbers

Performance Measure: Increase Berkeley's bicycle mode share¹ by 50 percent by 2025, from approximately 10 percent to 15 percent.

Performance Measure: Increase Berkeley's bicycle mode share by 100 percent by 2035, from approximately 10 percent to 20 percent.

Goal 3: All Ages and Abilities

Performance Measure: Complete the Tier 1 Bikeway Network, including high-priority Bicycle Boulevards, Milvia Street Bikeway, Complete Street Corridor Studies (including Downtown and UC Berkeley Campus perimeter streets and the Southside Pilot Project), and the Ohlone Greenway, by 2025.

Performance Measure: Complete the Tier 2 and Tier 3 Bikeway Network, including remaining Bicycle Boulevards, Complete Street Corridor Studies, and other bikeways by 2035.²

2.3 POLICIES & ACTIONS

Specific policies and actions to achieve the above goals are organized by the various phases of project delivery to align with the City process of implementing this Plan.

Planning

Policy PL-1. Integrate bicycle network and facility needs into all City planning documents and capital improvement projects.

ACTIONS:

- Review the City's Capital Improvement Program list on an annual basis to ensure that recommended bikeway network projects are incorporated at the earliest possible stage of both new capital projects and maintenance of existing facilities.
- Follow a multi-disciplinary project scoping process that incorporates the needs of all modes and stakeholders, both internal and external; the design process should include the City divisions, departments, and staff responsible for emergency response, parking, law enforcement, maintenance, and other affected areas.
- Ensure that all traffic impact studies, analyses of proposed street changes, and development projects address impacts on bicycling and bicycling facilities. Specifically, the following should be considered:
 - » Consistency with General Plan, Area Plan, and Bicycle Plan policies and recommendations;

¹ As measured by US Census American Community Survey and by City of Berkeley Bicycle Counts

² As defined by the Berkeley Strategic Transportation Plan and the Alameda County Transportation Commission Countywide Transportation Plan and Countywide Multimodal Arterial Plan.

- » Impact on the existing bikeway network;
- » Degree to which bicycle travel patterns are altered or restricted by the projects; and
- » Safety of future bicycle operations (based on project conformity to Bicycle Plan design guidelines and City, State, and Federal design standards).
- Amend the Berkeley Municipal Code to update bicycle parking specifications and requirements to current best practice for both short- and long-term bicycle parking as part of both commercial and residential development projects and major renovations.
- Capital project planning should include bikeways, consistent with the City's adopted Complete Streets Policy and Berkeley Strategic Transportation Plan.

Policy PL-2. When considering transportation impacts under the California Environmental Quality Act, the City shall consider how a plan or project affects bicyclists per Berkeley General Plan Policy T-18.

ACTIONS:

- Integrate Vehicle Miles Traveled transportation impact analysis thresholds as a Statemandated alternative to Level of Service.
 Work with the Alameda County Transportation Commission and the Metropolitan Transportation Commission to ensure conformity with County and Regional travel models.
- Establish new City traffic analysis standards that consider all modes of transportation, including pedestrians, bicycles, and transit in addition to automobiles, consistent with a comprehensive, integrated transportation network for all users as described in the City of Berkeley Complete Streets Policy. Utilize Level of Traffic Stress to quantify bicycle transportation in this network-based Complete Streets Policy context.

Policy PL-3. Coordinate with other agencies to incorporate Berkeley Bicycle Plan elements.

ACTIONS:

- Work with adjacent governmental entities, public service companies, coordinating agencies and transit agencies, and the University of California, to ensure that Bicycle Plan recommendations are incorporated into their planning and areas of responsibility.
- Work with partner government agencies to incorporate other agencies' plans and studies into the funding, study, design, and construction of Bike Plan projects, whenever feasible within the scope of the particular project.
- Work with transit providers to improve bicycle access to transit stations and stops and onboard transit vehicles, especially during peak commute hours, and to provide secure bike parking at stations and stops.

Policy PL-4. *Support a successful bike share system in Berkeley.*

ACTIONS:

- Promote bike share use by Berkeley employees (including the City of Berkeley), residents and visitors, especially as an access strategy for BART and AC Transit riders.
- Ensure proper funding and staffing levels for development and operations for the entire length of the bike share contract.

Design

Policy D-1. *Design a Low Stress Bikeway Network suitable for the "Interested but Concerned," to include people all ages and ability levels riding bicycles in Berkeley.*

ACTIONS:

- Design a network of continuous Low Stress
 Bikeways as identified in the Berkeley Bicycle
 Plan and Appendix F: Design Guidelines.
- Adopt the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide as the primary design guide for citywide bicycle facility design.
- Utilize the most recent State and Federal design standards and guidelines.
- Follow a multi-disciplinary design process that incorporates and balances the needs of all modes and stakeholders, both internal and external; the design process should include the City divisions, departments, and staff responsible for emergency response, parking, law enforcement, maintenance, and other affected areas, as well as outside agencies such as AC Transit, BART, UC Berkeley, Caltrans and other responsible external stakeholder agencies.
- Work with AC Transit, UC Berkeley, and other transit providers to design bikeways to minimize transit-vehicle interactions, optimize transit service and operations, and provide low
stress bike-to-transit access environments in areas heavily served by transit. In designing for both bicycles and transit, utilize the latest national design best practices, such as the National Association of City Transportation Officials (NACTO) Transit Street Design Guide and Urban Street Design Guide. Local guidance, such as the forthcoming AC Transit Design Standards and Guidelines Manual for Safe and Efficient Multimodal Transit Stops and Corridors will also be consulted.

Policy D-2. Through good design practices, continue to expand citywide bike parking supply including short-term and long-term facilities for both commercial and residential land uses.

ACTIONS:

- Regularly review and update the City's bicycle parking specifications and requirements, with input from affected City divisions, departments, and staff.
 - » Design short-term parking for maximum convenience, accessibility, and visibility, per City specifications for bicycle racks and corrals, including siting and placement on the sidewalk or in the street.
 - » Design long-term parking for maximum security and weather-protection, per City specifications for high-capacity bicycle racks, bicycle cages, bicycle rooms, and other secure enclosures.

- Ensure both the City Engineer and City
 Traffic Engineer approve Bicycle Parking
 Specifications prior to implementation.
- » Ensure the Planning Department approves
 Bicycle Parking Requirements for
 development projects.
- Distribute bicycle parking specifications and requirements to all affected City divisions, departments, and staff, particularly Engineering and Streets Divisions of Public Works, Parks Department, and Planning Department.
- As part of the citywide bicycle rack and corral design process, continue to support the city's bicycle parking information webpage including the bicycle parking map.

Funding

Policy F-1. *Continue and enhance the City's annual commitment of City-controlled funds for bicycle project implementation.*

- On an annual basis, conduct an internal audit of dedicated bicycle program funds to ensure they are being expended in the most effective way possible to achieve the goals of this Plan:
 - » Measure B Ped/Bike (Alameda County Transportation Commission, CTC)
 - » Measure BB Ped/Bike (Alameda CTC)

- » Transportation Funds for Clean Air (BAAQMD)
- » Transportation Development Act Article III (MTC)
- » Bicycle Plan Capital Improvement Program (City of Berkeley General Fund)
- Maintain an annual Bicycle Program budget to track and evaluate expenditure of program funding on both capital and staff costs.
- Through the City CIP process, assess and prepare for upcoming staffing, consultant, and capital funding needs as projects arise.

Policy F-2. Leverage existing funding to maximize project delivery.

ACTIONS:

- Utilizing city-controlled funds as local match, aggressively pursue funding from any and all available grant sources.
- Actively develop projects from the Bicycle Plan to position the City to best compete for grant funding.
- Follow the Bicycle Plan's prioritization recommendations, which include equity and other funder-determined factors in scoring.
- Seek to submit grant applications for projects that most competitively match with funder criteria.

Project Delivery

Policy PD-1. Construct projects within the Bicycle Plan utilizing all available internal and external resources.

ACTIONS:

- Develop, fund, and deploy a staffing plan consisting of City staff and consultant support at a level and quantity sufficient to implement recommended bikeway projects, including necessary internal (City) and external (public) engagement processes.
- Through the Bicycle Subcommittee and the City Transportation Commission, continue to support a representative bicycle advisory committee to assist City staff in the planning, design, and implementation of projects that positively impact bicycle travel and safety.

Policy PD-2. Ensure that bicyclists have accommodation in work zones.

ACTIONS:

• Develop a set of mandatory bicycle accommodations for work zones, including standards for rerouting or detours.

Operations & Maintenance

Policy OM-1. *Maintain designated bikeways to be comfortable and free of hazards to bicycling.*

ACTIONS:

- Incorporate a higher standard of care for bikeways into guidelines and timetables for maintenance activities, including repaying.
- In partnership with Public Works and the cycling community, develop and implement an appropriate minimum paving surface standard for Bicycle Boulevards and other low stress bikeways.
- Update repaving project selection methodology to prioritize Bicycle Boulevards and other low stress bikeways to ensure that the minimum paving surface standard is maintained.
- Identify and regularly update annual maintenance costs for bikeways; ensure proper funding levels for routine bicycle-related maintenance activities.
- Incorporate maintenance needs into design of physically protected bikeways to ensure proper maintenance after construction.
- Include other operational issues such as parking, traffic enforcement, and traffic operations during design of physically protected bikeways and intersections to ensure proper operation and enforcement.

Policy OM-2. Maintain bicycle parking.

ACTIONS:

- Promptly replace damaged bicycle racks utilizing contractor or corporation yard resources.
- Continue to remove abandoned bicycles from bicycle racks and donate to local non-profit community bicycle shops for use in youth education programs.

Programs

Policy PR-1. Educate bicyclists, motorists, and the public about bicycle safety and the benefits of bicycling.

- Develop a comprehensive Vision Zero strategy that outlines Engineering, Enforcement, Education and Encouragement actions.
- Support the continuation and expansion of bicycle safety education programs such as those taught by Bike East Bay.
- Support UC Berkeley and the Berkeley Unified School District (BUSD) to continue and expand bicycle safety education programs for students.

Policy PR-2. Encourage all Berkeley Public Schools to participate in the Alameda County Safe Routes to School program.

ACTIONS:

- Continue to support walk audits at Berkeley public schools and utilize improvement plans to pursue grant funding for implementation.
- Continue City staff participation in citywide SR2S Task Force meetings run by Alameda County's SR2S program.
- Encourage the Alameda CTC to expand funding for the SR2S program to include all Berkeley public schools.

Policy PR-3. Support police enforcement activities targeted at both bicyclists and motorists that educate and reinforce proper and safe behaviors.

- Collaborate with the Berkeley Police Department to establish a bicycling module in the Berkeley Police Department's Training Academy curriculum.
- Partner with Bike East Bay and the Berkeley Police Department to establish a bicycle ticket diversion program per Bicycle Traffic School bill (AB 902) that allows bicyclists who are ticketed for certain infractions to attend a class on safe bicycle riding to reduce or eliminate their fines.
- Focus data-driven enforcement efforts on behaviors with greatest crash risk and/or injury severity such as vehicle speeding or bicyclist wrong-way riding.

Policy PR-5. *Increase bicycle use through targeted marketing and promotion.*

ACTIONS:

- Provide current and easily accessible information about the Berkeley bicycle network, bicycle programs, and bicycle parking. This includes distribution of free bicycle maps, maintaining up-to-date City web pages, and providing opportunities for continued public feedback.
- Encourage major employers including UC Berkeley, the City of Berkeley, and the BUSD to continue, develop, or expand bicycle promotion programs for their employees.
- Encourage the use of bicycles for City employee commute and work travel purposes so that the City is seen as a model employer, including employee access to Bay Area Bike Share.

Evaluation

Policy E-1. *Improve the reporting and analysis of bicycle collisions.*

- Collaborate with the Berkeley Police
 Department to update current reporting
 methodologies to improve the amount and
 quality of reported bicycle collisions.
- Identify locations with a high number of bicycle collisions; determine the primary factors contributing to these collisions; evaluate whether current engineering, education, and enforcement countermeasures have been effective; recommend alternative countermeasures as needed.
- Report annually to the City's Bicycle Subcommittee on bicycle collision trends and analyses.

Policy E-2. Continue and expand the City's Annual Bicycle Count Program.

ACTIONS:

- Review and modify the manual count methodology on an annual basis, while ensuring consistency with previous years' data.
- Consider transitioning from volunteer counters to a professional data collection firm.
- Expand locations to broaden the geographic significance of the count program.
- Consider adding automated counters at key locations around the city.
- Consider adding an automated bicycle counter with digital display at a particularly high-volume, high-profile location such as the Milvia Bicycle Boulevard in front of City Hall. The high-visibility digital display will allow the public to see the total number of cyclists that have passed the counter on that day, over the course of the past year, and access the count data online.
- Prepare and publish an annual report summarizing each year's bicycle count data and analyzing it in terms of this Plan's Goals, Policies, Actions, and Recommendations.

Policy E-3. Report annually on the implementation of this Plan.

- Prepare and present a report to the Berkeley Transportation Commission or Berkeley City Council describing the progress in:
 - » Achieving the three Goals of the Plan in terms of their specific performance measures,
 - » Implementing the Policies and Actions of this Plan.

2.4 POLICY CONTEXT

The Berkeley Bicycle Plan is supported and influenced by existing plans, policies, and ordinances that support safe, high-quality bicycle environments and encourage greater bicycle mode share for all types of trips. This Plan builds on and translates these documents and initiatives into recommendations for future bicycle-related improvements. All of the City's adopted plans were reviewed as part of the development of the Bicycle Plan. A list of the City's plans and bicycle-related policies and actions are located in **Appendix A: Policy Review**.

2-11

EXISTING CONDITIONS

This chapter details the existing state of bicycle infrastructure in Berkeley and gives an update on the status of the recommendations set forth in the 2005 Berkeley Bicycle Plan.

3.1 BIKEWAY CLASSIFICATIONS

The California Department of Transportation (Caltrans) designates four classes of bicycle facilities: Classes I, II, III, and IV. In addition, the Alameda County Transportation Commission (ACTC) has adopted a set of sub-classifications for each Caltrans classification. These subclassifications were designed to harmonize previously existing local classification systems within Alameda County and to incorporate emerging bikeway typologies.

Class | Multi-Use Paths

Class I bikeways are multi-use or shared-use paths. They provide completely separated, exclusive right-of-way for bicycling, walking and other nonmotorized uses.



Table 3-1: Existing Class I Facility Mileage

ALAMEDA COUNTY SUB-CLASS	DESCRIPTION	MILES IN BERKELEY
IA	Paved Paths	12.4 miles
IB	Unpaved Paths	5.3 miles

CLASS I Multi-Use Path

Provides a completely separated right of way for the exclusive use of bicycles and pedestrians with crossflow minimized.



Class II Bicycle Lanes

Class II bicycle lanes are striped, preferential lanes for one-way bicycle travel on roadways. Some Class II bicycle lanes include striped buffers that add a few feet of separation between the bicycle lane and traffic lane or parking aisle. Caltrans requires a minimum of four feet of paved surface for Class II bikeways on roadways without gutters and five feet for roadways with gutters or adjacent to on-street parking.





Table 3-2: Existing Class II Facility Mileage

ALAMEDA COUNTY SUB-CLASS	DESCRIPTION	MILES IN BERKELEY
IIA	Conventional bicycle lane	11.7 miles
IIB	Upgraded bicycle lane (striped bicycle lanes with striped buffer between the bicycle lane and traffic lane)	0.3 miles
	Upgraded bicycle lane (bicycle lanes with green conflict markings)	0.0 miles*
IIC	Climbing bicycle lane (a bicycle lane in the uphill direction and a bicycle route in the downhill direction)	0.0 miles
IID	Contraflow bicycle lane (a striped bicycle lane that allows people to bicycle in the opposite direction of motor vehicle traffic, mainly used on streets that are designated as one-way for motor vehicle traffic)	0.4 miles

* 0.02 miles of bicycle lanes with green conflict markings were installed on Oxford Way between Addison Street and Center Street in 2015.

Class III Bicycle Routes

Class III bicycle routes are signed bicycle routes where people riding bicycles share a travel lane with people driving motor vehicles. Because they are mixed-flow facilities, Class III bicycle routes are only appropriate for low-volume streets with slow travel speeds.



CLASS III Bike Route Signed Shared Roadway

BIKEROUTE

Provides for shared use with pedestrian or motor vehicle traffic, typically on lower volume roadways.



Table 3-3: Existing Class III Facility Mileage

ALAMEDA COUNTY SUB-CLASS	DESCRIPTION	MILES IN BERKELEY
IIIA	Signage-only routes	4.5 miles
IIIB	Wide curb lane or shoulder (may include signage)	0.0 miles
IIIC	Route with standard shared lane markings (sharrows) or other pavement stenciling (may also include signage)	2.7 miles
IIID	Route with green-backed shared lane markings (sharrows), also known as "super sharrows"	0.0 miles
IIIE	Bicycle Boulevards (signed, shared travelways with low motor vehicle volumes and low speed limits that prioritize convenient and safe bicycle travel through traffic calming strategies, wayfinding signage, and traffic control adjustments)	11.9 miles

Class IV Cycletrack

A Class IV bikeway, also known as a cycletrack or separated/protected bikeway, is an on-street bicycle lane that is physically separated from motor vehicle traffic by a vertical element or barrier, such as a curb, bollards, or parking aisle. The passage of Assembly Bill (AB) 1193 required Caltrans to establish minimum safety design criteria for Class IV bikeways by January 1, 2016. The bill also authorized local agencies to use other safety design criteria established by a national association of public agency transportation officials, such as the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide, provided that the respective city adopts the criteria by resolution at a public meeting. One-way Class IV bikeways are typically five to seven feet wide, with a three-foot-wide buffer from motor traffic that includes within it a vertical barrier, or with a three-foot-wide buffer zone for the opening of motor vehicle passenger doors if the bikeway is protected from motor vehicle traffic by a parking aisle.

CLASS IV Cycletrack

Provides a separated path for one-way bicycle travel adjacent to a street or highway. Bicycles are separated from motor vehicle traffic by a raised curb, bollards, parking with a painted buffer, or other vertical physical barrier.



Table 3-4: Existing Class IV Facility Mileage

ALAMEDA COUNTY SUB-CLASS	DESCRIPTION	MILES IN BERKELEY
IVA	One-way cycletrack/ protected bikeway	0.1 miles
IVB	Two-way cycletrack/ protected bikeway	0.0 miles



3.2 EXISTING BIKEWAY NETWORK

Figure 3-1 shows the existing bicycle network in Berkeley and **Table 3-5** below lists the total miles of bicycle facilities by classification and sub-classification. Berkeley's Bicycle Boulevards, which are intended to form a low stress backbone network throughout the city, are discussed in greater detail in the following section.

Table 3-5: Existing Bicycle Boulevard Network

BIKEWAY TYPE	MILEAGE
Class IA: Paved Paths	13.9 miles
Ohlone Greenway	1.2 miles
San Francisco Bay Trail	7.4 miles
Aquatic Park Path	2.5 miles
9th Street Path	0.1 miles
West Street Path	0.5 miles
Other Paths	2.2 miles
Class IB: Unpaved Paths	5.3 miles
Class IIA: Standard Bicycle Lane	11.7 miles
Class IIB: Upgraded Bicycle Lane	0.3 miles
Buffered Bicycle Lanes	0.3 miles
Class IID: Contraflow Bicycle Lane	0.4 miles
Class IIIA: Signage-only Bicycle Route	4.5 miles
Class IIIC: Standard Sharrows	2.7 miles
Class IIIE: Bicycle Boulevard	11.9 miles
Class IVA: One-way Cycle Track/ Protected Bikeway	0.1 miles
Total	50.8 miles
Berkeley Bicycle Boulevard Network	15.8 miles

*Berkeley's Bicycle Boulevard network comprises segments of Class I, II and III facilities.



3.3 BICYCLE BOULEVARDS

3.3.1 What is a Bicycle Boulevard?

A Bicycle Boulevard is a roadway intended to prioritize bicycle travel and provide a low stress experience for people on bikes of all ages and abilities. The goal of Bicycle Boulevards are to provide low stress bikeways on pleasant neighborhood streets that are both safe and convenient. In order to achieve these goals, Bicycle Boulevards are only appropriate on streets without large truck or transit vehicles, and where traffic volumes and speeds are already low, or can be further reduced through traffic calming. For convenience, Bicycle Boulevard routes should not require people bicycling to stop any more frequently than they would on a parallel route.

The first seven Bicycle Boulevards in Berkeley were developed through community workshops in 1999, from which a set of design tools and guidelines were created. The guidelines outlined three phases of implementation: (1) signs and markings, (2) traffic calming and stop sign removal, and (3) intersection crossings. The first phase of implementation was finished in 2003. The second and third phases, which focus on safety and convenience, are being addressed as part of this Plan.

ELEMENTS OF BICYCLE BOULEVARDS:





Distinct Visual Identity: Unique pavement markings and wayfinding signs increase visibility of Bicycle Boulevard routes, assist with navigation, and alert drivers that the roadway is a priority route for people bicycling.





Safe, Convenient Crossings: Traffic controls, warning devices, and/or separated facilities at intersections help facilitate safe and convenient crossings of major streets along the Bicycle Boulevard network.



Bicycle Priority: Traffic calming treatments such as traffic circles, diverters, and chicanes, sometimes in place of existing stop signs, can help prioritize bicycle through-travel and discourage cut-through motor vehicle traffic.

BICYCLE BOULEVARD NETWORK

The Bicycle Boulevard Network consists of four north-south routes and three east-west routes:

North-South Routes

- Ninth Street
- California Street/King Street
- Milvia Street
- Hillegass Avenue/Bowditch Street

East-West Routes

- Virginia Street
- Channing Way
- Russell Street

Figure 3-2 shows this existing network.

3.3.2 Signage and Marking System

Berkeley pioneered a unique Bicycle Boulevard signage and marking system. The distinct purple signs are instantly recognizable and provide greater wayfinding information than standard Class III Bike Route signs. Signage and markings used along Berkeley's Bicycle Boulevards include:

- Destination and Distance Information Signs
- Route and Off-Route Guidance Signs
- Street and Advance Street Identification Signs
- Pavement Markings ("BIKE BLVD" stencils)

Each of these signs provides one or more of the 4 D's of a complete wayfinding system: destination, direction, distance, and distinction.

3.3.3 Traffic Calming

Berkeley's Bicycle Boulevards use traffic calming and bicycle priority to achieve a safe, comfortable and convenient experience for people who bicycle. Traffic calming treatments used along Berkeley's Bicycle Boulevard network include those shown below:



CIRCLE

Reduces speed at intersection using raised center median

DIVERTER



Prohibits auto traffic from entering into, and/or exiting from a street.

HUMP

 \sim

Reduces speed along segments using vertical deflection

CHICANE



Reduces speed along segment using horizontal deflection

Listance and reduces speeds

BULB-OUT

by viusally narrowing roadway at intersections





3.4 EXISTING BICYCLE SUPPORT FACILITIES

3.4.1 Wayfinding

A high quality bicycling environment includes not only bicycle facilities, but also an easily navigable network. Bicycle wayfinding assists residents, tourists and visitors in finding key community destinations by bicycle. Signs may also include "distance to" information, which displays mileage to community destinations, as seen below.

Existing Bicycle Boulevard wayfinding in Berkeley



3.4.2 Bike Parking

Bicycle parking is an essential supporting element of a complete bikeway network. Figure 3-4 shows the existing bike parking locations in Berkeley. Bicycle parking is generally classified into short-term or long-term facilities.

Short-term bicycle parking refers to traditional bike racks which may be located on public or private property. Bike racks serve people who need to park their bikes for relatively short durations, approximately two hours or less. Short-term bicycle parking does not provide additional security, so locked bicycles and their accessories exposed to potential theft or vandalism. However, short-term bike racks are more numerous and often more conveniently located near a destination. Short-term parking should be within constant visual range of a building or destination or located in welltraveled pedestrian areas to deter theft or vandalism. Within Berkeley there are over 1,300 on-street bike racks (providing over 2,600 spaces).

Bicycle Parking Corrals are groups of on-street bike racks that make efficient use of limited space where bicycle parking is in high demand. Corrals typically consist of five bicycle racks lined in a row which typically accommodate ten bicycles in a space otherwise occupied by one to two on-street motor vehicle parking spaces. Berkeley currently has seven bike corrals providing 70 spaces. Berkeley residents, local employees, and business and property owners



SHORT-TERM PARKING Allows for quick visits to stores, restaurants, schools, and other daylight-hour operations.



LONG-TERM PARKING Allows long-distance commuters the security of mind to store their bikes without worry of theft.

can request a bike corral through the City's Bike Corral Program. Requests are evaluated by City staff and, if a location is feasible, the location is added to the City's bicycle rack request list for installation as resources allow.

Long-term bicycle parking is the most secure form of parking and is ideal for individuals who need to park their bikes for more than a few hours or overnight. Long-term bike parking requires more space than short-term racks, may be located farther away from the ultimate destination, and is generally more costly due to added security or space requirements. Longterm parking can consist of:

- **Bike Lockers.** Fully enclosed and generally weather-resistant space where a single bicycle can be parked, secured by key or electronic lock. Bike lockers within Berkeley are located at Ashby and North Berkeley BART stations, the Berkeley Amtrak station, and the UC Berkeley campus. These lockers utilize the BikeLink system, which is an electronic payment card that allows individuals to park in any available locker and pay a nominal hourly fee (\$0.05 per hour).
- Enclosed Bike Cages. A fenced enclosure containing multiple bike racks. Entry to the enclosure is secured with a lock or key code, but within the cage, bicycles are exposed and secured to racks with the owner's own lock. Cages can be outside (ideally with a roof for weather resistance), or located inside building areas such as parking garages or utility rooms. Because contents are visible through the cage and bikes inside are accessible, the security of a bike cage is dependent on managing who has access to the entry key or code. Bike cages are most appropriate for closed environment such as a business, office building, or multifamily development with access limited to owners, tenants, or employees.
- **Bike Room.** Bicycle racks located within an interior locked room or a locked enclosure. Similar to a bike cage, but with increased security of being in a fully enclosed room without visibility. As with a bike cage, the security of a bike room is dependent on managing who has access to the entry key or code, and bike rooms are most appropriate where access is limited to owners, tenants, or employees.







Figure 3-3: Bicycle Parking Space Comparison

 Bike Station. A full-service bike parking facility offering controlled access and typically offering other supporting services such as attended parking, repairs, and retail space. The Berkeley Bike Station is located in a retail space on Shattuck Avenue adjacent to the Downtown Berkeley BART station and offers free attended valet parking, 24 hour accesscontrolled bike parking, bike repairs, sales of bike accessories, bike rentals, and classes.





FIGURE 3-4: EXISTING BICYCLE SUPPORT FACILITIES



3.5 UC BERKELEY CONNECTIONS

The University of California, Berkeley, located adjacent to downtown, had an enrollment of approximately 37,500 students in 2014. The most recent transportation report from the University states that 49 percent of the UC Berkeley community (students, faculty, and staff) reports using a non-auto mode of transportation to commute to campus.¹ The bikeway connections between the UC Berkeley campus and the City's bikeway network are important for supporting the community's bicycle mode share of all trip purposes. Figure 3-6 shows the existing bicycle network on and around campus.

Bicycle theft is an increasing problem at UC Berkeley. In January 2015, the campus Police Department enacted a "bait bike" program where bikes are equipped with tracking systems that enable officers to locate the bikes after they are stolen. Seven months later, bike thefts are down 45 percent and 31 thieves have been arrested.



Bicycle parking at UC Berkeley.

Campus Bicycle Plan (2006). University of California, Berkeley. http://pt.berkeley.edu/sites/ default/files/UCB_BikePlanFinal.pdf

BIKE MODE SPLIT





ARE A POPULAR HOME LOCATION FOR FACULTY AND GRAD STUDENT WHO BIKE

NON-AUTO TRAVEL

80% OF CAL-AFFLIATES COMMUTE TO CAMPUS BY A NON-AUTO FORM OF **TRANSPORTATION**

BAIT BIKE PROGRAM

SINCE IMPLEMENTATION, **31 ARRESTS HAVE** BEEN MADE AND BIKE THEFT HAS DECREASED 45%



Figure 3-5: Summary of UC Berkeley and bicycles



BICYCLE BOULEVARD NETWORK



HHHH RAILROAD



BART STATION

3.6 LAND USE PATTERNS

The Berkeley Bicycle Plan will support Berkeley's Priority Development Areas (PDAs), the areas where the City plans to focus development into denser, mixed land-use areas along Primary Transit Routes, shown in **Figure 3-7**. In conjunction with improved transit service, quality bicycle infrastructure within PDAs is intended to offer improved alternatives to driving. The existing and planned land uses in Berkeley have informed the recommendations of the Plan in an effort to maximize the number of residents who will have access to bicycle infrastructure.

3.6.1 Communities of Concern

As part of the San Francisco Bay Area's longrange integrated transportation and land-use/ housing strategy, Plan Bay Area, the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) analyzed the distribution of benefits and burdens that would result from implementation of the region's preferred planning scenario. To conduct this analysis, ABAG and MTC, along with extensive input from the Equity Working Group and other stakeholders, identified the location of "communities of concern." These communities included four or more of the factors listed in **Table 3-6**.

FACTOR	PERCENT OF REGIONAL POPULATION	CONCENTRATION THRESHOLD
Minority Population	54%	70%
Low Income (<200% of Poverty) Population	23%	30%
Limited English Proficiency Population	9%	20%
Zero-Vehicle Households	9%	10%
Seniors 75 and Over	6%	10%
Population with a Disability	18%	25%
Single-Parent Families	14%	20%
Cost-Burdened Renters	10%	15%

Table 3-6: Community of Concern Factors and Thresholds*

*Appendix A: Detailed Methodology, Plan Bay Area (2013). http://planbayarea.org/pdf/Draft_Plan_Bay_Area/Appendices_to_Draft_ Equity_Analysis_Report.pdf



FIGURE 3-7: LAND USE AND PRIORITY DEVELOPMENT



I - THE DOWNTOWN BERKELEY PRIORITY DEVELOPMENT AREA CALLS FOR MORE INTENSE, MIXED-USE DEVELOPMENT NEAR BART AND AC TRANSIT HUBS AS PART OF A LONG-TERM STRATEGY TO ENCOURAGE NON-AUTOMOBILE-BASED GROWTH PATTERNS

II - SINGLE FAMILY RESIDENTIAL (R-1), LIMITED TWO-FAMILY RESIDENTIAL (R-1A), SINGLE FAMILY RESIDENTIAL HILLSIDE (R-1H), SPECIFIC PLAN (SP), ENVIRONMENTAL SAFETY - RESIDENTIAL (ES-R), UNCLASSIFIED (U), RESTRICTED TWO-FAMILY RESIDENTIAL (R-2), RESTRICTED TWO-FAMILY RESIDENTIAL HILLSIDE (R-2H), RESTRICTED MULTIPLE-FAMILY RESIDENTIAL (R-2A), RESTRICTED MULTIPLE-FAMILY RESIDENTIAL HILLSIDE (R-2AH),

III - MULTIPLE-FAMILY RESIDENTRIAL (R-3), MULTIPLE-FAMILY RESIDENTIAL HILLSIDE (R-3H)

IV - MULTI-FAMILY RESIDENTIAL (R-4), MULTI-FAMILY RESIDENTIAL HILLSIDE (R-4H), HIGH DENSITY RESIDENTIAL (R-5), HIGH DENSITY RESIDENTIAL HILLSIDE (R-5H), RESIDENTIAL HIGH DENSITY SUBAREA (R-S), RESIDENTIAL HIGH DENSITY SUBAREA HILLSIDE (R-SH), RESIDENTIAL MIXED USE SUBAREA (R-SMU), MIXED USE RESIDENTIAL (MUR)

V - GENERAL COMMERCIAL (C-1), C-DMU BUFFER, C-DMU CORE, C-DMU OUTER CORE, C-DMU CORRIDOR, C-DMU BUFFER, ELMWOOD COMMERCIAL (C-E), NEIGHBORHOOD COMMERCIAL (C-N), NEIGHBORHOOD COMMERCIAL HILLSIDE (C-NH), NORTH SHATTUCK COMMERCIAL (C-NS), NORTH SHATTUCK COMMERCIAL HILLSIDE (C-NSH), SOUTH AREA COMMERCIAL (C-SA), SOLANO AVENUE (C-SO), TELEGRAPH AVENUE COMMERCIAL (C-T), WEST BERKELEY COMMERCIAL (C-W)

VI - MANUFACTURING (M), MIXED MANUFACTURING (MM), MIXED USE - LIGHT INDUSTRIAL (MULI)

With the City of Berkeley, the identified communities of concern were concentrated in south Berkeley near UC Berkeley and the Adeline Street corridor as well as west Berkeley around the San Pablo Avenue and University Avenue

corridors. See Figure 3-8 for a map of Berkeley's communities of concern. The proposed bikeway network should include particular consideration of how the projects will benefit and burden these communities.



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3.7 EXISTING PROGRAMS

Bicycle education, encouragement, and enforcement programs are an integral part of a bicycle-friendly city. The City of Berkeley supports and participates in bicycling education, encouragement, enforcement, and evaluation programs, which are described below. Program recommendations will be included in Chapter 6.



Alameda County SR2S programs use different educational and encouragement tactics depending on the grade level.

3.7.1 Safe Routes to School

Alameda County Safe Routes to School (SR2S) is a program of the Alameda County Transportation Commission that encourages students to get to school using active or shared forms of transportation including bicycling, walking and carpooling. The SR2S program funds and supports a variety of bicycle and pedestrian safety education activities, encouragement events, and school outreach and coordination. Program services are offered free for enrolled schools, and the program currently serves approximately 170 schools across Alameda County. Bicycle-specific programming within SR2S includes bike rodeos for grades K-5, a "Drive Your Bike" cycling skills program for middle school students, and the BikeMobile van which offers mobile bicycle repairs at schools and community events. Multiple Berkeley schools participate in the Alameda County SR2S program each year.

3.7.2 Bicycle Safety Education

The Alameda County Transportation Commission administers a countywide Bicycle Safety Education program which includes various classes and workshops promoting safe cycling skills. These events include: Traffic Skills 101 classes, road riding class workshops, family cycling workshops, and bike rodeos. Classes are held throughout Alameda County.

Bike East Bay, which is a non-profit organization dedicated to promoting bicycling as an everyday means of transportation and recreation for communities in the Contra Costa and Alameda Counties, also works with the City of Berkeley to host and coordinate education and encouragement activities and events in the City.



Residents and visitors biked through a temporary protected bikeway on Milvia Street during Bike to Work Day 2015

3.7.3 Bike to Work Day

Each year, the City of Berkeley participates in the Bay Area's Bike to Work Day activities. As bicycling has grown in popularity in the region, the event has continued to attract more and more residents and commuters. Berkeley's 2015 Bike to Work Day energizer station allowed commuters to test a temporary protected bikeway. In 2015 and 2016, and the City hosted major post-work celebrations by closing down a segment of Derby Street east of Milvia for live music, food trucks, and recognition of this year's Bike Friendly Business and Bike Commuters of the Year awards. Outreach for the Bicycle Plan update was conducted at both the 2015 and 2016 Bike to Work Day celebration events.

3.7.4 Bicycle Registration and Reporting Theft

The City of Berkeley Police Department does not offer any means of bicycle registration, but refers residents to www.bikeindex.org which is used by other Bay Area bike owners. This free website allows bicycle owners to register their bicycle, transfer ownership, and list a stolen bicycle. In the event that a bicycle is lost or stolen, the City of Berkeley Police Department offers an online portal for reporting theft.



Signs for Walk Bikes on Sidewalk, Ride Bikes on Street pilot program

3.7.5 Walk Bikes on Sidewalk, Ride Bikes on Street Pilot Program

In 2003, the City of Berkeley implemented a pilot program to attempt to increase public safety and reduce conflicts between people walking, bicycling, and driving. The project's goal was to better inform people walking, bicycling, and driving that the Berkeley Municipal Code (BMC) and the California Vehicle Code require bicycles be walked on the sidewalk and bicycles ridden on the street must go in the direction of motor vehicle traffic (unless in a contraflow bicycle lane). The Shattuck Avenue corridor between University Avenue and Kittredge Street in downtown Berkeley was the pilot area. The program included mounted traffic signs (shown above), sidewalk stencils at curb ramps, posters, and police enforcement. The "Walk Bikes on Sidewalk, Ride Bikes on Street" Pilot Program was developed by the Transportation Division of the City of Berkeley's Public Works Department in conjunction with the Berkeley Police Department, the Bicycle and Pedestrian subcommittees of the Transportation Commission, and the Commission on Aging and Disability. The pilot program ended in 2004.

3.7.6 Community Bike Shops

Street Level Cycles and Biketopia Community Workshop are two community bicycle retails shops that offer full-service bike repair, classes for do-it-yourself repair, and bike education programs. The City of Berkeley donates all abandoned bicycles to local community bike shops for use in youth education programs.

3.7.7 Helmet Distribution

The Berkeley Health and Human Services Department partnered with the Berkeley Police Department to offer free helmets for children as a means of encouraging children to wear helmets while bicycling. Between 1995 and 2011, over 3,000 helmets were distributed. The helmet distribution program ended due to a lack of continued grant funding and staff time to administer the activities.



NEEDS ANALYSIS

- All

BIKE SURVEY BE RESULTS Type of Cyclist Level of Comfort

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6666

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The needs of people bicycling within Berkeley are diverse and dependant on an individuals' level of experience, comfort, and confidence, to name a few factors. To understand the needs of people bicycling in Berkeley, this chapter examines a number of data sources including:

- Bicycle counts of the number of people bicycling at selected locations on the Berkeley bikeway network, collected annually
- Estimated bicycle trips of the number of residents who bicycle to work, school, shopping, and other nonrecreational trips
- Bicycle-related collisions to understand locations potentially in need of bicycle related improvements
- Community input on challenges to bicycling in Berkeley gathered from public outreach events and the project website
- The "Four Types of Cyclists" typologies applied to people who bicycle in Berkeley based on a citywide resident survey
- Level of Traffic Stress analysis to identify locations within the existing street network that may attract or deter people from riding bicycles in Berkeley
- Bicycle demand analysis to identify existing and potential origin and destination locations for people riding bicycles
- Gap analysis to identify potential missing links in the citywide bikeway network

⊿.1. CENSUS DATA

United States Census data provides an overall context for bicycling activity in Berkeley. The US Census American Community Survey (ACS) commute data is a consistent source for tracking long-term journey-to-work commute trends. However, the Census only collects data on the primary mode that Berkeley residents use to travel to work, and does not count residents who use a bicycle as part of their commute (linking to a longer transit trip, for example). The Census count also excludes trips made for recreation, to run errands, or to commute to school. Census data, therefore, only tracks a portion of the total bicycle trips in Berkeley.

Table 4-1 shows the commute mode share as reported in the 2014 ACS five-year estimates. Based on this multi-year sample, Berkeley has the fourth highest commute mode share of any city in the United States with 8.5 percent of residents commuting by bicycle to work. Table **4-2** shows the percentage of commute trips by bicycle for the top ten United States cities, according to the 2014 ACS five-year estimates.

Table 4-1: Mode Share for Work Commute (2014 ACS, 5-Year)

MODE	PERCENTAGE
Bicycle	8.5%
Car, truck, or van	42.7%
Public Transportation (excluding taxicab)	20.8%
Walked	16.2%
Taxicab, motorcycle, or other means	1.4%
Worked at home	10.4%

СІТҮ	TOTAL COMMUTE BY BICYCLE	POPULATION
Davis, CA	21.8%	66,093
Boulder, CO	10.1%	102,002
Palo Alto, CA	9.0%	65,998
Berkeley, CA	8.5%	115,688
Somerville, MA	5.3%	77,560
Cambridge, MA	6.9%	106,844
Portland, OR	6.3%	602,568
Eugene, OR	7.7%	158,131
Fort Collins, CO	6.5%	149,627
Santa Barbara, CA	6.0%	89,669

Table 4-2: Top US Bicycle Cities, Commute Trips by Bicycle (2014 ACS, 5-Year)

4.2 BICYCLE COUNTS

The City of Berkeley has been conducting bicycle counts along the bikeway network annually since 2000. The City's bicycle counts supplement the ACS data, which collects data on the primary mode of travel to work on an ongoing basis but does not consider those who use a bicycle as only a part of their commute trip, for recreation, or to run errands.

Following national best practices, trained volunteers conduct manual counts during the afternoon peak period from 4:00 pm to 6:00 pm on midweek days (Tuesday, Wednesday, and/ or Thursday) during the fall season. At each location, observers count bicyclists as they enter the intersection and note their movement (left turn, right turn, or straight through) as well as helmet use, sidewalk riding, and observed gender of the rider to the degree possible given the limitations of observational counts. Counts have been conducted at the following ten intersections located along the bikeway network:

- Bowditch & Channing
- Colusa & Marin
- Hillegass & Ashby
- Milvia & Channing
- Milvia & Hearst
- MLK & Russell
- Ninth & University
- Spruce & Rose
- Telegraph & Woolsey
- Virginia & California

Manual counts were conducted at select locations from 2000 to 2005 and consistently at all ten locations from 2009 to 2015. Due to staff shortages, limited or no counts were conducted from 2006 to 2008. Bicycle counts have been conducted at additional locations in various years, but the ten intersections listed above form the core subset of ongoing annual count locations. Having the same combination of intersections and data collection methods across consecutive years allows for effective analysis of changes and trends in bicycle volumes and behaviors in the city.
The City began manual counts at three additional locations in 2015:

- 9th St Path
- West St Path & Virginia
- Hearst & Oxford

Table 4-3 shows the manual bicycle countscollected at all locations and years since 2000.Overall, the average number of bicyclists at theten intersections has increased over the years, asshown in **Figure 4-1**.

Table 4-3:	Total	Counted	Bicyclists,	2-Hour	Evening	Peak	Period,	2000	-2015
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INTERSECTION	2000	2001	2002	2003	2004	2005	2009	2010	2011	2012	2013	2014	2015
Bowditch & Channing	224	258	214	229	272	187	296	305	254	274	216	308	268
Colusa & Marin	-	-	-	-	-	38	42	58	43	36	32	45	29
Hillegass & Ashby	57	-	116	-	76	105	114	138	160	144	159	125	164
Milvia & Channing	-	344	275	336	294	312	469	510	531	536	528	573	536
Milvia & Hearst	-	302	356	350	337	290	230	402	343	436	403	460	419
MLK & Russell	110	75	85	115	119	113	289	240	261	280	306	288	252
Ninth & University	44	47	65	16	75	82	80	110	107	95	152	146	150
Spruce & Rose	-	99	56	67	75	73	48	95	86	71	82	83	60
Telegraph & Woolsey	135	149	149	-	146	145	227	187	214	212	194	225	184
Virginia & California	-	47	74	84	80	108	140	140	166	202	175	204	229
Avg. of 10 intersections	114	132	126	120	138	126	194	219	217	229	225	246	229
Total of 10 intersections	570	1,321	1,390	1,197	1,474	1,453	1,935	2,185	2,165	2,286	2,247	2,457	2,291
California & Russell	30	62	59	116	91	113	105	-	-	-	-	-	-
Hearst & Oxford	-	-	-	-	-	-	-	-	-	-	-	-	284
9th Street Path	-	-	-	-	-	-	-	-	-	-	-	-	153
Virginia & West St Path	-	-	-	-	-	-	-	-	-	-	-	-	160
Grand total	600	1,383	1,449	1,313	1,565	1,566	2,040	2,185	2,165	2,286	2,247	2,457	2,888

Figure 4-2 shows the existing bicycle counts at various locations in Berkeley. The counts indicate that, between 2005 and 2015, there has been a 58 percent increase of people bicycling at the ten selected intersections.

The following subsections describe trends regarding bicyclist gender, helmet use, and sidewalk riding based on information gathered during the annual counts.



Figure 4-1: Change in Annual Average Bicycle Counts, 2000-2015



FIGURE 4-2: BICYCLE COUNTS AT SELECTED INTERSECTIONS

BIKES PER 2-HOUR PEAK PERIOD [2015]



4.2.1. Gender

The gender of people bicycling has remained consistent between 2009 and 2015 (see Figure 4-3). In 2015, 63 percent of bicyclists were observed to be male (1,441 out of 2,291 bicyclists) which is almost identical to the 62 percent of bicyclists who were observed to be male in 2009. Recent research suggests that women may have a greater perception of safety concerns for streets without bicycle facilities¹.

This is reflected in the observations of bicyclist gender in Berkeley, with the lowest proportion of women bicycling occurring at Spruce Street and Rose Street (22 percent) and Hearst Avenue and Oxford Street (28 percent), streets with limited bicycle accommodations. The highest proportion of women bicycling occurred at Martin Luther King, Jr. Way and Russell Street (41 percent), Colusa Avenue and Marin Avenue (41 percent), and Milvia Street and Channing Way (40 percent), streets with more robust bicycle infrastructure.



Figure 4-3: Bicyclist gender at 10 selected intersections (2009-2015)

Baker, L. 2009 - "How to get more bicyclists on the road: To boost urban bicycling, figure out what women want," Scientific American Magazine, October 16, 2009; Twaddle, H., et al., 2011 - Latent bicycle commuting demand and effects of gender on commuter cycling and accident rates, Transportation Research Record, 2190/2010, 28-36; Reeves, H. 2012 - "Spokes & soles // As infrastructure improves, more Twin Cities women bike,' Southwest Journal, 11 June 2012; Akar, G., Fischer, N., and Namgung, M. 2013 - Bicycling Choice and Gender Case Study: The Ohio State University, Int. J. of Sust. Trans., Volume 7, Issue 5

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4.2.2. Helmet Usage

In 2015, 72 percent of observed bicyclists at the ten selected intersections were wearing a helmet (1,649 of 2,291 bicyclists). While the percent of bicyclists wearing helmets has fluctuated since counts began in 2009, the overall trend has been a steady 16 percent increase between 2009 and 2015 (see **Figure 4-4**). The intersections with the greatest observed helmet use between 2009 and 2015 were Spruce Street at Rose Street (80 to 90 percent) and Marin Avenue at Colusa Avenue (76 to 95 percent).



Figure 4-4: Helmet use at 10 selected intersections (2009-2015)

HELMET NO HELMET

4.2.3. Sidewalk Riding

Between 2009 and 2015, the number of people riding their bicycles on the sidewalk instead of in the street was low relative to the total number of bicyclists observed at the 10 selected intersections, remaining consistently between four and five percent of all observed bicyclists. This is much lower than 16 percent observed in 2000¹. However, observations at the intersection of 9th Street and University Avenue revealed that 15 percent of bicyclists rode on the sidewalk, with most of the sidewalk riding taking place on University Avenue, an arterial street with many activity centers and no bicycle facilities (see Figure 4-5).

¹ Observations of sidewalk riding in 2000 included only five intersections instead of the ten intersections tracked between 2009-2015 (Bowditch and Channing, Hillegass and Ashby, Martin Luther King, Jr. and Russell, 9th and University, and Telegraph and Woolsey).



Figure 4-5: Observed Sidewalk Riding

4.2.4. Automated Counters

In addition to the ten selected intersections, 24-hour automated count data was collected along two paths: the West Street Path near Virginia Street and the 9th Street Path near the south Berkeley city limits. While manual bicycle counts provide a snapshot of bicycling on a single day, automated counters provide a continuous stream of ridership data to identify daily, monthly, and yearly trends. The automated counters are not able to distinguish between bicyclists and pedestrians; therefore, separate modal split factors were developed through manual observations of the count locations. On average, the West Street Path near Virginia Street experiences just over 300 people bicycling per day and the 9th Street Path near the south Berkeley city limits experience almost 700 bicyclists per day (See Table 4-4).

	WEST STREET PATH	9TH STREET PATH
Total Annual Bike/Ped	197,903	344,527
Total Annual Bike	108,253	252,194
Monthly Average	9,634	7,700
Daily Average	317	691
Annual Average PM Peak (4-6 PM)	52	113

Table 4-4: Interpolated Bike Counts at Selected Path Locations (October 2014 - September 2015)

4.3. BICYCLE DEMAND

A two-part bicycle demand analysis was conducted to provide a more accurate estimate of total bicycling in Berkeley as well as the geographic distribution of existing and potential bicycle trips.

4.3.1. Total Daily Bicycle Trips

The first part of the bicycle demand calculation was run using additional Berkeley-specific travel data from the ACS, the Alameda County Safe Routes to School Program, and a recent UC Berkeley travel survey. The demand model inputs are outlined below, and the results and full list of data sources are shown in **Table 4-5**:

- Number of bicycle commuters, derived from the ACS
- Work at home bicycle mode share
- Number of those who work from home and likely bicycle (derived from assumption that five percent of those who work at home make at least one bicycle trip daily)
- Bicycle to school mode share:
- Number of students biking to school, derived from multiplying the K-8 student population by the Alameda County bicycle to school average rate of four percent

- Number of those who bicycle to transit:
 - » Number of people who bicycle to BART or Amtrak, assuming that five percent of transit patrons use bicycles to access the station and/or their destination

Based on this model, there are an estimated 37,069 total daily bicycle transportation trips made by Berkeley residents. This number includes people who bike for work, errands, personal trips, and school trips. It does not account for purely recreational trips. Together with the ACS commute data, as well as the City of Berkeley's ongoing bicycle count data, this analysis can be used to track citywide bicycle use and demand in Berkeley over time.

Fable 4-5: Interpolated Bike	e Counts at Selected	Path Locations (O)ctober 2014 – S	eptember 2015)
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VARIABLE	FIGURE	CALCULATION AND SOURCE
Existing number of bike-to-work commuters	4,640	Employed persons multiplied by bike-to-work mode share
Existing bike-to-work mode share	8.5%	2014 ACS, 5-Year Estimates
Existing employed population	54,583	2014 ACS, 5-Year Estimates
Existing number of work-at-home bike commuters	284	Employed persons multiplied by work-at-home mode share. Assumes 5% of population working at home makes at least one daily bicycle trip
Existing work-at-home mode share	10.4%	2014 ACS, 5-Year Estimates
Existing employed population	54,583	2014 ACS, 5-Year Estimates
Existing transit bicycle commuters	568	Employed persons multiplied by transit mode share. Assumes 5% of transit riders access transit by bicycle (Average of BART and AC Transit bike access volumes - BART Bicycle Plan Modeling Access to Transit (2012) and Alameda Countywide Bicycle Plan (2012))
Existing transit-to-work mode share	21.0%	2014 ACS, B08301 5-Year Estimates
Existing employed population	54,183	2014 ACS, 5-Year Estimates
Existing school children bike commuters	278	School children population multiplied by school children bike mode share
Existing school children bicycling mode share	4.0%	Alameda County SR2S Program (Berkeley elementary and middle school only)
Existing school children, ages 5-14 (grades K-8th)	6,938	2014 ACS, S0101 5-Year Estimates
Existing college/graduate bike commuters	12,778	College/graduate student population multiplied by college student bicycling mode share
Existing estimated college/graduate bicycling mode share	34.0%	UC Berkeley 2014 (includes graduate students who live in and outside of Berkeley)
Existing number of college/graduate students in study area	37,581	UC Berkeley 2014 (includes graduate students who live in and outside of Berkeley)
Existing total number of bike commuters	18,548	Total bike-to-work, school, college and utilitarian bike trips. Does not include recreation.
Total daily bicycling trips	37,096	Total bicycle commuters x 2 (for round trips)

This is an order-of-magnitude estimate based on available American Community Survey data and does not include recreational trips, nor does it include trips made by people who live in other cities and work or attend school in Berkeley. It can be used as a secondary analysis method to track bicycle usage estimates over time.

4.3.2. Bicycle Demand Map

The estimate of daily bicycle trips shown in **Table 4-4** is a useful metric to track over time; however, for planning purposes it is also important to understand the geographic potential for bicycle trips. Spatial analysis of the proximity and density of trip generators (where people live) and trip attractors (where people work, shop, play, access public transit, and go to school) can help identify areas with high potential demand for bicycle activity in Berkeley. The list of data inputs is shown in **Table 4-6**. **Figure 4-6** overlays trips generators and trip attractors into a single composite sketch of bicycling demand in Berkeley: the darker the color, the higher the demand for bicycling. The current bikeway network is overlaid on the demand map to illustrate how well current bikeways provide coverage and connectivity to high demand areas. The results can be used to identify network gaps and to prioritize bicycle projects in areas of high trip demand.

DEMOGRAPHIC DATA	 Population Density % of Bike/Ped Commuters % of Households Without Vehicles
EMPLOYMENT DATA	 Retail Employment Density Educational Services Employment Density Health Care and Social Assistance Employment Density Arts, Entertainment, and Recreation
SHOPPING AND RECREATION DATA	Employment Density Retail Corridors
SHOPPING AND RECREATION DATA	Parks Schools
	• Libraries
	• Museums
TRANSIT DATA	• Bus Stops
	• Train Stops
	• Transit Hubs

Table 4-6: Bicycle Demand Map Inputs

As shown, the majority of the downtown and major street corridors have high demand for bicycling, including Shattuck Avenue, University Avenue, Sacramento Street (north of Allston Way), Telegraph Avenue, portions of San Pablo Avenue, and the areas around the BART and Amtrak stations. Berkeley's system of bikeways has historically been developed around a lowerstress residential street Bicycle Boulevard network, with many major streets lacking bikeways. Figure 4-1 shows that the current bikeway network, while providing coverage across most parts of the city, doesn't directly connect to many of the highest demand areas for bicycling, including commercial street corridors and the perimeter of the UC Berkeley campus. In many cases, only a block or two separates the designated bikeway from the high demand commercial street destinations; however, that "last block" gap can be a significant barrier to residents accessing their destination and choosing to make a trip by bicycle. Last block gaps may force people to ride along high-stress streets without bikeways, and can contribute to unsafe cycling behaviors such as wrong-way riding and sidewalk riding as people seek to take the most direct route to their destination.



FIGURE 4-6: COMPOSITE BICYCLE DEMAND





4.4. COLLISION ANALYSIS

Bicycle-related collisions and collision locations in Berkeley were analyzed over the most recent twelve-year period of available data, 2001-2012. A bicycle-related collision describes a collision involving a bicycle with a second party (e.g. motor vehicle, pedestrian, stationary object) or without a second party (e.g., the person riding a bicycle has a solo-crash due to slippery road conditions or rider error). The term "collision location" describes a geographic location where at least one collision was recorded over the twelve-year period.

Collision data for this report was generated from the California Statewide Integrated Traffic Report System (SWITRS). Because SWITRS combines records from all state and local police departments, data varies due to differences in reporting methods. It is important to note that the number of collisions reported to SWITRS is likely an underestimate of the actual number of collisions that take place because some parties do not report minor collisions to law enforcement, particularly collisions not resulting in injury or property damage. Although underreporting and omissions of "near-misses" are limitations, analyzing the crash data can illustrate trends both spatially and in behaviors (motorist and cyclist) or design factors that cause bicycle collisions in Berkeley. A map of bicycle-related collision density from 2001 to 2012 is shown in Figure 4-6.



The analysis of reported bicycle-related collisions can reveal patterns and potential sources of safety issues, both design and behavior-related. These findings can provide the City of Berkeley with a basis for infrastructure and program improvements to enhance bicycle safety. A list of primary findings is below, and described in the following sections. A more detailed collision analysis is included in Appendix B.

- Between 2001 and 2012, there were 1,773 total reported bicycle collisions in Berkeley.
- Bicycle-involved collisions were concentrated along roadway segments without bikeway infrastructure near major activity centers such as commercial corridors, UC Berkeley, and Ashby BART station. This suggests that people bicycling in Berkeley are willing to ride on routes without bikeway infrastructure if it is the most direct and accessible route to their destination.
- On streets with bikeway infrastructure, Milvia Street had the highest number of total collisions between 2001 and 2012, which suggests that programmatic and design changes may be necessary to accommodate the mix of roadway users along this downtown Bicycle Boulevard.
- Along Bicycle Boulevards, the highest density of collisions occurred where the Bicycle Boulevard crossed a major arterial such as Shattuck Avenue, University Avenue, College Avenue, and Martin Luther King Jr Way. This

finding aligns with public input, which called for improved crossings of Bicycle Boulevards at major streets.

- Collisions resulting in **severe injuries were concentrated at intersections**, particularly along Ashby Avenue, Adeline Street, College Avenue, and Channing Way.
- Approximately 50 percent of reported collisions involved bicyclists between the ages of 20 and 39, over representing the Census' reported total number of residents within this age range by roughly 10 percent. This may be the most common age of people who bicycle in Berkeley. This finding may also suggest that targeted programming for college students and young professionals could help reduce collisions for which the person bicycling is at fault.
- The most common factors resulting in a bicycle-involved collision were a right-ofway violation, hazardous violation, unsafe speed, and improper turning. Potential collision mitigation strategies to address these violations may include bikeway channelization along major arterials, distracted driving programming, additional strategies to slow people riding bicycles on non-Bicycle Boulevards with steep downhill slopes, and improved intersection design. Further definition on these collision factors are included below.

4.5. PUBLIC OUTREACH

The project involved an extensive public engagement process which included two public open houses, regular updates to the Bicycle Subcommittee of the Transportation Commission, information tables at nearly a dozen local community events (e.g., farmers' markets, street fairs), outreach at the 2015 and 2016 Bike to Work Day events, a project website with an ongoing comment page, and a bicycling preference survey. Over 1,000 comments were received throughout the process from gathering existing conditions through review of the public draft plan document. The main themes public input indicated support for include:

- Safer crossings at major streets along the Bicycle Boulevard network
- Designated bikeways along major street corridors, especially those serving downtown and campus area
- Physical separation in bikeway design along major streets, along corridors and at intersections
- Improved pavement quality along the entire bikeway network



4.6. BICYCLING PREFERENCE SURVEY

As part of the public outreach, a survey was conducted of Berkeley residents asking about their interests, current habits, concerns, and facility preferences around bicycling. The survey used address-based random sampling to ensure responses were representative of the Berkeley population.¹ Survey staff interviewed 660 Berkeley residents between March 2 and March 28, 2015, yielding a margin of error of +/- 4 percent and a confidence level of 95 percent.²

The survey was modeled closely after *Four Types of Bicyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential,* a study completed by Professor Jennifer Dill from Portland State University.³ Surveys were administered door-to-door and were presented on tablet computers which included pictures to better convey different street types and other concepts relevant to the survey.

Interviews were conducted during the evening hours of 4:00 PM through 7:30 PM on weekdays and during the afternoon on weekends to ensure greater participation among all demographic groups, especially commuters who would be returning home from work. During the weekday evenings, interviewers were careful to stop before it became too dark outside so as not to appear threatening.

One goal of the survey was to include UC Berkeley students in the respondent pool, as they compose a large percentage the city's population. In addition to the interviews with students that occurred as a result of door-todoor interviewing, outreach representatives conducted interviews at several of the university's dormitories.

4.6.1. Categorizing People Who Bicycle in Berkeley

To understand the potential demand for bicycling in Berkeley, respondents were sorted into groups based both on their current bicycling behavior and their bicycling comfort level on different facility types and roadway conditions. This allowed for comparing responses between groups to help reveal which factors affect one's decision to ride a bicycle, particularly related to different roadway conditions and bikeway facility types. These categories of bicyclists are described below.

¹ The survey firm Civinomics used the publicly available zoning map of the City of Berkeley to categorize each street based upon its zoning designation. Streets were then randomly selected from each zoning category in proportion to the number of residents who live within each category. Each street within a certain zoning designation had an equal chance of being selected compared to other similarly zoned streets in the same area. Some streets have multiple zoning designations through multiple jurisdictions. In such a case, the street is separated out by designation and jurisdictional area and treated as multiple streets.

² A 95% confidence interval means that if the same population is sampled on numerous occasions and interval estimates are made on each occasion, the resulting intervals would bracket the true population parameter in approximately 95% of the cases.

³ Dill, J. and N. McNeil. (2012) Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential. http://web.pdx.edu/-jdill/Types_of_Cyclists_PSUWorkingPaper. pdf.

BICYCLING COMFORT LEVEL

Bicycling comfort level is based on a classification system originally developed by Portland City Bicycle Planner Roger Geller. Geller's "Four Types of Transportation Cyclists" classified the general population of the city into categories of transportation bicyclists by their differing needs and bicycling comfort levels given different roadway conditions. Geller's typologies have been carried forward into several subsequent studies in cities outside Portland at the national level, and were used in the City of Berkeley analysis for consistency with national best practices and comparison to other top cycling cities. Under Geller's classification, the population of a city can be placed into one of the four following groups based on their relationship to bicycle transportation: "Strong and Fearless," "Enthusiastic and Confident," and "Interested but Concerned." The fourth group are nonbicyclists, called the "No Way No How" group.

These categories are meant to guide efforts to assess an area's market demand for bicycling as a means of transportation, such as commuting to work and running errands.

TYPE OF BICYCLIST	DESCRIPTION
Strong and Fearless	This group is willing to ride a bicycle on any roadway regardless of traffic conditions. Comfortable taking the lane and riding in a vehicular manner on major streets without designated bicycle facilities.
Enthusiastic and Confident	This group consists of people riding bicycles who are confident riding in most roadway situations but prefer to have a designated facility. Comfortable riding on major streets with a bike lane.
Interested but Concerned	This group is more cautious and has some inclination towards bicycling, but is held back by concern over sharing the road with cars. Not very comfortable on major streets, even with a striped bike lane, and prefer separated pathways or low traffic neighborhood streets.
No Way No How	This group comprises residents who simply are not interested at all in bicycling may be physically unable or don't know how to ride a bicycle, and they are unlikely to adopt bicycling in any way.

Table 4-7: Four Types of Bicyclists

4.6.2. Survey Results

The survey found that three percent of Berkeley residents are *Strong and Fearless* bicyclists, 16 percent are *Enthusiastic and Confident*, 71 percent are *Interested but Concerned*, and 10 percent fall into the *No Way No How* category. In other words, 90 percent of Berkeley residents already bicycle or would consider bicycling if the right bikeway facility or roadway conditions were available. That is a larger percentage than any other city that has conducted a similar study, including Portland, as shown in **Figure 4-8**.

In Four Types of Bicyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential, Professor Dill outlines a method for creating a profile of a city's population based on Geller's categories. Having done this, planners can then analyze responses to a number of other questions by the different types of bicyclists to better understand the factors that motivate people to bicycle.

A respondent's assignment to one of the four groups depended on their answers to how comfortable they would feel bicycling on various hypothetical street scenarios, e.g. a paved path separate from the street, a two lane commercial street with no bikeway, a four lane commercial street with buffered bicycle lanes, etc. Whether someone indicated that they would like to bicycle more than they currently do, as well as whether they had bicycled in the last month and whether they were physically able to bicycle also determined how some respondents were sorted.

Figure 4-8: Four Types of Bicyclists



Figure 4-9: Bicyclist Level of Comfort



4

identified as Interested but Concerned

4-24

CITY OF BERKELEY BIKE PLAN

INTERESTED BUT CONCERNED BICYCLISTS IN BERKELEY

Seventy-one percent of Berkeley residents were classified as *Interested but Concerned*, which means the majority of Berkeley residents would be willing to bike if the right bikeway facilities were provided. Addressing barriers from this group would yield the greatest return on bicycle facility investment.

Asked to describe their subjective level of comfort riding on different types of streets, survey results showed that *Interested but Concerned* bicyclists become significantly more comfortable as separated bicycle facilities were added to roadways. For example, when asked about riding on a two lane commercial shopping street, the *Interested but Concerned* riders responded that they would be very uncomfortable if there were no bicycle facility, somewhat comfortable if a bicycle lane was added, and very comfortable if there were a bicycle lane separated from traffic by a curb or parked cars.

Taken altogether, the Report's findings indicate the potential for significant ridership growth. With carefully planned infrastructure investments and outreach campaigns that target the needs of the Interested but Concerned group of bicyclists, Berkeley has the potential to experience a substantial increase in bicycle riding.

4.7. LEVEL OF TRAFFIC STRESS

Building on the bicycling preference survey and user typologies, a Level of Traffic Stress (LTS) analysis was conducted for Berkeley's roadway network. Traffic stress is the perceived sense of danger associated with riding in or adjacent to vehicle traffic; studies have shown that traffic stress is one of the greatest deterrents to bicycling. The less stressful—and therefore more comfortable-a bicycle facility is, the wider its appeal to a broader segment of the population. A bicycle network will attract a large portion of the bicycling population if it is designed to reduce stress associated with potential motor vehicle conflicts and if it connects people bicycling with where they want to go. Bikeways are considered low stress if they involve very little traffic interaction by nature of the roadway's vehicle speeds and volumes (e.g., a shared low-traffic neighborhood street) or if greater degrees of physical separation are placed between the bikeway and traffic lane on roadways with higher traffic volumes and speeds (e.g., a separated bikeway or cycletrack on a major street).

An LTS Analysis is an objective, data-driven evaluation model which identifies streets with high levels of traffic stress, gaps in the bicycle network, and gaps between streets with low levels of traffic stress. **Figure 4-10** shows a summary of LTS analysis factors. More information about the LTS Analysis can be found in **Appendix C: Level of Traffic Stress**. Figure 4-10: LTS analysis factors

LEVEL OF TRAFFIC STRESS ANALYSIS

Traffic stress is the perceived sense of danger associated with riding in or adjacent to vehicle traffic.



*According to the Berkeley Bicycle Plan Public Survey

The level of traffic stress scores were mapped to illustrate the low stress connections and gaps throughout Berkeley. It is important to note that people tolerate different levels of stress; a strong and fearless bicyclist will feel less stress than an interested but concerned bicyclist. The LTS results map approximates the user experience for the majority of Berkeley residents, however people may have differing opinions of traffic stress depending on their own experiences.

CITY OF BERKELEY BIKE PLAN

4.7.1. LTS Findings

Figure 4-11 shows the LTS results of the major roadways and on-street bicycle network in Berkeley. Major roadways, such as San Pablo Avenue and Martin Luther King Jr. Way, have high LTS scores, indicating they are the most stressful for people riding bicycles. Many of the existing on-street bicycle network segments in Berkeley consist of relatively low stress streets that are acceptable for travel by some children (LTS 1) and the majority of adults (LTS 2). These are primarily neighborhood street Bicycle Boulevards. However, high stress roadways and intersections bisect this low stress network and create barriers for people who bike along the Bicycle Boulevards or want to access major service and commercial corridors, effectively lowering the corridor LTS score and dramatically reducing comfort.

The low stress streets that have an LTS score of 1 or 2 are shown in **Figure 4-12**. These are the streets on which nearly all types of people should feel comfortable riding bicycles. As shown, Berkeley has good coverage with a network of low stress bikeways. California Street, 9th Street and Hillegass Avenue provide northsouth connections; Virginia Street, Channing Way and Russell Street provide east-west connections. However, there are gaps in the low stress network, including a section on the Milvia Avenue Bicycle Boulevard, a lack of low stress connections north and south of Virginia Street and between Channing Way and Russell Street, and surrounding the UCB campus. High-stress intersections are often a result of a bikeway crossing a major roadway where the intersection design or stop-control is insufficient. For example, Channing Way, an LTS 2 Bicycle Boulevard, crosses Sacramento Street, which is a high-volume roadway. Sacramento Street traffic does not stop, and people riding bicycles must traverse multiple lanes of traffic to continue. As such, an "Interested but Concerned" cyclist may feel comfortable biking on Channing Way, but this journey becomes far more stressful upon reaching Sacramento Street. While many "enthusiastic and confident" or "interested but concerned" Berkelev residents endure such stressful crossing conditions out of necessity, only the three percent of Berkeley residents who identify as "strong and fearless" would actually feel comfortable bicycling on Channing Way across Sacramento Street. Highstress intersections become impediments for individuals traveling on the bike network, and likely inhibit the 16 percent of "enthusiastic and confident" and the 71 percent of "interested but concerned" residents from biking more frequently, or at all. As is, there are very few continuous low stress segments that provide access entirely across Berkeley.

Figure 4-13 shows low stress (LTS 1 and 2) streets and intersections with high stress (LTS 4) gaps. This map helps illustrate how low stress streets in Berkeley's on-street network are often disconnected by high stress roadways and intersections. A continuous low stress network is essential for bicyclists of all abilities to travel easily throughout the street network.



FIGURE 4-11: LEVEL OF TRAFFIC STRESS

CORRIDORS



INTERSECTIONS

- LTS 1 ALL AGES AND ABILITIES (Up to 90% of Berkeley residents)
- LTS 2 INTERESTED BUT CONCERNED (Up to 79% of Berkeley residents)
- LTS 3 ENTHUSIASTIC AND CONFIDENT (Up to 16% of Berkeley residents)
- LTS 4 STRONG AND FEARLESS (Up to 3% of Berkeley residents)

BART STATION







FIGURE 4-12: LOW STRESS NETWORK COVERAGE

CORRIDORS

LTS 1 - ALL AGES AND ABILITIES



INTERSECTIONS

- LTS 1 ALL AGES AND ABILITIES
- LTS 2 INTERESTED BUT CONCERNED



HHHH RAILROAD



BART STATION





FIGURE 4-13: LOW STRESS NETWORK & INTERSECTIONS WITH HIGH STRESS NETWORK & INTERSECTION GAPS



INTERSECTIONS

- LTS 1 ALL AGES AND ABILITIES
- LTS 2 INTERESTED BUT CONCERNED

INTERSECTION GAPS

- LTS 3 ENTHUSIASTIC AND CONFIDENT
- LTS 4 STRONG AND FEARLESS

BART STATION



4.7.2. LTS Conclusion

The Level of Traffic Stress results demonstrate the importance of assessing a citywide bikeway not only for connectivity, but also for its ability to serve the diverse needs of its users. Although the current Berkeley bikeway network provides good overall coverage of low stress bikeways through the Bicycle Boulevards, the presence of high-stress gaps (segments and intersections) along these routes likely inhibit many Berkeley residents who identify as "enthusiastic and confident" and "interested but concerned" from bicycling.

To serve all types of people riding bicycles, an on-street bikeway network must provide continuous low stress LTS 1 and LTS 2 segments and intersections, from end to end. A single high stress gap on an otherwise low stress facility can deter use. By pinpointing and prioritizing the exact high-stress locations that likely dissuade people riding bicycles, this Plan can focus on identifying the improvements that will bring the high-stress LTS 3 and LTS 4 gaps down to low stress LTS 1 and LTS 2 levels, thereby removing the barriers to bicycling for a larger proportion of Berkeley residents.

4.8. INFORMING THE RECOMMENDATIONS

The findings of the needs analysis chapter in terms of demand, collisions, and particularly the Level of Traffic Stress provide quantitative data that directly inform the project recommendations in the next chapter. This Plan focuses on making improvements to address identified gaps in the network:

- High-stress gaps occur on the bikeway network where a bikeway segment or intersection has a high-stress score of LTS 3 or LTS 4. On the Bicycle Boulevard network, any bikeway segment or intersection with a score of LTS 2 or above is considered a high-stress gap. The Bicycle Boulevard network is presumed to be a primarily low stress network for bicyclists of all ages and abilities.
- 2. **Bikeway network demand gaps** are missing bikeway segments where there is high demand but no existing bikeway. Examples include a neighborhood with a deficiency of bikeway access, or a commercial street that has a density of destinations but lacks a bikeway.



Project recommendations in the following chapter focus on making crossing improvements and segment upgrades along the existing LTS 1 and 2 network (primarily Bike Boulevards) to ensure a continuous low stress experience from end-to-end of the facility, as well as upgrading existing higher stress segments of bikeways (primarily Class II bike lanes on major streets) to a lower-stress facility type. Several additional facility segments are recommended in order to provide better network coverage and connectivity in high demand areas. Page intentionally left blank.

PROPOSED BIKEWAY NETWORK

This chapter presents the recommended bikeway network, which supports a vision for Berkeley where bicycling is safe, comfortable, and convenient for people of all ages and abilities.

Recommendations were guided by the Plan's goals and policies, a datadriven safety and demand analysis, and extensive community input. Through this process emerged an overarching bikeway network vision: a continuous and connected system of "Low Stress" bikeways that provide safe and comfortable travel for all users and link to all key destinations in Berkeley. Figure 5.1 illustrates the Low Stress Bikeway Network Vision showing how low-traffic bicycle boulevards, separated major-street bikeways and multi-use paths, all with safe intersection crossings, can form a network that 79% of Berkeley's population would feel comfortable bicycling on.

Safety considerations are especially important for parents riding with their children, or for older children riding independently. And in terms of the potential for reducing traffic congestion and helping to achieve the City's climate action goals, school trips account for a significant portion of morning auto traffic and yet are often less than a mile in length. Therefore it was important that the Low Stress Network connect to as many schools in Berkeley as possible, and allow parents and children within a given enrollment area to have the option of a completely low stress trip from their residence to school. Figure 5.2 illustrates the Low Stress Network in relation to Berkeley's schools; as shown nearly all the city's schools are within 1/8 of a mile (approximately 1 block) from a Low Stress facility.



FIGURE 5-1: LOW-STRESS BIKEWAY NETWORK VISION

PAVED PATH

BICYCLE	BOULEVARD	NETWORK
DIGIGEE	DOOLLING	

CYCLETRACK [4]

COMPLETE STREET CORRIDOR STUDIES -LOW STRESS BIKEWAY RECOMMENDATION

STUDY CYCLETRACK [4]*

PRIMARY TRANSIT ROUTE -STUDY CYCLETRACK [4]*

*Complete Street Corridor Studies are proposed multimodal transportation studies, not planned projects. Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan, as well as recommendations from AC Transit's Major Corridors Study. For further information, see Section 5.7 of the Berkeley Bicycle Plan.



FIGURE 5-2: LOW-STRESS BIKEWAY NETWORK VISION WITH BERKELEY SCHOOLS

PAVED PATH	PAVED PATH COMPLETE STREET CORRIDOR STUDIES - LOW STRESS RIKEWAY RECOMMENDATION					
BICYCLE BOULEVARD NETWORK CYCLETRACK [4]	STUDY CYCLETRACK [4]* PRIMARY TRANSIT ROUTE - STUDY CYCLETRACK [4]*		ENROLLMENT BOUNDARIES			

*Complete Street Corridor Studies are proposed multimodal transportation studies, not planned projects. Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan, as well as recommendations from AC Transit's Major Corridors Study. For further information, see Section 5.7 of the Berkeley Bicycle Plan.

5.1 PROJECT RECOMMENDATION **CATEGORIES**

Berkeley's bikeway network recommendations are described in detail on the following pages and have been grouped into five categories:

1. Bicycle Boulevards

a. New and Enhanced Bicycle Boulevard Segments

b. Bicycle Boulevard Crossing Improvements

- 2. Downtown and UC Berkeley Campus Area **Projects**
- 3. Ohlone Greenway Improvements
- 4. Upgrades to Existing Class II Bike Lanes and Class III Bike Routes
- 5. Citywide Recommendations
- 6. Complete Street Corridors

Figures 5-3 and 5-4 display the recommended bicycle network and future studies. The associated costs for each project and description of the implementation process can be found in Chapter 6: Implementation.

Table 5-1 summarizes the miles of recommended bikeways by project type.

Table 5-1: Summary of Project Recommendations

ТҮРЕ	MILEAGE
Class 1A: Paved Path	1.5
Class 2A: Standard Bike Lane	0.1
Class 2B: Upgraded Bike Lane	3.0
Class 3C: Sharrows	13.9
Class 3E: Bicycle Boulevard	12.4
Class 4: Cycletrack	18.4



*Complete Street Corridor Studies are proposed multimodal transportation studies, not planned projects. Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan, as well as recommendations from AC Transit's Major Corridors Study. For further information, see Section 5.7 of the Berkeley Bicycle Plan.



*Complete Street Corridor Studies are proposed multimodal transportation studies, not planned projects. Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies that will include a traffic study. Environmental analysis, public process, and coordination with all affected State, County, and local transit gencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies considered as part of future Complete Street Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan, as well as recommendations from AC Transit's Major Corridors Study. For further information, see Section 5.7 of the Berkeley Bicycle Plan.
5.2 BICYCLE BOULEVARD NETWORK IMPROVEMENTS

Berkeley's Bicycle Boulevards form the core of the city's low stress bikeway network, and as such should offer a safe, comfortable and convenient experience for people who bicycle. Bicycle Boulevards accomplish this through:

- Traffic control or warning devices to help people on bicycles cross major streets;
- Low traffic volumes and speeds, which in some cases are achieved through traffic calming devices that discourage or limit non-local vehicle through traffic;
- Prioritized travel for bikes by assigning the right-of-way to the Bicycle Boulevard at intersections wherever possible; and
- Traffic control to help bicycles cross major streets.

Existing Bicycle Boulevard corridors are:

North-South Bicycle Boulevards

- Ninth Street
- California Street/King Street
- Milvia Street
- Bowditch Street/Hillegass Avenue

East-West Bicycle Boulevards

- Virginia Street
- Channing Way
- Russell Street

This Plan proposes several new Bicycle Boulevards and enhancements to the existing seven Bicycle Boulevards to provide greater traffic calming and convenience for through bicycle travel. Sections 5.2.1, 5.2.2 and 5.2.3 describe the Bicycle Boulevard enhancements in greater detail. Figures 5-3 and 5-4 depict the Bicycle Boulevard network within the overall bikeway network, while Figures 5-13 and 5-14 depict intersection control improvements along Bicycle Boulevard and low stress bikeway network. Figure 5-15 presents proposed traffic calming enhancements on the Bicycle Boulevard network. Table E-4 in Appendix E lists specific improvements and costs.

5.2.1 New Bicycle Boulevards

This Plan recommends five new Bicycle Boulevard corridors. These additional corridors are intended to fill gaps in the low stress network, particularly in south Berkeley.

Addison Street - This east-west corridor runs parallel to University Avenue and connects downtown Berkeley to West Berkeley, connecting to Strawberry Creek Park, the I-80 overcrossing. It also links to 9th Street and Milvia Street Bicycle Boulevards.

Derby Street/Parker Street - This east-west corridor follows Parker Street and Derby Street, linking the residential, industrial and commercial areas of West Berkeley to the UC Clark Kerr Campus. It connects to several existing and proposed north-south Bicycle Boulevards, and provides access to Longfellow Middle School, Moellering Field, Berkeley Tech Academy, Willard Middle School, Willard Park, and Emerson Elementary along with numerous residential areas. **Fulton Street -** South of Dwight Way, Fulton Street is designated as a Bicycle Boulevard. This north-south route extends from the proposed Class IV bikeway along Fulton Street through the campus area, provides access to LeConte Elementary, and connects with the existing Russell Street and proposed Derby Street and Woolsey Street Bicycle Boulevards. It links the downtown/campus area through residential areas and provides a connection south onto the City of Oakland's bikeway network via Woolsey Street.

Harmon Street/65th Street - This east-west corridor in south Berkeley runs parallel to Alcatraz Avenue and provides a connection between the Adeline Street corridor / Lorin District and the 65th Street bikeway corridor which connects into Emeryville. It links to existing King Street and proposed Mabel Street Bicycle Boulevards.

Kains Avenue - This route extends north from the Virginia Street Bicycle Boulevard and provides a connection into the city of Albany's bikeway network east of San Pablo Avenue. **Mabel Street -** This north-south corridor runs parallel to San Pablo Avenue, provides a signalized crossing of Ashby Street in south Berkeley, links to San Pablo Park, and connects north to Strawberry Creek Park. It would also Link to Russell Street and Channing Way and proposed Harmon Street/65th Street Bicycle Boulevards.

Rose Street/Camelia Street - This east-west corridor follows Camelia Street, Cornell Avenue, Rose Street and Walnut Street. It links the residential and retail areas of the Gilman District with Cedar-Rose Park, Jefferson Elementary, Martin Luther King, Jr. Middle School, Live Oak Park, and Oxford Elementary. This bikeway connects with the 9th Street, California Street, and Milvia Street Bicycle Boulevards, as well as the Ohlone Greenway.

Woolsey Street - This existing signed Class III route is proposed to be upgraded to a Bicycle Boulevard. This east-west route along Berkeley's south border extends between the Hillegass Avenue and King Street Bicycle Boulevards, providing direct access to the Ashby BART station. It provides connections south into the City of Oakland's bikeway network at Colby Street and King Street.



Bicycle Boulevards make riding a bicycle feel safer and more intuitive for all ages and abilities.

5.2.2 Bicycle Boulevard Major Street Crossings

Major street crossings are a critical piece of the Bicycle Boulevard network. One of the three goals for Bicycle Boulevards is to "develop a network of efficient routes for bicyclists," which means reducing the number of times that a cyclist must stop along the route, and improving the ability to cross major intersections.

As discussed in **Chapter 4: Needs Analysis**, many Bicycle Boulevard corridors are low stress within the neighborhood until a person on bike must cross a major street such as Sacramento Street or San Pablo Avenue. These high stress crossings are barriers to more people bicycling, and a single high-stress crossing point along an otherwise low stress Bicycle Boulevard route can be a major deterrent to use.

All major street crossings of the existing and proposed Bicycle Boulevard network were studied as part of this Plan, and each location was assigned a recommended treatment based on the Unsignalized Bikeway Crossing Treatment Progression shown in **Table 5-2**. This treatment progression shows the LTS score achieved by implementing specific warning devices or traffic controls at currently unsignalized crossings along the Bicycle Boulevard network. The higher the major street volume and greater number of lanes, the higher intensity of warning devices or traffic controls necessary to achieve a low stress (LTS 1 or 2) crossing.

The goal is for all Bicycle Boulevards to achieve a score of LTS 1 or LTS 2, with LTS 2 being the level of traffic stress that most adults are willing to tolerate. Upgrading all crossing treatments to an LTS 2 would mean that approximately 79 percent of Berkeley's population would be comfortable using them.

The following pages discuss and illustrate the different crossing treatments outlined in Table 5-2.

Fable 5-2: Unsignalized B	Bikeway Crossing	g Treatment P	Progression
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	TRAFFIC VOLUMES						
TREATMENT	VERY LOW	LOW		MEDIUM		HIGH	
	Up to 3 lanes	Up to 3 Ianes	4 lanes	Up to 3 lanes	4 or 5 lanes	Up to 3 lanes	4 or 5 Ianes
Marked Crossing	LTS 1	LTS 1 or 2	LTS 2	LTS 3	LTS 3	LTS 4	LTS 4
Median Refuge Island ¹	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3	LTS 3	LTS 4
RRFB ^{2, 3}	Х	LTS 1	LTS 1	LTS 2	LTS 3	LTS 3	LTS 3
RRFB with median ^{1, 2, 3}	Х	LTS 1	LTS 1	LTS 1	LTS 2	LTS 2	LTS 3
Pedestrian Hybrid Beacon (HAWK) ²	Х	Х	LTS 1	LTS 1	LTS 1	LTS 1	LTS 1
Traffic Signal ²	Х	Х	Х	LTS 1	LTS 1	LTS 1	LTS 1

X No additional benefit

1. Minimum 6-ft wide median

2. Subject to successful warrant analysis

3. 4-Way Stop Signs may be considered as an alternative to RRFBs

LTS refers to Level of Traffic Stress

MARKED CROSSINGS

Marked crossings by themselves are appropriate on low and very low traffic streets with one lane in each direction. Marked crossings should always include advance warning signage and advance yield lines, and can be enhanced with curb extensions to shorten the crossing distance and increase visibility. On streets with one lane each direction and moderate traffic volumes, the addition of a median refuge is necessary to achieve LTS 2. Figure 5-5 shows an example of a marked crossing.

RRFB CROSSING

Rectangular Rapid Flashing Beacons (RRFBs) are user-actuated amber LEDs that supplement warning signs at uncontrolled intersections and mid-block crosswalks. They can be activated by people walking and bicycling by manually pushing a button or passively by a video detection or detector loop system.

RRFBs by themselves can achieve LTS 1 on streets up to 4 lanes with low traffic volumes. Figure 5-6 shows an example of an RRFB at an LTS 1 location.



Figure 5-5: Marked Crossing

Figure 5-6: RRFB at LTS 1 Location



Figure 5-7: Median Island Refuge



For crossings of roadways with one lane in each direction and higher traffic volumes (12,500+ ADT), or on 4-lane streets with medium volumes. a median refuge island is recommended to achieve LTS 2, as shown in Figure 5-7.

A phased crossing treatment approach is recommended in these locations: In Phase 1, install an RRFB and monitor the effectiveness (e.g., driver yield rate to people bicycling). If the yield compliance appears to be unacceptable according to standards established by the City Traffic Engineer, the City should consider installing a Pedestrian Hybrid Beacon (see below) as a Phase 2. Note that the Bike Crossing Treatment Progression table notes that these locations should have an RRFB with a median it may be infeasible to install a sufficiently wide median in some of these locations. Although they do not serve precisely the same function as a median refuge island, this Plan recommends consideration of curb extensions as a way to shorten the crossing distance and improve visibility of people bicycling and walking across the street, given that there is only one lane of crossing in each direction.

PEDESTRIAN HYBRID BEACON CROSSING

A Pedestrian Hybrid Beacon (PHB), also known as a High-Intensity Activated crosswalk (HAWK) beacon, is a traffic control device used to stop roadway traffic and allow people to walk or bike across an intersection. They can be activated by people walking and bicycling by manually pushing a button or passively by a video detection or detector loop system. A PHB creates the lowest level of stress (LTS 1) for people crossing major streets on a bicycle (see Figure 5-8 and Figure 5-9).



Figure 5-8: PHBs Help Create an LTS 1 Environment for Bicyclists

On Bicycle Boulevard segments where the Bicycle Boulevard approach has higher volumes or significant right turn movements, creating a channelized lane for the Bicycle Boulevard can reduce potential conflicts on the approach, and also provide an opportunity for a forced motorist right turn to eliminate through traffic. Traffic diversion can also be accomplished by installing a continuous median across the intersection with a bicycle pass-through channel, as shown in **Figure 5-10**.



Figure 5-9: PHB with a Channelized Approach

Figure 5-10: PHB with Median Diverter



TWO-WAY CYCLETRACK CONNECTOR (AT INTERSECTION)

A cycletrack connector is proposed for offset major intersection crossings along the Bicycle Boulevard network. This treatment provides a protected, low stress crossing on the bikeway approach, and a low stress two-way facility on the cross-street parallel to the bikeway approach. An example of this is on eastbound Heinz Avenue, where the Bicycle Boulevard reaches San Pablo Avenue, then continues east on Oregon Street (which is offset approximately 200 feet to the north of Heinz Avenue). A cycletrack connector will offer protected travel space and physical separation from adjacent vehicle traffic along San Pablo Avenue and allow cyclists to utilize designated crossing points to best handle offset major street crossings.

Figure 5-11: Two-Way Cycle Track Connector



PROTECTED INTERSECTION

With a protected intersection, the Bicycle Boulevard approach has a physical barrier separating the bikeway from the adjacent travel lane. Protected intersections may be physically protected and/or protected using signal timing. This protection could be in the form of a fully protected cycletrack extending to the intersection, or in the case of Bicycle Boulevards with channelized bikeway treatments such as seen on Channing Way at Martin Luther King, Jr. Boulevard. Protected intersections typically require the use of bicycle signals to isolate bicycle movements from conflicting vehicle movements. Bicycle signal phases can be added to the traffic signals to isolate bicycle movements from conflicting vehicle movements. **Figure 5-12** shows an example of a protected intersection at a Bicycle Boulevard crossing.

Figure 5-12: Protected Intersection





EXISTING BICYCLE BOULEVARD NETWORK

STANDARD BIKE LANE [2A]

BICYCLE BOULEVARD [3E]

*Complete Street Corridor Studies are proposed multimodal transportation studies, not planned projects. Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan, as well as recommendations from AC Transit's Major Corridors Study. For further information, see Section 5.7 of the Berkeley Bicycle Plan.



*Complete Street Corridor Studies are proposed multimodal transportation studies, not planned projects. Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without Complete Street Corridor Studies that will include a traffic study, environmen-tal analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan, as well as recommendations from AC Transit's Major Corridors Study. For further information, see Section 5.7 of the Berkeley Bicycle Plan.

5.2.3 Bicycle Boulevard Traffic Calming and Bicycle Priority

Berkeley's Bicycle Boulevards use traffic calming and bicycle priority to achieve a safe, comfortable and convenient experience for people who bicycle. Intersections along Bicycle Boulevards will be evaluated as part of neighborhood-level public outreach and involvement, to see whether traffic calming treatments would be more effective than stop signs in establishing bicycle priority while reducing the speed and volume of motor vehicles cut-through traffic. While these plan recommendations focus on traffic circles and diverters as primary Bicycle Boulevard traffic calming strategies, the City should utilize the full range of traffic calming options when needed. Examples of other traffic calming treatments that have been found effective in Berkeley and Bay Area cities include speed tables, raised crosswalks, corner sidewalk bulbouts, and chicanes. Pilot projects using temporary materials may be developed at some locations to test effectiveness before longer-term installations are pursued.

TRAFFIC CIRCLES AND DIVERTERS

Figure 5-15 shows recommended conceptual traffic calming improvements along the Bicycle Boulevard network. New traffic circles are

recommended as a traffic calming feature to slow and discourage non-local vehicle traffic. Diverters are recommended to direct vehicles off the Bicycle Boulevards and onto larger roadways, decreasing vehicle speeding and cut-through traffic. New recommended diverter locations were generally selected to provide at least one diversion point between each major street along the Bicycle Boulevard network. Recommended traffic circle and diverter locations in this Plan may be changed based on traffic studies, public process, and/or neighborhood feedback. The City may pilot these locations with temporary installations to understand their traffic impacts before making them permanent. Table E-4 in Appendix E lists specific locations where traffic circles and diverters are proposed in this Plan.

SPEED TABLES AND HUMPS

The City should continue to utilize speed tables where appropriate to reduce vehicle speeds, and consider them for inclusion on Bicycle Boulevards where additional traffic calming is needed. It is recommended that the City of Berkeley continue its practice of replacing existing speed humps on Bicycle Boulevards when these streets are repaved. These replacement speed humps should be designed with gentle transitions on the approach and departure ramps, in the form of a sinusoidal curve. In partnership with Berkeley's accessibility community, the City should evaluate these newer speed hump design standards for use on Bicycle Boulevards.



FIGURE 5-15: RECOMMENDED LOW STRESS BIKE BOULEVARD TRAFFIC CALMING IMPROVEMENTS



BICYCLE RIGHT-OF-WAY EVALUATION

Prioritizing travel for people riding bicycles can be accomplished by assigning the right-ofway to the Bicycle Boulevard at intersections, wherever possible. This right-of-way assignment is a critical design element of Bicycle Boulevards and offers a similar level of flow and connectivity to what is offered on major streets, yet without forcing people riding bicycles to share the road with high-volume vehicle traffic. Before assigning right-of-way to the Bicycle Boulevard, intersections will be evaluated as part of neighborhood-level traffic study, public outreach, and involvement, to ensure that the needs of local residents are also being met.

5.3 DOWNTOWN AND UC BERKELEY CAMPUS RECOMMENDATIONS

This Plan includes several recommendations surrounding the UC Berkeley campus and around the Downtown area, shown in **Figure 5-14**, and listed in **Table E-5** in **Appendix E**.

One key project in the downtown area is the Milvia Street corridor, which is proposed for a Class IV two-way cycletrack between Blake Street and Hearst Avenue. **Figures 5-16** through **Figure 5-20** provide an overview of the Milvia Street Corridor project, including conceptual designs for implementing the cycletrack through the downtown area as well as a new protected intersection at Milvia Street/University Avenue.

Note that these are illustrative concepts only and specific project design details, including facility geometrics, travel or parking lane modifications, signage and pavement markings, and signal phasing, will be considered during the design phase and associated public outreach for each recommended project.



Figure 5-16: Milvia Street Bicycle Boulevard Recommended Improvement Concept Overview Map









Figure 5-18: Milvia Street at University Avenue Recommendations

PROPOSED BIKEWAY NETWORK







Figure 5-20: Milvia Street at Blake Street Recommendations

5.4 OHLONE GREENWAY IMPROVEMENTS

The Ohlone Greenway is an existing shared use path that runs north-south from Richmond to Berkeley. This Plan recommends a series of pathway widening, enhanced lighting, and roadway crossing improvements along the Ohlone Greenway corridor within Berkeley.

The Ohlone Greenway is approximately eight feet wide for much of its length through Berkeley. Design standards for shared use paths like the Ohlone Greenway (which receive heavy recreational and commuter use by bicyclists and other non-motorized users) recommend at least a 12-foot width with separated areas for pedestrians and bicyclists if possible. North of Santa Fe Avenue into Albany, sufficient width below the elevated BART tracks exists to provide separated bicycle and pedestrian space. However, within Berkeley, adjacent uses including fenced portions of the BART right-of-way, residential property lines, tennis courts, and parking areas constrain much of the Ohlone Greenway alignment between Gilman Street and the North Berkeley BART station, and limit possibilities for widening. Where possible opportunities to widen the pathway should be evaluated through this section. One area where widening is feasible is where the Ohlone Greenway extends through Cedar- Rose Park. Through the park a minimum 12 foot wide greenway width is recommended, with a separate soft-surface pedestrian path.

Crossing enhancements are also recommended for roadway crossings along the Ohlone Greenway. For all uncontrolled crossings a standard crossing treatment is proposed, consisting of Rectangular Rapid Flash Beacons (RRFBs) and a raised crosswalk and shown in **Figure 5-21**. Other crossing enhancements include studying a fully raised intersection at the Gilman Street / Curtis Street crossing, and installing a two-way cycletrack connector at Peralta Avenue.

Lighting improves the safety and security of path users by increasing visibility during non-daylight hours. Given the Ohlone Greenway's function as a major year-round recreation and commute corridor, having adequate lighting is essential. Lighting upgrades are recommended along the full corridor. Per AASHTO recommendations, average maintained horizontal illumination levels should be 5 lux to 22 lux. Higher illumination levels should be considered at crossing approaches, drinking fountains, benches, or any location where potential security problems exist. Lighting should be downcast to minimize light pollution.

Landscaping along the corridor should be trimmed back to provide for additional clear path space and to increase visibility, security, and effectiveness of lighting. Along the Ohlone Park segment (parallel to Hearst Avenue) a widened pathway is recommended along with the creation of mixing zones at the cross-streets where pedestrian cross traffic can be expected. Mixing zones can be designed through the use of different paving materials such as pavers as well as with signage and markings. Figures 5-21 through 5-26 illustrate conceptual improvements to the Ohlone Greenway. These improvements are also listed in Table E-6 in Appendix E.

Note that these are illustrative concepts only and specific design details will be considered during the design phase and associated public outreach for each recommended improvement.



Figure 5-21: Ohlone Greenway Recommended Improvement Locations

Figure 5-22: Path Improvements to the Ohlone Greenway

OHLONE GREENWAY PATH IMPROVEMENTS

UNCONTROLLED CROSSING TYPICAL TREATMENT



Figure 5-23: Peralta and Hopkins Streets improvements

A. PERALTA AND HOPKINS STREETS

BERKELEY OHLONE GREENWAY

- Existing Path Width = 8' Recommended: Widen path to minimum of 12' and provide separated soft surface pedestrian path where feasible, upgrade pathway lighting.
- 2 Long-term: two-way cycle track connector with raised crosswalk; requires the removal of 8-10 parking spaces. Short-term: improve wayfinding
- 3 Existing Intersection Conditions: Three-way stop. Recommended: Install raised crosswalk



Cedar-Rose

Park

Figure 5-24: Improvements around Cedar-Rose Park

N

B. CEDAR-ROSE PARK

BERKELEY OHLONE GREENWAY

- Existing: Marked crosswalk Recommended: Install RRFB and raised crosswalk (see crossing detail). Requires removal of two small street trees and one parking space
- 2 Existing: Path Width 8' Recommended: Widen path to minimum of 12' and provide separated soft surface pedestrian path where feasible, upgrade pathway lighting

CEDAR ST

1

12

N

Figure 5-25: Improvements Around North Berkeley BART Station



Figure 5-26: Improvements Around Ohlone Park

D. OHLONE PARK PED/BIKE INTERSECTIONS

BERKELEY OHLONE GREENWAY

- Existing Path Width = 8' Recommended: Widen path to minimum of 12' and provide separated soft surface pedestrian path where feasible, upgrade pathway lighting
- 2 Pedestrian crossing locations: Install mixing zone pavement treatment and signage
- **5** Study Class IV cycle track option on Hearst Ave



5.5 UPGRADES TO EXISTING CLASS II BIKE LANES AND CLASS III BIKE ROUTES

5.5.1 New / Upgraded Class II Bike Lanes

A bike lane is a striped lane that provides a designated space within the roadway for people who bike. Design guidelines require a minimum 5-foot-width for standard bike lanes striped next to curbs or parking lanes, but 6 to 7 feet is the preferred width and the addition of a painted buffer between traffic and/or parking lanes is desired where traffic volumes are high or there is high parking turnover.

This Plan recommends both new and upgraded Class II bike lanes. Upgrades include adding painted buffers between the vehicle lane and bike lane or painting conflict areas of the existing bike lanes green.

These improvements are depicted on **Figures 5-3** and **5-4**, and are listed in **Tables E-3** and **E-5** in **Appendix E**.

5.5.2 New / Upgraded Class III Bike Routes

Class III bicycle routes are signed bicycle routes where people riding bicycles share a travel lane with people driving motor vehicles. Because they are mixed-flow facilities, Class III bicycle routes are only appropriate for low-volume streets with slow travel speeds. Many of Berkeley's Class III bike routes are part of the Bicycle Boulevard Network and discussed as part of the Bicycle Boulevard network projects below.

This project category includes enhancements to existing Class 3A signage-only facilities to add shared lane markings (upgrading to Class 3C), as well as some new Class 3C facilities to complete the network. There is also a project segment along Spruce Street in the Berkeley hills to install an uphill "climbing lane" with a Class 2A bike lane in the uphill direction and Class 3C sharrows in the downhill direction, to provide better separation for the slower moving uphill cyclist.

These improvements are depicted on **Figures 5-3** and **5-4**, and are listed in **Tables E-3** and **E-5** in **Appendix E.**

5.6 CITYWIDE RECOMMENDATIONS

5.6.1 Bicycle Detection

Detection of bicyclists at actuated (not pretimed) traffic signals is important for safety of bicyclists and motorists. The California Manual on Uniform Traffic Control Devices (CA MUTCD) requires that all new and modified traffics signals be able to detect bicyclists with passive detection (rather than having to push a button). This Plan recommends that the City of Berkeley continue to adhere to this requirement by ensuring passive detection of bicyclists at all signalized intersections.

serves people who intend to leave their bicycles for longer periods of time and is typically found at workplaces and in multifamily residential buildings, transit stations, and other commercial buildings. These facilities provide a high level of security but are less convenient than bicycle racks. Berkeley has bike lockers available citywide at BART and Amtrak stations.





5.6.2 Bicycle Parking

Bicycle parking is available throughout Berkeley, but many locations do not provide an adequate amount of bike parking to meet demand. As such, many bicyclists instead lock their bikes to street fixtures such as trees, telephone poles, and sign poles.

RECOMMENDED TYPES AND QUANTITIES OF BICYCLE PARKING

Bicycle parking can be categorized into shortterm and long-term parking. Sidewalk bicycle racks or bicycle corrals are preferred for shortterm bike parking (less than two hours), serving people who leave their bicycles for relatively short periods of time, typically for shopping, errands, eating or recreation. Bicycle racks provide a high level of convenience but relatively low level of security.

Long-term bike parking includes bike lockers, bike rooms, or Bike Stations. Long-term parking The City has developed specifications for architects, engineers and contractors on how and where bike racks should be placed and installed. These are available at http://www. ci.berkeley.ca.us/uploadedFiles/Public_Works/ Level_3_Transportation/Bike_Rack_Specs_ Installation_Sept2008.pdf.

Expanded Bicycle Parking Design Guidelines and recommended quantities by land use can be found in Appendix F: Design Guidelines.

CITYWIDE BICYCLE PARKING PROGRAM

More than 1,000 bicycle racks exist throughout Berkeley, as well as Bike Station and highcapacity, in-street Bicycle Corrals. The locations where bike parking is available are described in Chapter 3 and shown on an interactive map on the City's website. This website is updated frequently and can be found at **http://www.** cityofberkeley.info/bikeparkingmap/.

It is recommended the City continue its highly successful request-based bicycle rack and corral program, and continue to proactively install bike parking in commercial areas. As noted in Chapter 3, bicycle corrals typically take up unused red curb area or a vehicle parking space and can accommodate up to 12 bicycles. They can be placed at intersection corners (where vehicles are not allowed to park) because they do not inhibit sight distances for roadway users. Business owners can apply for free bike corral installation. More information can be found at http://cityofberkeley.info/bikecorral/.

The City should work with BART to plan, fund, design, and construct a new Bike Station at North Berkeley BART, where demand for bicycle parking is exceptionally high and BART has documented recurring theft and vandalism issues.

The City should begin to consider the needs of electric bicycle users in any study of the provision of bike parking. The needs of e-bike users are different than typical bicyclists,



On-street bike corrals can take the place of a vehicle parking space and be installed at street corners

including capabilities for charging bicycle batteries and enhanced safety/anti-theft options.

5.7 COMPLETE STREETS CORRIDOR STUDIES

As defined by the Berkeley Complete Streets Policy, "Complete Streets" describes a comprehensive, integrated transportation network with infrastructure and design that allows safe and convenient travel along and across streets for all users, including people walking, people bicycling, persons with disabilities, people driving motor vehicles, movers of commercial goods, users and operators of public transportation, emergency responders, seniors, youth, and families. Providing a complete network does not necessarily mean that every street will provide dedicated facilities for all transportation modes, but rather that the transportation network will provide convenient, safe, and connected routes for all modes of transportation within and across the City. For the purposes of bikeway planning, the City of Berkeley considers both the major/ collector street and parallel streets part of a Complete Street Corridor; potential bikeways on both the major/collector street bikeway and on parallel streets should be evaluated as part of a Complete Street Corridor Study.

Of the major and collector streets shown in the map figures as requiring a Class IV Cycletrack to meet LTS 1 or 2 (see **Figures 5-1, 5-2, 5-3, 5-4, 5-13, 5-14, 6-1**, and **6-2**), most of them will

require further study in order to evaluate their suitability for this treatment and impacts on other modes of transportation. These major and collector Streets provide access to local Berkeley businesses. Some facilitate direct crosstown or interjurisdictional travel not duplicated by a parallel street. They currently serve multiple modes of transportation, on-street parking, and many are commercial corridors that have goods movement needs related to deliveries and loading/unloading at businesses, which are vital to the economic vitality of these areas. As such, they require further consideration above and beyond that of bicycle travel. These streets are therefore labeled as "Complete Street Corridor Studies" on Figures 5-1, 5-2, 5-3, 5-4, 5-13, 5-14, 6-1, and 6-2.

Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without these Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan. Corridor studies on San Pablo Avenue, Telegraph Avenue, University Avenue, and Ashby Avenue will be led by the Alameda County Transportation Commission (CTC). The City of Berkeley has already initiated

studies and/or capital projects on a number of other Complete Street Corridors, including Hearst Avenue, Bancroft Way, Fulton Street, and Adeline Street, in coordination with outside partner agencies, including UC Berkeley, AC Transit, BART, and others.

As defined by the City of Berkeley General Plan Transportation Element, most of the future Complete Street Corridor Studies are either Primary or Secondary Transit Routes. General Plan Policy T-4 "Transit-First Policy" gives priority to alternative transportation and transit over single-occupant vehicles on Transit Routes. The Alameda County Transportation Commission Countywide Multimodal Arterial Plan identifies many of the future Complete Street Corridor Studies as part of the Transit Emphasis modal priority network. In this planning and policy context and given the importance of approaching Complete Streets from an integrated, layered network perspective, it is critically important to consider how transit service can be maintained and improved as an outcome of future Complete Street Corridor Studies. Studies to consider the inclusion of bikeways will be coordinated with proposed improvements to transit performance on Primary Transit Routes, such as bus boarding islands, transit-only lanes, transit signal priority/ queue jump lanes, far-side bus stop relocations, and other improvements as described in the AC Transit Major Corridor Study. In addition, these studies should approach Secondary Transit Routes as opportunities for transit improvements, such as bus stop optimization

and relocation, among other potential improvements. At the conclusion of the Complete Streets Corridor Study process, design alternatives which have a significant negative effect on transit on Primary Transit Routes will not be recommended. Criteria to define what constitutes a significant negative effect on transit will be developed and applied during the Study process for each corridor. Consideration of how to allocate limited public right-of-way among various travel modes will be made consistent with Alameda County Transportation Commission modal priorities and the City of Berkeley General Plan.

Future Complete Street Corridor Studies should be undertaken in the context of national design best practices such as the National Association of City Transportation Officials (NACTO) Transit Street Design Guide and Urban Street Design Guide. Local guidance such as the forthcoming AC Transit Design Standards and Guidelines Manual for Safe and Efficient Multimodal Transit Stops and Corridors will also be consulted. Studies should carefully consider the potential impacts and trade-offs of including bikeways on Primary and Secondary Transit Routes, including potential median reductions, repurposing of parking or travel lanes, and the need to avoid impacts to transit operations that could otherwise occur. Example transit performance criteria that may be considered as part of future Complete Street Corridor Studies could include: on-time performance and reliability; gapping/bunching; transit travel time; operational and safety conflicts with other

modes of transportation; maintaining minimum lane widths; and other criteria to be identified through the study process.

These corridors may have interim treatments installed while the corridor study and final recommended design are being completed. Interim treatments are those that do not require a full Complete Streets Corridor Study. Interim or phased treatments may still require traffic study, interagency coordination, and public process if they impact roadway capacity, parking, or transit operations. Interim or phased treatments should not negatively impact existing transit operations; mitigations should accompany interim treatments to ensure no degradation of transit service. For example, Shared Roadway Bicycle Markings may be installed, or existing bike lanes may first be colored green, then later converted into a Class IV Cycletrack if feasible without negatively impacting existing or planned transit operations on Primary or Secondary Transit Routes. Table 6-8 shows the extent of the Complete Street Corridor Study projects and provides the recommended interim treatments. Some corridors list multiple interim treatment types that would be implemented along different segments of the same corridor. Table E-7 in Appendix E presents a more detailed breakdown of the recommended Complete Street Corridor Studies and interim treatments.

For more information about future Complete Street Corridor Studies, see **Section 6.7**, **Appendix E**, and **Appendix F**.

IMPLEMENTATION

This chapter presents the strategies Berkeley should use when implementing this Plan. The chapter includes the evaluation criteria and scoring method, project cost estimates, and a map of prioritized projects. Full project lists can be found in **Appendix E: Project Recommendation and Prioritization Tables**.

6-1

6.1 PROJECT EVALUATION STRATEGY

This plan provides a vision, goals, policies and recommendations for building out a network of bikeways and support facilities through the year 2035. In order to provide a strategy for which projects to implement first, the infrastructure recommendations from Chapter 5 were evaluated against a set of criteria that prioritized each project based on safety, community support, and equity factors. Based on the scoring, projects were sorted into Tier 1 (high priority), Tier 2 (mid-term), and Tier 3 (longer term).

The prioritization tiers recommended in this plan are intended to serve as general guidelines. Implementation priorities may change as a result of a variety of factors including funding opportunities or integration with other planning efforts or development. Changes in bicycling patterns, demand or community support may also affect implementation priorities over time.

6.1.1 Evaluation Criteria

Recommended projects were scored against evaluation criteria listed in **Table 6-1**. Prior to being scored, individual project segments and intersections were consolidated and organized into logical implementation corridors based on their location and extents.

6.2 PROJECT PRIORITIZATION

The prioritization corridors were organized into three tiers based on the evaluation scoring. **Figure 6-1** shows the Tier 1 priority projects, and **Figure 6-2** shows projects in all tiers.

Tables that show the projects in each prioritization corridor are included in **Appendix E: Project Recommendations and Prioritization Tables**.

Table 6-2 shows the planning-level costestimates to implement each tier.

CRITERIA	DESCRIPTION	MAX SCORE
Safety	Combination of safety, LTS, and demand analysis	50
Community Support	Projects are scored based on whether the project or area was identified for improvement during the initial community input phase	30
Equity	Projects are scored based on whether they are located within a MTC designated Community of Concern.	20
	Total Possible Score	100

Table 6-1: Evaluation Criteria

TIER 1 PROJECTS

Figure 6-1 shows (and **Table 6-3** lists) the Tier 1 (high priority) projects including planning level cost estimates.

Table 6-2: Planning-Level Capital Cost Estimates

TIER	PLANNING LEVEL COST ESTIMATE
Tier 1	\$26,318,900
Tier 2	\$4,658,400
Tier 3	\$3,493,800
Total	\$34,471,100



FIGURE 6-1: PROJECT PRIORITIZATION CORRIDORS



*Complete Street Corridor Studies are proposed multimodal transportation studies, not planned projects. Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan, as well as recommendations from AC Transit's Major Corridors Study. For further information, see Section 5.7 of the Berkeley Bicycle Plan.
Table 6-3: Tier 1 Projects

CORRIDOR	RECOMMENDED PROJECT OR STUDY	LOCATION	CROSS ST A	CROSS ST B	NOTES	MILES	TOTAL COST ESTIMATE
9th St	RRFB	9th St	Cedar St	-		-	\$50,000
	Traffic Signal	Ashby Ave	9th St	-	Future trail project	-	\$500,000
Addison St	1A: Paved Path	Addison St	Curtis St	Browning St	Connector	0.06	\$201,500
	3C: Sharrows	Bolivar Dr	Aquatic Park Path	Addison St		0.12	\$2,800
	3E: Bike Boulevard	Addison St	Bolivar Dr	Oxford St	Class I Path between Curtis St and Browning St	1.96	\$98,000
	Cycletrack Crossing	Addison St	San Pablo Ave			-	\$60,000
	РНВ	Addison St	Sacramento St	-		-	\$250,000
	RRFB + Median	Addison St	MLK Jr Way	-		-	\$70,000
	RRFB + Median	Addison St	Oxford St	-		-	\$70,000
	RRFB + Median	Addison St	6th St	-		-	\$70,000
	Traffic Circle	Addison St	7th St	-		-	\$50,000
	Traffic Circle	Addison St	5th St	-		-	\$50,000
	Traffic Diverter	Addison St	Grant St	-		-	\$50,000
	Traffic Diverter	Addison St	10th St	-		-	\$50,000
Adeline St	Study Cycletrack (4)	Adeline St	King St	Shattuck Ave	Complete Street Corridor Study	0.99	\$710,800
Alcatraz Ave	RRFB + Median	Alcatraz Ave	King St	-		-	\$70,000
California St	RRFB	Dwight St	California St	-		-	\$50,000
	RRFB + Median	Ashby Ave	California St			-	\$70,000
Camelia St	РНВ	San Pablo Ave	Camelia St			-	\$250,000
	RRFB + Median	Cornell Ave	Hopkins St			-	\$70,000
Channing Wy	2B: Upgraded Bike Lane	Channing Way	MLK Jr Way	Piedmont Ave		1.13	\$204,100
	РНВ	Channing Way	San Pablo Ave	-		-	\$250,000
	РНВ	Channing Way	Sacramento St	-		-	\$250,000
	Protected Intersection	Channing Way	Shattuck Ave	-		-	\$650,000
	Protected Intersection	Channing Way	Telegraph Ave	-		-	\$650,000

CORRIDOR	RECOMMENDED PROJECT OR STUDY	LOCATION	CROSS ST A	CROSS ST B	NOTES	MILES	TOTAL COST ESTIMATE
Channing Wy	RRFB + Median	Channing Way	6th St	-		-	\$70,000
	Traffic Circle	Channing Wy	7th St	-		-	\$50,000
	Traffic Circle	Channing Wy	Browning St	-		-	\$50,000
	Traffic Circle	9th St	Channing Wy	-		-	\$50,000
	Traffic Circle	Bonar St	Channing Wy	-		-	\$50,000
	Traffic Circle	California St	Channing Wy	-		-	\$50,000
	Traffic Circle	Channing Wy	Dana St	-		-	\$50,000
	Traffic Circle	Channing Wy	Ellsworth St	-		-	\$50,000
	Traffic Circle	Channing Wy	Fulton St	-		-	\$50,000
	Traffic Diverter	Channing Wy	10th St	-		-	\$50,000
	Traffic Diverter	Channing Wy	Curtis St	-		-	\$50,000
	Traffic Diverter	Channing Wy	Bowditch St	-		-	\$50,000
Claremont Ave	Study Cycletrack (4)	Claremont Ave	City Limits - South	Warring St	Complete Street Corridor Study	1.10	\$675,800
Dana St	Study Cycletrack (4)	Dana St	Bancroft Way	Dwight Way	Complete Street Corridor Study	0.25	\$195,100
Derby St	РНВ	San Pablo Ave	Parker St			-	\$250,000
	РНВ	Shattuck Ave	Derby St			-	\$250,000
	Traffic Diverter	Derby St	Fulton St			-	\$50,000
Fulton St, Bancroft Way	2A: Standard Bike Lane	Center St	Shattuck Ave	Oxford St		0.12	\$10,700
Hearst Ave	3C: Sharrows	Hearst Ave	Arch St/Le Conte Ave	Euclid Ave	Climbing route	0.21	\$2,100
	3E: Bike Boulevard	Fulton St, Prince St, Deakin St, Wheeler St	Dwight Way	Woolsey St		0.98	\$49,200
	Study Cycletrack (4)	Bancroft Way	Milvia St	Piedmont Ave	Complete Street Corridor Study	1.00	\$607,200
	Study Cycletrack (4)	Fulton St, Oxford St	Dwight Way	Virginia St	Complete Street Corridor Study	0.89	\$726,700
	Study Cycletrack (4)	Hearst Ave	California St	Arch St/Le Conte Ave	Complete Street Corridor Study	0.91	\$659,300
	Cycletrack Crossing	Bancroft Way	Barrow Ln/ Bowditch St	-		-	\$60,000
	Protected Intersection	Hearst Ave	Shattuck Ave	-		-	\$650,000
	Protected Intersection	Hearst Ave	Oxford St	-		-	\$650,000
	Protected Intersection	Hearst Ave	Arch St/Le Conte Ave	-		-	\$650,000

CORRIDOR	RECOMMENDED PROJECT OR STUDY	LOCATION	CROSS ST A	CROSS ST B	NOTES	MILES	TOTAL COST ESTIMATE
Fulton St, Bancroft Way	Protected Intersection	Fulton St	Bancroft Way	-		-	\$650,000
Hearst Ave	Protected Intersection	Bancroft Way	Telegraph Ave	-		-	\$650,000
	Protected Intersection	Fulton St	Dwight Way	-		-	\$650,000
	Traffic Circle	Fulton St	Parker St	-		-	\$50,000
	Traffic Circle	Fulton St	Oregon St	-		-	\$50,000
	Traffic Circle	Prince St	Wheeler St	-		-	\$50,000
	Traffic Circle	Prince St	Deakin St	-		-	\$50,000
Hillegass Ave	РНВ	Ashby Ave	Hillegass Ave	-		-	\$250,000
	RRFB + Median	Dwight Way	Hillegass Ave/ Bowditch St	-		-	\$70,000
	Traffic Circle	Hillegass Ave	Russell St	-		-	\$50,000
Hopkins St	Study Cycletrack (4)	Hopkins St	9th St	Milvia St	Complete Street Corridor Study	1.50	\$1,014,100
	Study Cycletrack (4)	Gilman St	2nd St	Hopkins St	Complete Street Corridor Study	1.19	\$926,800
Milvia St	4: Two-Way Cycletrack	Milvia St	Hearst Ave	Blake St		0.75	\$451,500
	Protected Intersection	University Ave	Milvia St	-		-	\$650,000
	RRFB	Milvia St	Rose St	-		-	\$50,000
	RRFB	Milvia St	Hopkins St	-		-	\$50,000
	Traffic Circle	Milvia St	Oregon St	-		-	\$50,000
	Traffic Circle	Milvia St	Parker St	-		-	\$50,000
Ohlone Greenway	1A: Paved Path	Ohlone Greenway	City Limits - North	Peralta Ave	Off-street	0.34	\$1,190,000
	1A: Paved Path	Ohlone Greenway	Hopkins St	Virginia St	Off-street	0.36	\$1,276,900
	1A: Paved Path	Ohlone Greenway	Sacramento St	MLK Jr Way	Off-street	0.50	\$1,742,000
	3E: Bike Boulevard	Acton St	Delaware St	Virginia St		0.13	\$6,300
	Study Cycletrack (4)	Delaware St	Acton St	Sacramento St	Complete Street Corridor Study	0.13	\$101,800
	Study Cycletrack (4)	Peralta Ave	Hopkins St	Ohlone Greenway		0.05	\$30,000
	Protected Intersection	Delaware St	Sacramento St	-		-	\$650,000
	Raised Intersection	Ohlone Greenway	Gilman St				\$125,000

CORRIDOR	RECOMMENDED PROJECT OR STUDY	LOCATION	CROSS ST A	CROSS ST B	NOTES	MILES	TOTAL COST ESTIMATE
Ohlone Greenway	RRFB + Median + Raised	Ohlone Greenway	Santa Fe				\$85,000
	RRFB + Median + Raised	Ohlone Greenway	Hopkins St				\$85,000
	RRFB + Median + Raised	Ohlone Greenway	Rose St				\$85,000
	RRFB + Median + Raised	Ohlone Greenway	Cedar St				\$85,000
	RRFB + Median + Raised	Ohlone Greenway	Franklin St				\$85,000
	RRFB + Median + Raised	Ohlone Greenway	Peralta				\$85,000
Russell St	Cycletrack Crossing	San Pablo Ave	Heinz Ave/ Russell St	-	Short term - Sidewalk	-	\$60,000
	РНВ	Russell St	Sacramento St	-		-	\$250,000
	РНВ	Russell St	Adeline St	-		-	\$250,000
	RRFB + Median	Russell St	Shattuck Ave	-		-	\$70,000
	RRFB + Median	Russell St	Claremont Ave	-		-	\$70,000
	Traffic Circle	Russell St	King St	-		-	\$50,000
	Traffic Signal	San Pablo Ave	Heinz Ave/ Russell St	-		-	\$500,000
San Pablo Ave	Study Cycletrack (4)	San Pablo Ave	City Limits - South	City Limits - North	Complete Street Corridor Study	2.35	\$1,434,100
Shattuck Ave	Study Cycletrack (4)	Shattuck Ave	City Limits - South	Rose St	Complete Street Corridor Study	2.08	\$147,100

CORRIDOR	RECOMMENDED PROJECT OR STUDY	LOCATION	CROSS ST A	CROSS ST B	NOTES	MILES	TOTAL COST ESTIMATE
Virginia St	РНВ	San Pablo Ave	Virginia St	-		-	\$250,000
	РНВ	Sacramento St	Virginia St	-		-	\$250,000
	РНВ	Shattuck Ave	Virginia St	-		-	\$250,000
	RRFB	Oxford St	Virginia St	-		-	\$50,000
	RRFB + Median	MLK Jr Way	Virginia St	-		-	\$70,000
Woolsey St	РНВ	Adeline St	Woolsey St	-		-	\$250,000
	RRFB + Median	Woolsey St	Shattuck Ave	-		-	\$70,000
						Tota	I \$26,318,900



6.3 PILOT PROJECTS

"Pilot projects" are a way to test the impacts of changes to the transportation network by temporarily constructing improvements using non-permanent materials, in place for a specified, limited amount of time. These projects enable the City to study the real-world efficacy of such changes, often at a relatively modest cost due to the short-term materials used. Utilizing before and after data collection, they are monitored to understand benefits and tradeoffs, with the goal of adjusting the final design before committing to a more expensive permanent capital project.

Short-term demonstration projects, sometimes called tactical urbanism or temporary installations, are installed for one or two days in order to quickly evaluate a project and to gather feedback from the public. Demonstration projects usually use cones, temporary marking tape, moveable planters, and other nonpermanent materials that can be easily be installed, modified, and removed, as needed. Short-term demonstration projects could include but are not limited to the following:

- Complex Bike Boulevard crossings:
- » Addison Street/San Pablo Avenue
- » Oregon Street/Heinz Avenue/San Pablo Avenue
- » Hillegass Avenue/Bancroft Way

Longer-term pilot projects can be installed for a longer period of time prior to permanent implementation. This allows for extensive data collection and public input, especially for potentially contentious projects. Materials such as traffic paint, flexible traffic delineator posts, and moveable planters are often used during pilot projects and then may be later upgraded to permanent treatments such as thermoplastic, asphalt, concrete, and rigid bollards. Long-term pilot projects could include but are not limited to the following:

- Southside Pilot Project (in partnership with AC Transit), including bikeway, pedestrian, and transit improvements:
 - » Telegraph Avenue from Bancroft Way to Dwight Way
 - » Bancroft Way from Piedmont Avenue to Milvia Street
 - » Dana Street from Bancroft Way to Dwight Way
 - Fulton Street from Bancroft Way to Dwight
 Way
- Downtown Milvia Street Bikeway including University Avenue intersection
- High-priority Bike Boulevard corridors, such as:
 - » Channing Way
 - » Milvia Street
 - » Addison Street
 - » King Street
 - » Russell Street

Both demonstration and long-term pilots should be approached from a Complete Streets design perspective, in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan. Pilot Projects should integrate improvements for all modes of transportation whenever possible, including consideration of people walking, biking, riding transit, and driving. For example, pilot projects on Primary or Secondary Transit Routes should seek to test transit operations and access improvements whenever possible, utilizing the latest national design best practices, such as the National Association of City Transportation Officials (NACTO) Transit Street Design Guide and Urban Street Design Guide. Local guidance, such as the forthcoming AC Transit Design Standards and Guidelines Manual for Safe and Efficient Multimodal Transit Stops and Corridors will also be consulted.

6.4 CAPITAL COST ESTIMATE ASSUMPTIONS

Table 6-4 gives the 2016 planning level cost assumptions used to determine project cost estimates. Unit costs are typical or average costs in the Bay Area. While they reflect typical costs, unit costs do not consider project-specific factors such as right-of-way acquisition, intensive grading, landscaping, or other location-specific factors that may increase actual costs. For some segments, project costs may be significantly greater.

Table 6-4: Planning-Level Cost Estimates

UNIT	COST ESTIMATE
Mile	\$50,000
Each	\$350
Mile	\$3,500,000
Mile	\$600,000
Mile	\$90,000
Mile	\$180,000
Intersection	\$60,000
Intersection	\$50,000
Intersection	\$70,000
Intersection	\$85,000
Intersection	\$125,000
Each	\$250,000
Intersection	\$500,000
Each	\$650,000
Each	\$50,000
Each	\$1,500,000
	UNIT Mile Each Mile Mile Mile Intersection Intersection Intersection Intersection Each Each Each Each

*Assume 2 sharrow markings per intersection

6.5 MAINTENANCE COSTS

Maintenance costs are important to factor in during the annual budgeting process. **Table 6-5** shows the estimated total annual costs of maintaining the bikeway facility types discussed in this Plan.

FACILITY TYPE	COST PER MILE PER YEAR	PROPOSED LENGTH (MILES)	TOTAL ANNUAL COST	NOTES
Class I Shared-Use Path	\$8,500	1.5	\$12,750	Lighting, debris cleanup, and removal of vegetation overgrowth
Class II Bicycle Lanes (two sides)	\$1,500	3.1	\$4,650	Repainting lane stripes and stencils; sign replacement as needed
Class III Bicycle Routes (two sides)	\$1,000	26.3	\$26,300	Sign and shared-lane stencil replacement as needed
Class IV Separated Bikeways (two sides)	\$4,000	18.4	\$73,600	Debris removal; repainting stripes and stencils; sign replacement; replacing damaged barriers
Total		49.3	\$117,300	

Table 6-5:	Total Annua	al Maintenance	Costs
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6.6 PLAN IMPLEMENTATION AND STAFFING COSTS

Capital project costs only capture a portion of the resources needed to fully implement this plan. In addition to base capital costs, contingencies are added to capture unanticipated increases in the cost of project materials and/or labor. The City will need to utilize a combination of staff and consultant resources for project delivery phases that include Planning (conceptual project development and funding); Preliminary Engineering (environmental clearance and design); Final Design; and Construction Management (contractor oversight, inspection, and invoicing). **Table 6-6** provides a planning-level estimate of these "soft costs" associated with delivering Tier 1, 2, and 3 projects.

Table 6-6: Total Planning-Level Implementation Cost Estimate

TIER	YEARS	CAPITAL COST	CAPITAL CONTINGENCY (10%)	CAPITAL TOTAL
Tier 1	2016-2025	\$26,318,900	\$2,631,890	\$28,950,790
Tier 2	2025-2035	\$4,658,400	\$465,840	\$5,124,240
Tier 3	2025-2035	\$3,493,800	\$349,380	\$3,843,180
Totals		\$34,471,100		\$37,918,210

Table continues below

TIER	PLANNING (25%)	PRELIMINARY ENGINEERING (25%)	CONSTRUCTION MANAGEMENT (15%)	TOTAL "SOFT COSTS"	TOTAL COST ESTIMATE
Tier 1	\$7,237,700	\$7,237,700	\$4,342,600	\$18,818,000	\$47,768,800
Tier 2	\$1,281,100	\$1,281,100	\$768,600	\$3,330,800	\$8,455,000
Tier 3	\$960,800	\$960,800	\$576,500	\$2,498,100	\$6,341,300
Totals				\$24,646,900	\$62,565,100

6.7 PROJECT RECOMMENDATIONS

This Plan recommends nearly \$34.5 million in infrastructure recommendations to help Berkeley achieve its vision of becoming a model bicyclefriendly city. **Table 6-7** shows the mileage or count along with total cost estimate by type of recommendation. **Appendix E: Project Recommendation Tables and Prioritization** provides the full project lists and their locations.

Complete Street Corridor Studies

As defined by the Berkeley Complete Streets Policy, "Complete Streets" describes a comprehensive, integrated transportation network for all users. Providing a complete network does not necessarily mean that every street will provide dedicated facilities for all transportation modes, but rather that the

Table 6-7: Summary of Project Recommendations and Cost Estimates

ТҮРЕ	MILEAGE/COUNT	COST ESTIMATE
Class 1A: Paved Path	1.5 miles	\$5,285,700
Class 2A: Standard Bike Lane	0.1 miles	\$10,700
Class 2B: Upgraded Bike Lane	3.0 miles	\$541,500
Class 3C: Sharrows	13.9 miles	\$71,600
Class 3E: Bicycle Boulevard	12.4 miles	\$621,900
Class 4: Cycletrack	18.4 miles	\$9,903,300
Complete Street Corridor Interim Treatments	17.0 miles	\$1,181,400
Two-Way Cycletrack Crossing Connector	4 ct.	\$240,000
Pedestrian Hybrid Beacon (PHB)	16 ct.	\$4,000,000
Protected Intersection	10 ct.	\$6,500,000
Raised Intersection	1 ct.	\$125,000
RRFB	5 ct.	\$250,000
RRFB + Median	14 ct.	\$980,000
RRFB + Median + Raised Crosswalk	6 ct.	\$510,000
Traffic Circle	42 ct.	\$2,100,000
Traffic Diverter	13 ct.	\$650,000
Traffic Signal	3 ct.	\$1,500,000
Total	66.3 miles/114 ct	\$34,471,100

transportation network will provide convenient, safe, and connected routes for all modes of transportation within and across the City. For the purposes of bikeway planning, the City of Berkeley considers both the major/collector street and parallel streets part of a Complete Street Corridor; potential bikeways on both the major/collector street bikeway and on parallel streets should be evaluated as part of a Complete Street Corridor Study. Of the major and collector streets shown on Figure 6-1 and Figure 6-2 as requiring a Class IV Cycletrack to meet LTS 1 or 2, most of them will require further study in order to evaluate their suitability for this treatment and impacts on other modes of transportation. These major and collector streets provide access to local Berkeley businesses or opportunities for direct cross-town or interjurisdictional travel not duplicated by a parallel street. They currently serve multiple modes of transportation, requiring further consideration above and beyond that of bicycle travel. These streets are therefore labeled as "Complete Street Corridor Studies" on the map figures.

Class IV Cycle Tracks and other bikeway types that might impact transit operations, parking, or roadway capacity will not be implemented without these Complete Street Corridor Studies that will include a traffic study, environmental analysis, public process, and coordination with all affected State, County, and local transit agencies. Potential bikeways to be considered as part of future Complete Street Corridor Studies will be evaluated in the context of the modal priorities established by the Berkeley General Plan Transportation Element and the Alameda County Transportation Commission Countywide Multimodal Arterial Plan. Studies to consider the inclusion of bikeways will be coordinated with proposed improvements to transit performance on Primary Transit Routes, such as bus boarding islands, transit-only lanes, transit signal priority/queue jump lanes, far-side bus stop relocations, and other improvements as described in the AC Transit Major Corridor Study. In addition, these studies should approach Secondary Transit Routes as opportunities for transit improvements, such as bus stop optimization and relocation, among other potential improvements. At the conclusion of the Complete Streets Corridor Study process, design alternatives which have a significant negative effect on transit on Primary Transit Routes will not be recommended. Criteria to define what constitutes a significant negative effect on transit will be developed and applied during the Study process for each corridor. Example criteria for evaluating transit impacts are provided in Section 5.7 of this Plan. Consideration of how to allocate limited public right-of-way among various travel modes will be made consistent with Alameda County Transportation Commission modal priorities and the City of Berkeley General Plan.

These corridors may have interim treatments installed while the corridor study and final recommended design are being completed. Interim treatments are those that do not require a full Complete Streets Corridor Study. Interim and phased treatments may still require traffic study, interagency coordination, and public process if they impact roadway capacity, parking, or transit operations. Interim and phased treatments should not negatively impact existing transit operations; mitigations should accompany interim treatments to ensure no degradation of transit service. For example, Shared Roadway Bicycle Markings may be installed, or existing bike lanes may first be colored green, then later converted into a Class IV Cycletrack if feasible without

negatively impacting existing or planned transit operations on Primary or Secondary Transit Routes. **Table 6-8** shows the extent of the Complete Street Corridor Study projects and provides the recommended interim treatments. Some corridors list multiple interim treatment types that would be implemented along different segments of the same corridor. **Table E-7** in **Appendix E** presents a more detailed breakdown of the recommended Complete Street Corridor Studies and interim treatments.

For more information about future Complete Street Corridor Studies, see **Section 5.7**, **Appendix E**, and **Appendix F**.

Table 6-8: Complete Street Corridor Studies

LOCATION	CROSS ST A	CROSS ST <u>B</u>	RECOMMENDED STUDY	INTERIM TREATMENT	MILES	TOTAL COST ESTIMAT <u>E</u>
4th St	Virginia St	University Ave	2B: Upgraded Bike Lane	3C: Sharrows	0.31	\$58,500
Adeline St	King St	Shattuck Ave	Study Cycletrack (4)	2B: Upgraded Bike Lane, 3C: Sharrows	0.99	\$710,800
Bancroft Way	Milvia St	Piedmont Ave	Study Cycletrack (4)	3C: Sharrows	1.00	\$607,200
Claremont Ave	City Limits - South	Warring St	Study Cycletrack (4)	3C: Sharrows	1.10	\$675,800
Colusa Ave	Solano Ave	Tacoma Ave	Study Cycletrack (4)	2B: Upgraded Bike Lane	0.13	\$104,800
Dana St	Bancroft Way	Dwight Way	Study Cycletrack (4)	2B: Upgraded Bike Lane	0.25	\$195,100
Delaware St	Acton St	Sacramento St	Study Cycletrack (4)	2B: Upgraded Bike Lane	0.13	\$101,800
Euclid Ave	Virginia St	Hearst Ave	2B: Upgraded Bike Lane	3C: Sharrows	0.19	\$36,800
Fulton St, Oxford St	Dwight Way	Virginia St	Study Cycletrack (4)	2B: Upgraded Bike Lane, 3C: Sharrows, Study Cycletrack (4)	0.89	\$726,700
Gilman St	2nd St	Hopkins St	Study Cycletrack (4)	2B: Upgraded Bike Lane	1.19	\$926,800
Hearst Ave	California St	Arch St/Le Conte Ave	Study Cycletrack (4)	2B: Upgraded Bike Lane	0.91	\$659,300
Hopkins St	9th St	Milvia St	Study Cycletrack (4)	2B: Upgraded Bike Lane, 3C: Sharrows	1.50	\$1,014,100
Piedmont Ave, Warring St	Bancroft Way	Derby St	Study Cycletrack (4)	3C: Sharrows	0.54	\$327,000
San Pablo Ave	City Limits - South	City Limits - North	Study Cycletrack (4)	3C: Sharrows	2.35	\$1,434,100
Shattuck Ave	City Limits - South	Rose St	Study Cycletrack (4)	3C: Sharrows	2.08	\$147,100
Solano Ave	City Limits - West	Northbrae Tunnel	Study Cycletrack (4)	3C: Sharrows	0.52	\$317,500
Telegraph Ave	Woolsey St	Bancroft Way	Study Cycletrack (4)	2B: Upgraded Bike Lane	1.09	\$851,100
The Alameda	Hopkins St	Solano Ave	Study Cycletrack (4)	2A: Standard Bike Lane	0.44	\$303,400
University Ave	Oxford St	4th St	Study Cycletrack (4)	3C: Sharrows	1.88	\$1,144,400
					Tota	al \$10,342,300