Title

Pedestrian and Bicycle Safety Strategies for UC Berkeley Campus and Periphery: Recommendations for Implementation

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ACKNOWLEDGEMENTS

This report was prepared for the University of California, Berkeley (UC Berkeley) Office of Risk Management by the UC Berkeley Safe Transportation Research and Education Center (SafeTREC) with funding from the University of California Be Smart About Safety (BSAS) program. Guidance for the development of this report was also provided by the UC Berkeley Office of Physical and Environmental Planning and the City of Berkeley Transportation Division.

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TABLE OF CONTENTS

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EXECUTIVE SUMMARY
May 2012

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Overview


Pedestrians cross Bancroft Way at Telegraph Avenue.

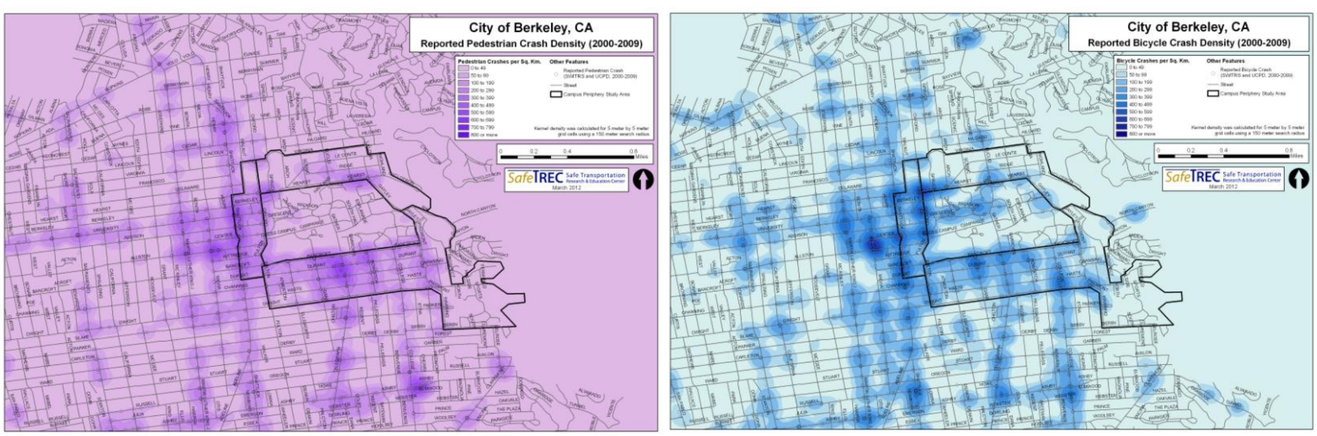
The high level of pedestrian, bicycle, and transit activity on city-owned streets surrounding the UC Berkeley campus creates a dynamic social environment and gives Berkeley much of its charm. But the streets around the campus (henceforth called the campus periphery) are also places where pedestrians and bicyclists have been injured or killed in collisions with automobiles. This creates liability for drivers, the City, and the University—and worse, causes suffering for crash victims and their families.

Everyone has an interest in reducing the frequency and severity of pedestrian and bicycle crashes within the campus periphery. This document, developed by the UC Berkeley Safe Transportation Research and Education Center (SafeTREC), recommends short- and long-term actions to improve pedestrian and bicycle safety on and near the campus.

The Campus Periphery


Bicyclists ride to campus on the Bowditch Street Bicycle Boulevard.

The campus periphery is one of the busiest parts of Alameda County. On a typical class day, it attracts more than 34,000 students and more than 14,000 faculty and staff. About 40% of these people walk, 25% use public transit, and 10% ride bicycles. Encouraging walking and bicycling is essential for maintaining the character, vitality, and sustainability of the campus periphery. As walking and bicycling are promoted, it is critical to make the environment safe for these modes. Although the campus periphery area defined for this study comprises less than 6% of the City of Berkeley, **approximately 25% of the City's automobile-pedestrian collisions and nearly 20% of the City's automobile-bicycle collisions occur within it.**



There have been high concentrations of pedestrian and bicycle crashes in Berkeley near the UC Berkeley campus.

Shared Goals

The City and University are both committed to reducing pedestrian and bicycle crashes:

- The City of Berkeley is improving pedestrian and bicycle safety through its Pedestrian Master Plan, Bicycle Master Plan, and other area-specific plans.
- UC Berkeley is implementing pedestrian and bicycle improvements recommended in its Long Range Development Plan, Bicycle Plan, and Landscape Master Plan.

The SafeTREC research team categorized its recommended improvements into several groups based on their anticipated ease of implementation and support from existing City and University plans. Although most of the streets in the campus periphery area belong to the City, the City and University have collaborated regularly to plan and implement improvements that will increase the safety of the environment for pedestrians and bicyclists. As such, the recommendations in this document provide additional tools and rationale for both parties to use in existing and future planning initiatives.

Implementation Strategy

Curb ramps were installed at the corner of Telegraph Avenue and Durant Avenue.

SafeTREC's recommendations for improving pedestrian and bicycle conditions in the campus and periphery are divided into four implementation categories. Recommendations within each group are prioritized objectively according to the suitability of existing roadway conditions for walking and bicycling, approximated pedestrian and bicycle activity, and reported pedestrian and bicycle crashes along specific roadway corridors. Completion of projects will depend on staff time available and the extent of technical analysis and public outreach.

- **Group 1**: Supported by Existing Plan, Straightforward to Implement—Recommendations that are supported by a City or University plan and could be relatively straightforward to implement, meaning that the projects may be relatively inexpensive, may not require extensive analysis, or preliminary studies are already underway. The City and University could begin to work on recommendations in this group within a year after the completion of this study. Within this group, there are several Early Action projects that could be completed within a year (see below).
- **Group 2:** Supported by Existing Plan, Challenging to Implement—Recommendations that are supported by a City or University plan but usually involve significant public outreach and a large amount of staff time. The City and University could begin to move forward with the recommendations in this group when resources are available in the next two years.
- **Group 3:** New Suggestion, Straightforward to Implement—Recommendations that may be relatively straightforward to implement but are not supported by an official plan. For signage or striping recommendations, the City and University may be able to move forward toward implementation within a year after completion of this study with little additional planning. Other recommendations in this category may involve a more formal planning process, so they could take up to five years to begin.
- **Group 4:** New Suggestion, Challenging to Implement—Ideas that could be considered by the City and University in future planning processes.

Early Action Projects

The City and University are working together to implement a number of pedestrian and bicycle improvements within their near-term project plans. Many are low-cost and called for in existing City and University plans. Through this study, SafeTREC suggests that the City and University could complete the projects below within the next year.

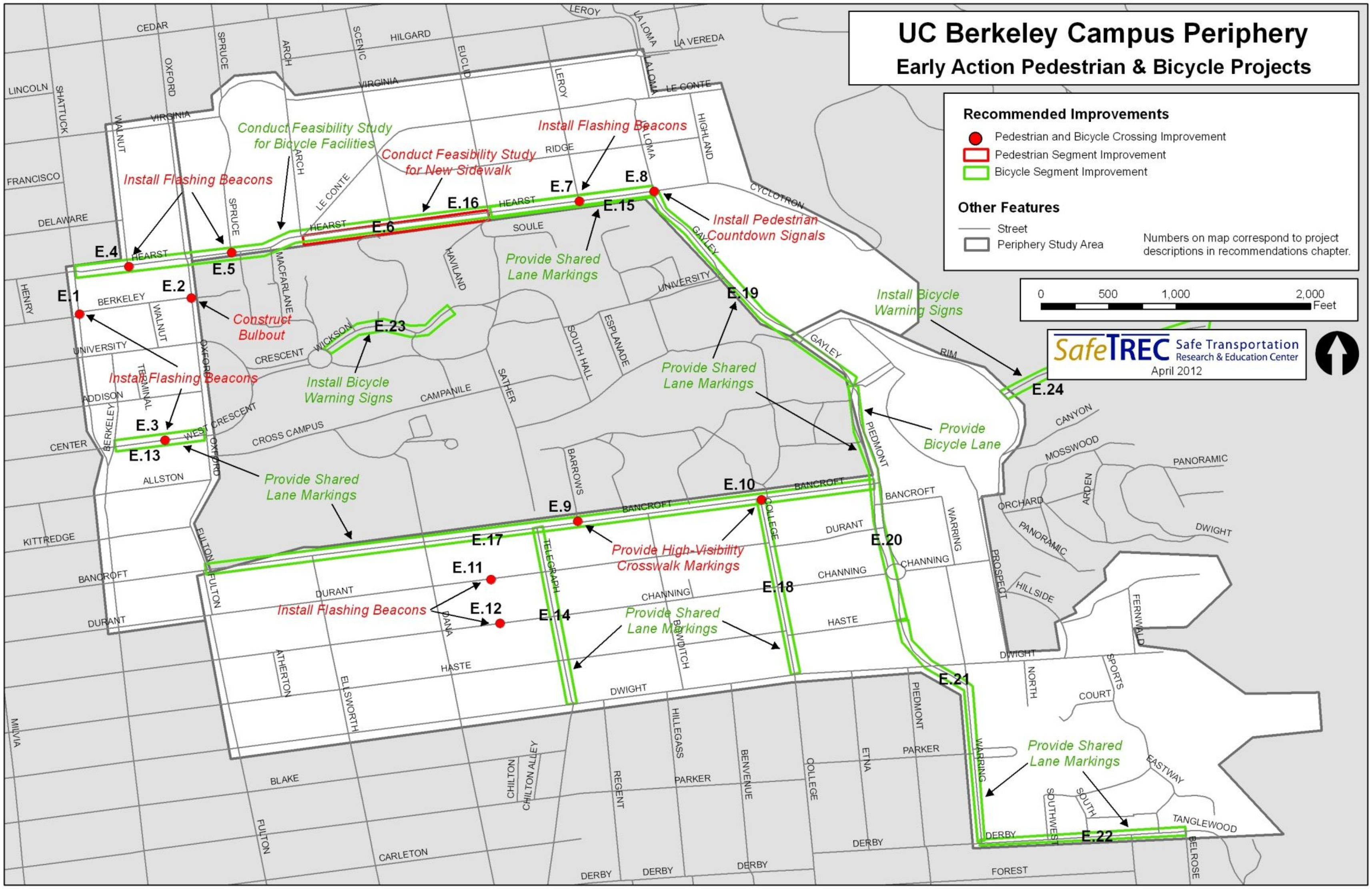
Rectangular rapid flashing beacons emphasize the pedestrian crossing of Bancroft Way at Dana Street.

Pedestrian Improvements

- E.1. Shattuck Ave. & Berkeley Way—Install flashing beacons (e.g., Rectangular Rapid Flashing Beacons or Pedestrian Hybrid Beacons) and pedestrian warning signs
- E.2. Oxford St. & Berkeley Way—Construct curb bulbouts
- E.3. Center Street midblock crossing between Shattuck Avenue and Oxford Street—Install flashing beacons and pedestrian warning signs
- E.4. Hearst Ave. & Walnut St.—Install flashing beacons and pedestrian warning signs
- E.5. Hearst Ave. & Spruce St.—Install flashing beacons and pedestrian warning signs
- E.6. Hearst Ave. between LeConte Ave. and Euclid Ave.—Conduct feasibility study for new sidewalk on south side of street
- E.7. Hearst Ave. & Leroy Ave.—Install flashing beacons and pedestrian warning signs
- E.8. Hearst Ave. & Gayley Rd.—Install pedestrian countdown signals
- E.9. Bancroft Way & Barrow Lane—Provide high-visibility ladder crosswalk markings
- E.10. Bancroft Way & College Ave.—Provide high-visibility ladder crosswalk markings
- E.11. Durant St. midblock crossing between Dana St. and Telegraph Ave.—Install flashing beacons and pedestrian warning signs
- E.12. Channing Way midblock crossing between Dana St. and Telegraph Ave.—Install flashing beacons and pedestrian warning signs

Bicycle Improvements

- E.13. Center Street between Shattuck Ave. and Oxford St.—Provide shared lane markings
- E.14. Telegraph Ave.between Dwight Way and Bancroft Way—Provide shared lane markings
- E.15. Hearst Ave. between Euclid Ave.and Gayley Rd.—Provide shared lane markings
- E.16. Hearst Ave. between Oxford St. and Gayley Rd.—Conduct feasibility study for new bicycle facilities in corridor
- E.17. Bancroft Way between Piedmont Ave. and Shattuck Ave.—Provide shared lane markings
- E.18. College Ave. between Bancroft Way and Dwight Way—Provide shared lane markings
- E.19. Gayley Rd. between Hearst Ave. and Optometry Lane—Provide shared lane markings
- E.20. Piedmont Ave. between Optometry Lane and Haste St.—Provide bicycle lanes in northbound direction and shared lane markings in southbound direction
- E.21. Piedmont Ave./Warring St. between Haste St. and Derby St.—Provide shared lane markings
- E.22. Derby S. between Warring St. and Belrose Ave.—Provide shared lane markings
- E.23. Wickson Dr. between West Circle and Memorial Glade—Install bicycle warning signs
- E.24. Centennial Dr. between Stadium Rim Way and Grizzly Peak Dr.—Install “Share the Roadway with Bicycles” signs and provide shared lane markings



UC Berkeley Campus Periphery
Early Action Pedestrian & Bicycle Projects
Recommended Improvements
Pedestrian and Bicycle Crossing Improvement
Pedestrian Segment Improvement
Bicycle Segment Improvement
Other Features
Street
Periphery Study Area
Numbers on map correspond to project descriptions in recommendations chapter.
0 500 1,000 2,000 Feet
SafeTREC Safe Transportation Research & Education Center
April 2012
Conduct Feasibility Study for Bicycle Facilities
Conduct Feasibility Study for New Sidewalk
Install Flashing Beacons
Install Pedestrian Countdown Signals
Construct Bulbout
Install Bicycle Warning Signs
Provide Shared Lane Markings
Provide Bicycle Lane
Provide High-Visibility Crosswalk Markings
E.1
E.2
E.3
E.4
E.5
E.6
E.7
E.8
E.9
E.10
E.11
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E.21
E.22
E.23
E.24

Additional Recommendations

Examples of additional short- and long-term recommendations are listed below. Chapter 6 of the main document lists specific infrastructure projects according to each of the four groups described above. Some physical improvements could also be implemented as opportunities become available through roadway reconstruction or site redevelopment projects. These infrastructure changes could be complemented by education, encouragement, and enforcement programs.

In-street bicycle corral serves high demand for bicycle parking on Center Street west of Oxford Street.

- Provide curb bulbouts, median islands, stop signs, traffic signals, and better lighting to improve pedestrian and bicycle crossings
- Reconfigure roadway lanes and stripe new bicycle lanes on several roadways to improve conditions for bicycling along the roadway
- Create slow-speed, shared-space zones on streets adjacent to campus and several streets in downtown Berkeley to make pedestrian and bicycle travel safer and more comfortable
- Consider a two-way bicycle facility separated from adjacent traffic at the campus boundary on Oxford Street and parts of Bancroft Way
- Supplement shared lane markings with a 5- to 6-foot-wide green stripe to guide bicyclists to ride in the appropriate position and help prevent potential car-door crashes
- Provide more bicycle parking on campus and in the periphery area
- Implement a variety of pedestrian, bicyclist, and driver safety education and enforcement programs
- Increase enforcement of traffic laws to improve pedestrian, bicyclist, and driver behavior
- Encourage walking and bicycling to campus through programs such as Campus Bike Day and a pilot bicycle sharing program

Performance Measures

This study suggests performance measures to benchmark progress. The performance measures will build on the extensive database created for this study and will track pedestrian and bicycle infrastructure, activity levels, behavior, and safety, enabling the City and University to assess how much improvements have reduced pedestrian and bicycle accidents. Ideally, these findings will also support the transportation and long-term sustainability goals adopted by the City and University and help prioritize where to make future investments.

1. INTRODUCTION

The University of California, Berkeley (UC Berkeley) campus is recognized as a hub for world-class research and teaching, but it also serves as a major destination for pedestrian, bicycle, public transit, and automobile commuters. On a typical class day, more than 34,000 students and more than 14,000 faculty and staff travel to and from campus. More people move into and out of the campus area each day than any other activity center in Alameda County. Of these commuters, many use sustainable travel modes. Approximately 40 percent walk, 25 percent use public transit, and 10 percent bicycle.[1]

In addition to facilitating access to UC Berkeley, streets within several blocks of campus serve many other business, social, and academic activities. The campus periphery area contains dormitories, public buildings, research centers, parking structures, apartments and homes, and vibrant commercial centers around Telegraph Avenue, Shattuck Avenue, and Euclid Street. Movement of people between these activity locations, campus, and other nearby destinations helps create the rich street environment at the heart of the City of Berkeley.

Encouraging walking and bicycling is essential for maintaining the character, vitality, and sustainability of the area surrounding campus. These travel modes use less space than automobiles, cost less than other types of transportation, do not produce air pollution, and promote social connection. However, interactions between pedestrians, bicyclists, and motorized vehicles also create a risk for collisions and injuries. While the UC Berkeley campus periphery study area (within two to four blocks of the campus boundary) covers less than 6 percent of the City of Berkeley, approximately 25 percent of the City's automobile-pedestrian collisions reported between 2000 and 2009 occurred within this area. The campus periphery area experienced nearly 20 percent of the City's reported automobile-bicycle collisions.

The high incidence of pedestrian and bicycle crashes is due partly to the high levels of walking and bicycling activity near campus. However, roadway conditions and individual travel behaviors are also likely to contribute to crash risk. While the campus and nearby destinations are ideally situated for walking and bicycling, the campus is bounded by multi-lane roadways on three sides. These streets often have high motor vehicle volumes and high-speed traffic. Pedestrians have long crossing distances at some intersections and at others must negotiate automobiles turning right without stopping. Bicycle routes from the south do not make convenient connections into campus, resulting in some bicyclists riding against motor vehicle traffic or on busy sidewalks. Bicycle lanes on other streets end before they reach the edge of campus. Some pedestrians and bicyclists cross streets without stopping or looking; some drivers do not yield to pedestrians in crosswalks and turn right on red lights without stopping. While the focus of this document is on pedestrian and bicycle safety in the campus periphery, the campus itself also experiences conflicts among pedestrians, bicyclists, and a small number of motor vehicles. Injury risk for pedestrians and bicyclists should also be reduced within the main campus.

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[1]Calculations based on student and faculty and staff mode shares in the UC Berkeley 2011 Campus Sustainability Report. The student 2008 mode share included 55% walk, 24% transit, and 11% bicycle. The faculty and staff 2009 mode share included 9% walk, 25% transit, and 9% bicycle.

Streets and pathways in and around the UC Berkeley Campus are maintained by two separate jurisdictions: the University of California, Berkeley and the City of Berkeley. Both public agencies have established policies to improve pedestrian and bicycle safety and are taking actions to reduce crash risk. The City of Berkeley is improving pedestrian and bicycle safety near campus by implementing the recommendations of its Pedestrian Master Plan, Bicycle Master Plan, and other small-area plans. UC Berkeley continues to improve walking and bicycling by implementing components of its Long Range Development Plan, Bicycle Plan, and Landscape Master Plan. While progress is being made toward reducing pedestrian and bicycle crash risk, additional emphasis should be placed on the campus periphery area. This strategic document represents recommendations by the UC Berkeley Safe Transportation Research and Education Center (SafeTREC) for a coordinated effort by UC Berkeley and the City of Berkeley to reduce pedestrian and bicyclist injuries on and near campus.

Many pedestrians cross Oxford Street to access the main campus.

2. PURPOSE

This document recommends specific actions to improve pedestrian and bicycle safety on and near the UC Berkeley campus. As these sustainable transportation modes are promoted by UC Berkeley and the City of Berkeley, it is essential to reduce the risk of pedestrian and bicyclist crashes and injuries. Preventing injuries will also reduce UC Berkeley and City of Berkeley liability and reduce the burden of crashes on local police, firefighters, emergency medical technicians, and other first responders.

2.1. Study Contents

This study strives to improve safety in several ways. It:

- Emphasizes implementing pedestrian and bicycle project and program recommendations from existing plans adopted by UC Berkeley and the City of Berkeley (Section 3).
- Describes existing conditions related to pedestrian and bicycle infrastructure, activity, and safety on and near the UC Berkeley campus (Section 4).
- Uses an in-depth analysis of street corridors in the campus periphery area to prioritize recommendations for physical infrastructure improvements (Section 5).
- Recommends physical infrastructure projects to increase pedestrian and bicyclist safety (Section 6).
- Recommends pedestrian, bicyclist, and driver safety education and enforcement programs to complement physical infrastructure projects (Section 6).
- Proposes ideas for potential pedestrian and bicycle safety improvements over the next 10 to 20 years. These long-term ideas are suggested as a contribution to future public conversations about how public streets and spaces in and around campus are used. All community discussions and plans about transportation and land use in the campus area should lead to a safer, more enjoyable environment for walking and bicycling and fewer pedestrian and bicyclist injuries (Section 6).
- Provides a framework for evaluating the impact of specific actions over time in the campus periphery area, in terms of pedestrian and bicycle infrastructure, activity, behavior, and safety (Section 7).

2.2. Long-Term Vision

The UC Berkeley main campus should be a place to travel slowly, relax, socialize, and learn. Automobiles should be rare, and there should be minimal risk of pedestrian and bicycle collisions. The UC Berkeley campus periphery area should be a place where it is convenient, comfortable, and safe for pedestrians and bicyclists of all ages and abilities, including people walking and bicycling from public transit and automobiles. This means that automobiles should travel at speeds similar to bicycles and all vehicle operators (private automobile drivers, bus drivers, and bicyclists) should drive and ride in a frame of mind that anticipates bicyclists on all roadways and anticipates pedestrians crossing the street in all marked and unmarked crosswalks.

The recommendations of this document will help create a physical and social environment that supports this vision. The campus periphery area improvements will also serve as a model that can be expanded to include other parts of the City of Berkeley and San Francisco Bay Area communities. A safer, more comfortable environment for pedestrians and bicyclists in the campus periphery needs to be supported by broad mode shifts that reduce automobile use and increase sustainable travel modes throughout the region. This will make it possible for the streets around campus to have lower automobile speeds and be shared by people using all travel modes without having traffic spillover effects to other neighborhoods. Therefore, this plan is linked closely with UC Berkeley Campus and City of Berkeley transportation demand management initiatives and supports other sustainable transportation planning efforts throughout the region.

Telegraph Avenue is a vibrant, pedestrian-oriented commercial corridor south of the main campus.

3. EXISTING PLANS

UC Berkeley and the City of Berkeley share similar visions for increasing pedestrian and bicycle activity and improving pedestrian and bicycle safety. For example, the UC Berkeley Campus 2020 Long Range Development Plan establishes policies to increase student housing within one mile of campus, reduce demand for drive-alone trips to campus, and reduce demand for automobile parking by promoting alternative transportation modes. The Transportation Element of the City of Berkeley General Plan seeks to reduce automobile use and vehicle miles traveled in the City by promoting alternatives to driving; improve the quality of life in neighborhoods by slowing automobile traffic on all residential streets; and make bicycling and walking safe, attractive, easy, and convenient for people of all ages and abilities. It also includes an action to encourage additional housing within walking distance of campus to reduce University-related traffic.

Several existing plans from UC Berkeley and the City of Berkeley were used as references to develop this document. These include:

UC Berkeley Plans

- 2020 Long Range Development Plan (2005)
- Long Range Development Plan Five Year Expenditure Plan (2006-2010)
- Campus Bicycle Plan (2006)
- Sustainability Plan (2009)
- Climate Action Plan (2009)
- Landscape Master Plan (2004)
- New Century Plan (2003)
- College of Engineering Streetscape and Open Space Master Plan (2002)

City of Berkeley Plans

- General Plan: Transportation Element (2001)
- Pedestrian Master Plan (2010)
- Bicycle Plan Update (2005)
- Bicycle Plan: Draft for Inclusion in the General Plan (1998)
- Southside Plan (2011)
- Downtown Area Plan (2012)

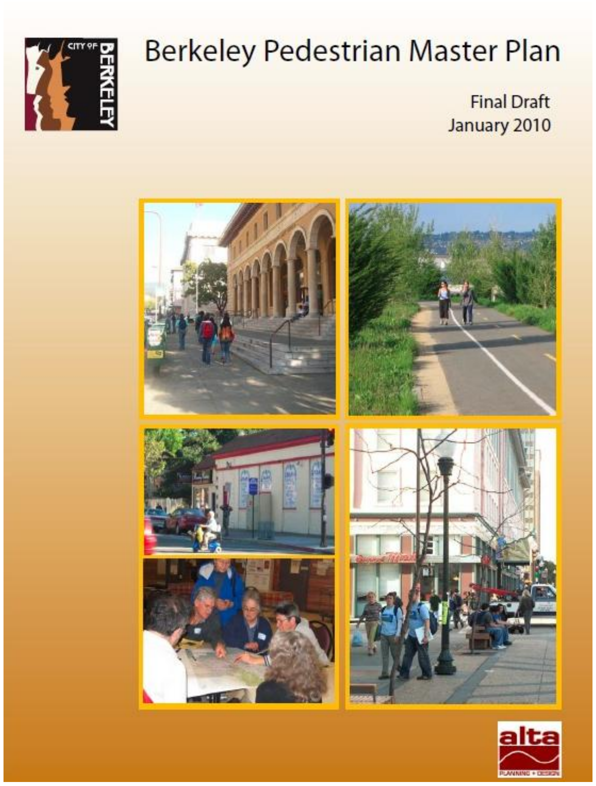
Many pedestrian and bicycle project and program recommendations in this study are supported by these documents. Specific policies and recommendations from existing UC Berkeley and City of Berkeley plans are included in Appendix A.

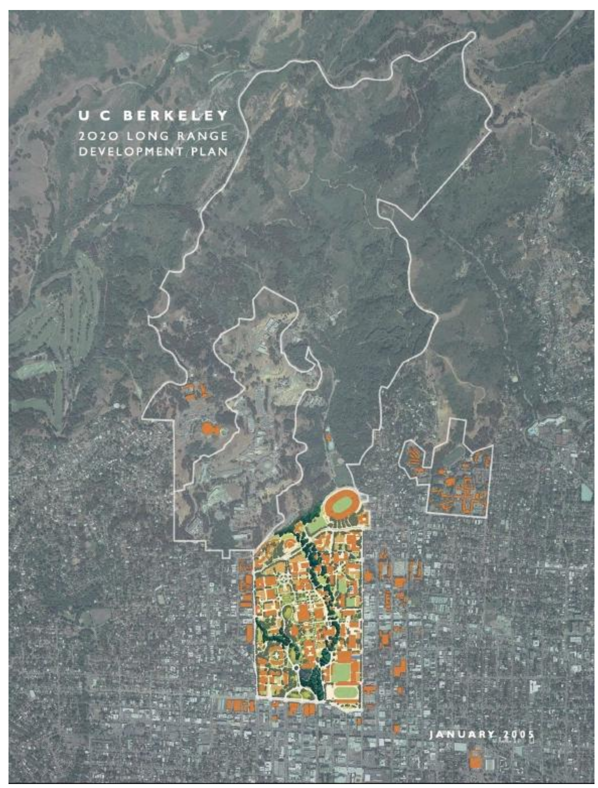
> "Create a model bicycle- and pedestrian-friendly city where bicycling and walking are safe, attractive, easy, and convenient forms of transportation and recreation for people of all ages and abilities."
>
> --*City of Berkeley General Plan*, Transportation Element, Objective 6

> "The streets that define the Campus Park—Bancroft, Oxford/Fulton, Hearst, and Gayley/Piedmont—should be re-envisioned as 'seams' linking the Campus Park and its adjacent blocks, rather than dividers. UC Berkeley should collaborate with the City of Berkeley and Lawrence Berkeley National Laboratory to define, and jointly seek funds for, an integrated program of capital investments to improve the visual quality, pedestrian safety, functionality, amenity, bicycle access and transit service on these streets."
>
> --UC Berkeley *2020 Long Range Development Plan*, p. 46.

> "Work with other agencies and institutions, such as the University of California…to pursue…efforts to reduce automobile trips."
>
> --*City of Berkeley General Plan*, Transportation Element, Policy T-13, Major Public Institutions

There are many important recommendations for improving pedestrian and bicycle access and comfort within the main campus area included in the UC Berkeley New Century Plan, UC Berkeley Landscape Master Plan, and UC Berkeley Campus Bicycle Plan. However, this study focuses on the recommendations compiled from these documents that are most directly related to pedestrian and bicyclist safety. This study emphsizes pedestrian and bicycle safety improvements in the periphery study area where the greatest number of pedestrian, bicycle, and motor vehicle interactions occur.





The City of Berkeley and UC Berkeley are working to improve pedestrian and bicycle safety by implementing recommendations in adopted plans.

4. EXISTING CONDITIONS

The UC Berkeley campus periphery study area includes streets within two to four blocks of the campus boundary on all sides of campus. This area serves many transportation modes, including pedestrians, bicyclists, public transit patrons, and automobile users. The following sections describe multimodal infrastructure, pedestrian and bicycle travel patterns, and pedestrian and bicycle safety in the campus periphery study area. Appendix B provides a detailed description of all existing condition data collected in the study area.

4.1. Multimodal Infrastructure

The campus periphery study area includes infrastructure for many transportation system users, including pedestrians, bicyclists, transit users, and automobile users.

- Pedestrians are served by sidewalks on both sides of nearly all streets, marked crosswalks, and signalized crossings (Figure 4.1).
- Bicyclists take advantage of several bicycle boulevards, streets with designated bicycle lanes, and marked routes through the campus area (Figure 4.2). Bicycle parking is available at bicycle racks near the entrances to most buildings on campus and at bicycle racks near businesses in the Telegraph Avenue, Downtown Berkeley, and Euclid Avenue shopping districts. There is also a Downtown Berkeley Bicycle Station and an on-street bicycle parking corral near the intersection of Oxford Street and Center Street. At certain times of day, bicycle parking overflows onto parking meters, trees, and sign posts in high-activity areas, such as downtown Berkeley and the Telegraph Avenue corridor.
- Transit users arrive and depart from the Downtown Berkeley Bay Area Rapid Transit (BART) station and bus stops on all sides of campus (Figure 4.3). According to the BART Station Profile Study (2010), nearly 12,000 riders enter the Downtown Berkeley BART station using one of the 262 trains passing through the station on a typical weekday. The majority of these customers are traveling to and from work or school in downtown Berkeley or on the UC Berkeley campus. Most of these BART users walk to and from the station; fewer than 10% drive, carpool, or are dropped off at the station. AC Transit has

The campus periphery serves people using many types of transportation.

multiple routes serving the UC Berkeley campus, bringing students and workers to the campus periphery area from all parts of Alameda and Contra Costa Counties. AC Transit has over 1,120 buses stopping in the campus periphery on a typical weekday.[2] BEAR Transit also provides shuttle services in the campus vicinity, with 73 scheduled buses passing through the periphery area on a typical weekday. While most of these transit users walk to and from the bus, some also bring their bicycles on BART and buses and ride to campus and nearby activities.

Bancroft Way is a multilane roadway along the south boundary of campus.

- Automobile drivers and passengers use roadways outside of the main campus area, including the main thoroughfares of Telegraph Avenue, Shattuck Avenue, Oxford Avenue, and the one-way pair of Bancroft and Durant avenues. According to the LRDP Draft EIR (2004), automobile traffic near campus peaks in the morning between 7:45 a.m. and 8:45 a.m. and in the evening between 5:00 p.m. and 6:00 p.m. One exception is that the evening peak on Gayley Road and Piedmont Avenue is from 4:00 p.m. to 5:00 p.m. The LRDP Draft EIR states: "the most commonly applied LOS standard in other Bay Area and California jurisdictions is LOS D; i.e., LOS A-D are acceptable levels of operations and LOS E-F are not." Automobile traffic at all intersections in the campus periphery area operates at LOS D or better for morning and evening peak hours except Bancroft Way & Piedmont Avenue (LOS F) and Warring Street & Derby Street (LOS F). The only other intersection operating at LOS E or F is the stop-controlled traffic turning from Kittredge Street onto Fulton Street during the evening peak hour (LOS F). Traffic congestion was noted on northbound Telegraph Avenue and northbound Shattuck Avenue during the afternoon peak hour. Since 1990, faculty and staff drive-alone mode share has decreased from 60 percent to 43 percent and student drive-alone mode share has decreased from 11 percent to 7 percent (UC Berkeley Campus Sustainability Report 2010).
- Automobile parking is provided on most streets and in multiple parking structures on and near campus (Figure 4.4). UC Berkeley provides more than 7,000 off-street automobile parking spaces. The City of Berkeley and private operators provide more than 3,000 additional off-street automobile parking spaces near campus. Off-street parking demand peaks at approximately 11:30 a.m. on weekdays. Most on-street parking spaces have two-hour time limits (LRDP Draft EIR 2004).

[2]The number of buses stopping in the campus periphery area represents the total number of buses passing through the campus periphery area on each route on a typical weekday. For example, if a route has three stops in the campus periphery, a single stop was chosen and the number of times a stop was scheduled at that stop was summed to obtain the total number of buses on that route stopping in the periphery area. The sum total of busses on all routes stopping in the campus area was then calculated.

Figure 4.1. UC Berkeley Campus Periphery Existing Pedestrian Facilities

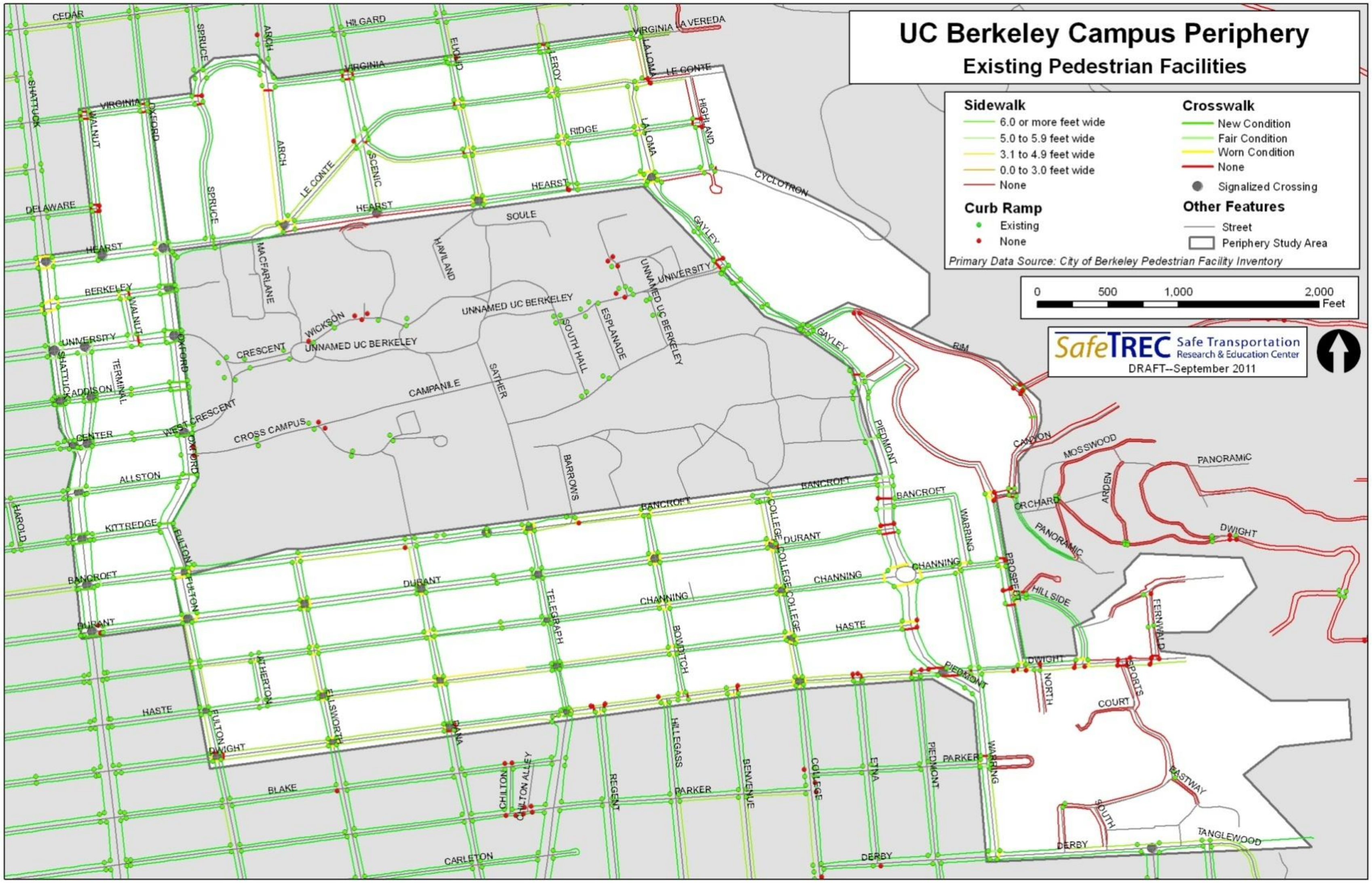


Figure 4.2. UC Berkeley Campus Periphery Existing Bicycle Facilities

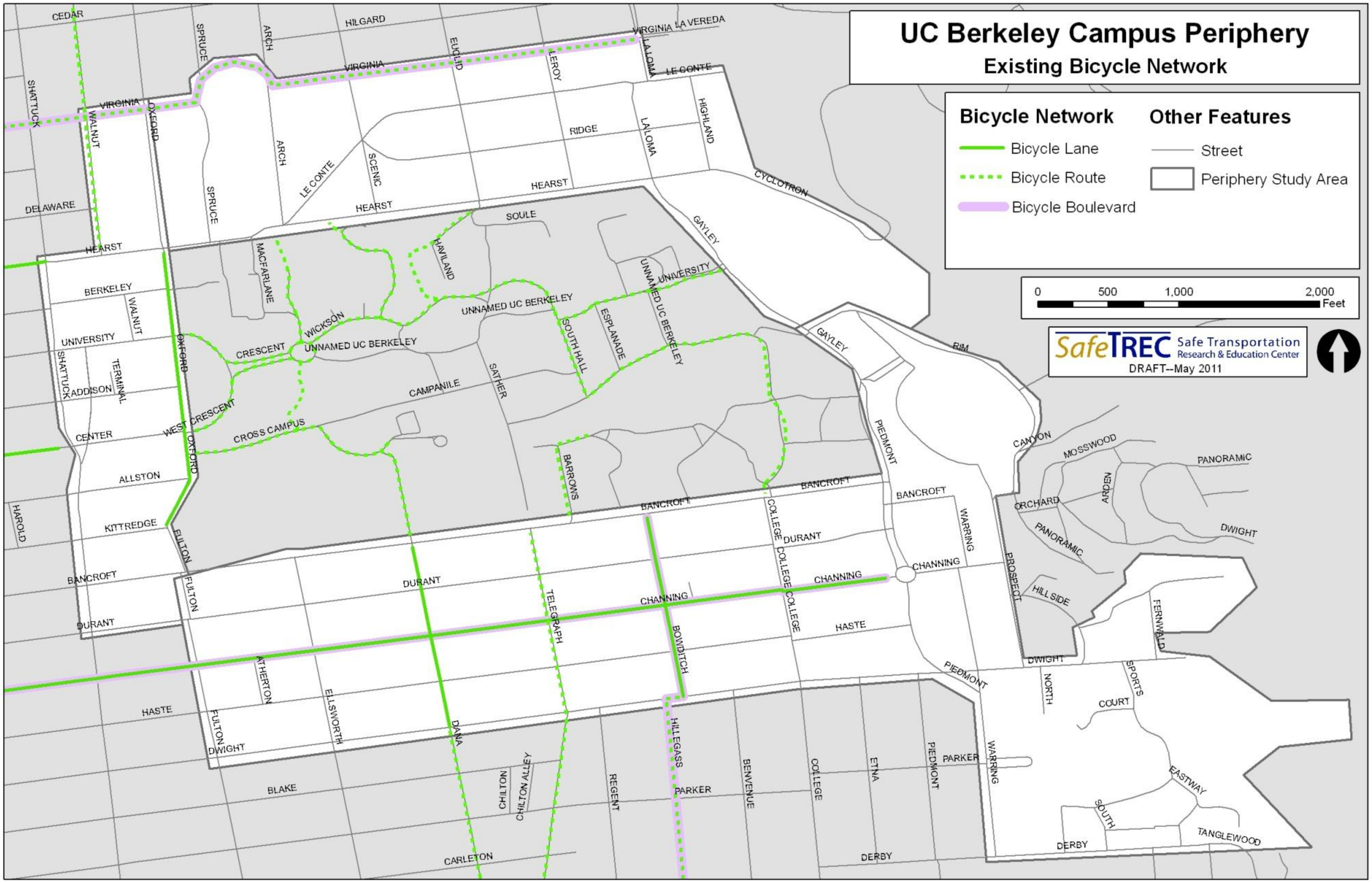


Figure 4.3. UC Berkeley Campus Periphery Existing Transit Facilities

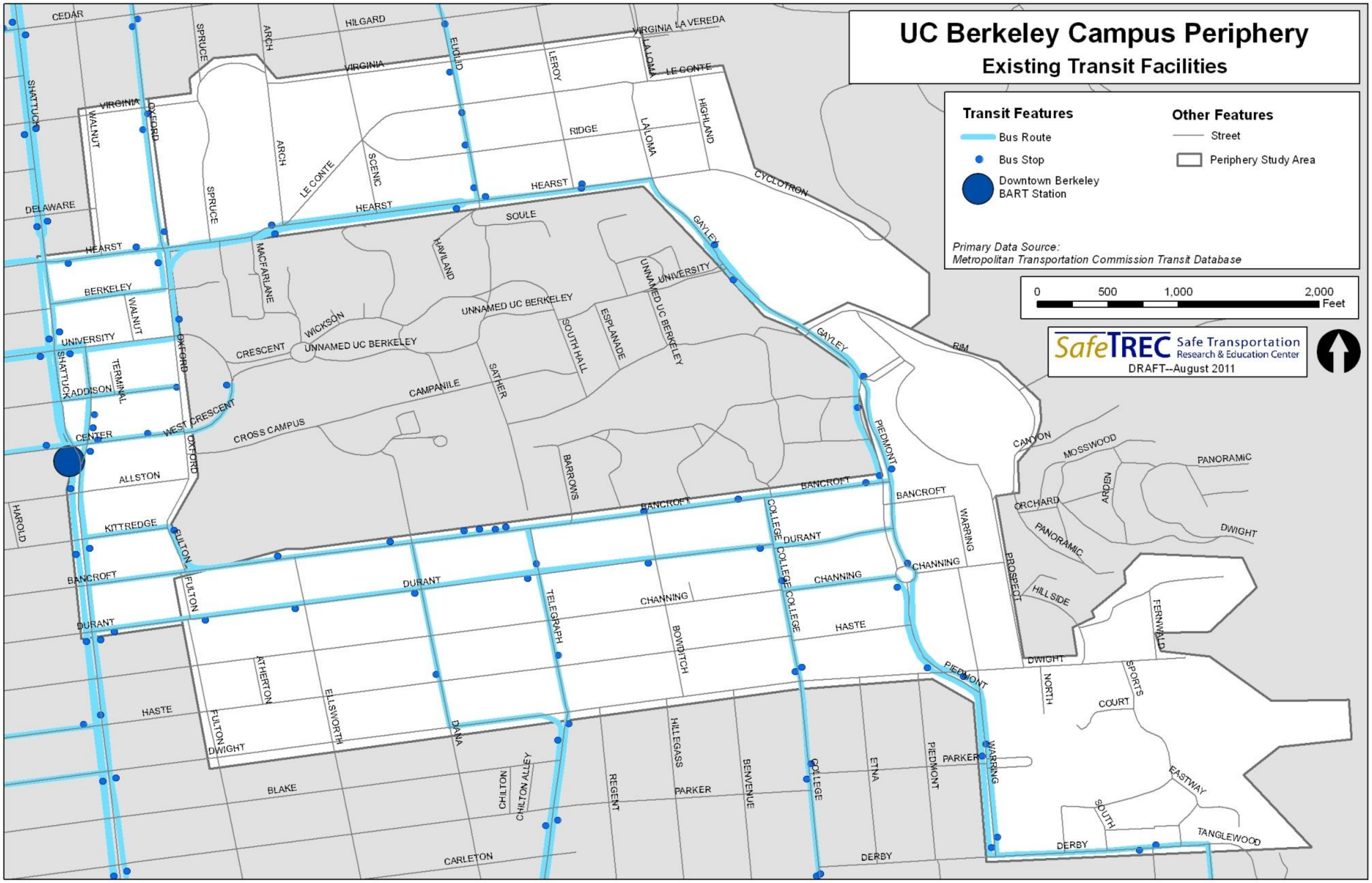
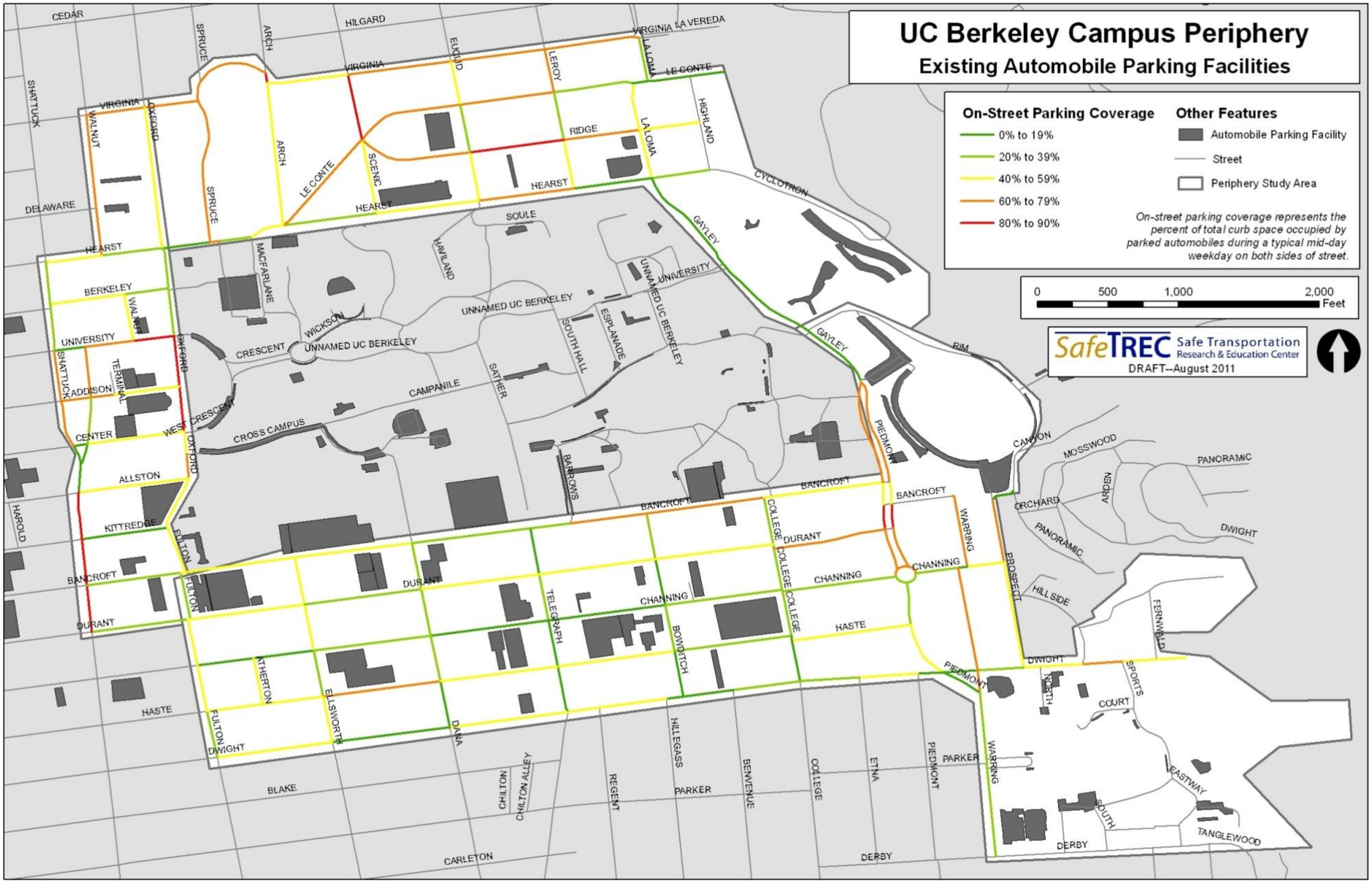


Figure 4.4. UC Berkeley Periphery Existing Automobile Parking Facilities



4.2. Pedestrian and Bicycle Travel Patterns

Walking and bicycling are common travel modes in the campus area. While many people travel by walking and bicycling exclusively, most automobile and transit users also walk on and near campus after they arrive by bus, train, or car. This underscores the importance of pedestrian accessibility, mobility, and safety in this area. The objective of this section is to study how pedestrian and bicyclist activities vary over time and space around the UC Berkeley campus periphery. Two levels of analysis we performed to achieve this: (i) long-term continuous counts at a single location to study changes over time, and (ii) short-term manual counts at multiple intersections around the campus periphery area to study differences between locations.

4.2.1. Changes in Pedestrian Activity Over Time

Background

To perform an in-depth analysis of changes in pedestrian activity over time, automatic pedestrian counters were installed in proximity to campus entrances on the north, south, and east sides of campus, as well as inside the campus. The automatic counter (EcoCounter Pyro Box Compact) recorded the number of directional pedestrian crossings across a virtual gate.[3] The selected locations are: (i) Tolman Hall which serves as a north side campus entry, (ii) PFA Theater which serves as a south side campus entry, (iii) Grinnell Pathway which serves as a west side entry, and (iv) Haviland Hall as an on-campus location. The exact locations of the counters are shown in Figure 4.5 and descriptive analyses of the pedestrian patterns are described below.

Data Analysis—Tolman Hall Site

This site is near Tolman Hall, south of the intersection of Hearst Avenue, Arch Street, and Le Conte Street. The data presented here is only for the walkway covered by the automatic counter (labeled "virtual gate" in Figure 4.5).[4] The counter collected data continuously at this location, aggregated in one-hour intervals, between November 2010 and February 2012. To date, there have been over 600,000 pedestrian crossings at this location, across different times, different weather conditions, and other factors which may affect pedestrian activity.

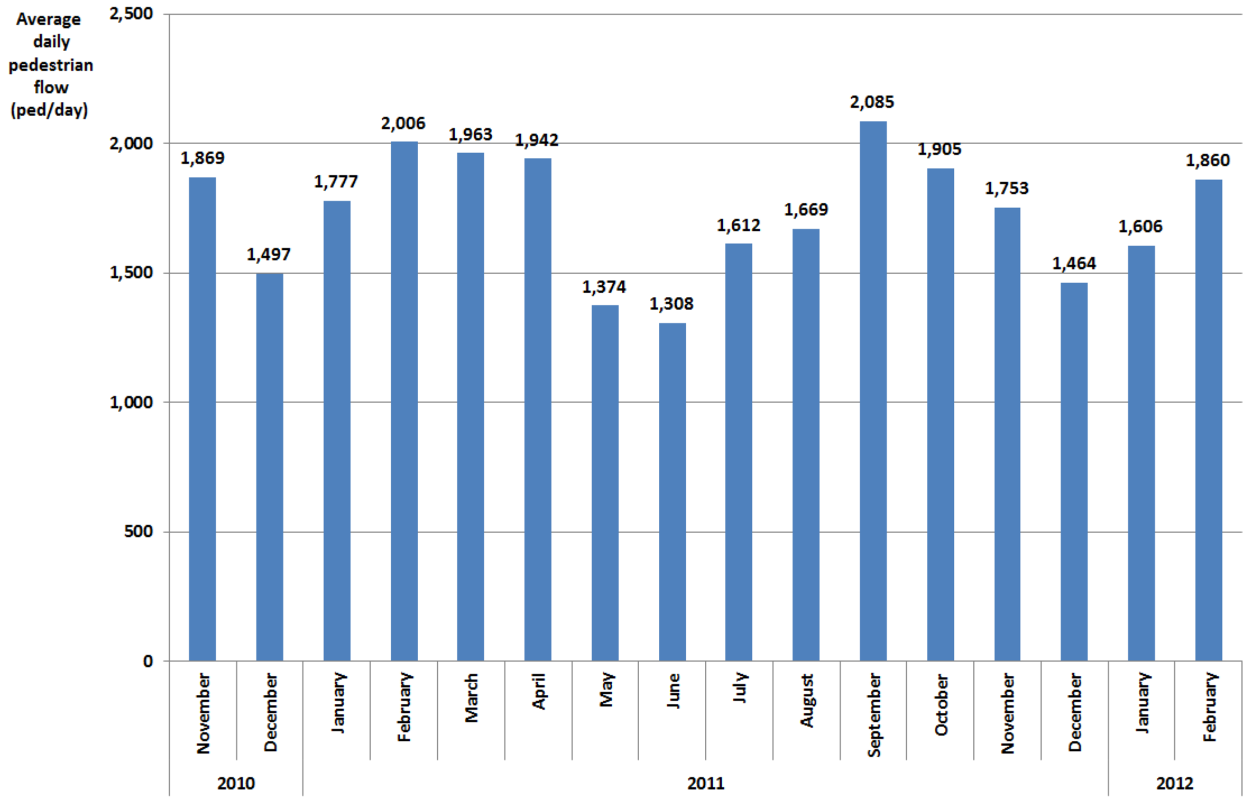
[3] The automatic counter does not differentiate between pedestrians and bicyclists, so the counts also include bicyclists. However, most of the people entering campus at this location were pedestrians.

[4] An analysis of the ratio between pedestrian crossings of the area covered and not covered by the counter showed that the detector accounted for about 61% of entering pedestrians, and about 70% of exiting pedestrians.

Figure 4.5. UC Berkeley Campus Periphery EcoCounter Study Sites

The data were processed and summarized over different time periods. Figure 4.6 shows the variation in the average daily pedestrian flow for different months. The value for each month represents the average number of daily pedestrian crossings, in both directions, for weekdays (Monday to Thursday).[5] It demonstrates that the variation in pedestrian activity is strongly associated with the academic calendar. For example, the summer months have a relatively low pedestrian activity, while months with regular academic activities (September to November; February to April) demonstrate high flows of about 2,000 pedestrian crossings per day.

Figure 4.6. Average Weekday Pedestrian Crossings, by Month (Tolman Hall site)



To investigate this variation further, the counts were separated by week, as shown in Figure 4.7. Again, the value for each week represents the average number of daily pedestrian crossings, in both directions, for weekdays (Monday to Thursday).[6] Naturally, the weekly data show even greater variation than monthly variation, and this variation is again associated with the academic calendar. For example, for the Spring 2011 semester the flow for the week before classes (Week 0) was very low, followed by nine weeks of high flows (Week 1-Week 9), which then dropped temporarily for spring break and rebounded to higher flows when classes were in session again (Week 10-Week 14), until the flow was reduced for Reading/Review/Recitation (Week 15) and Finals (Week 16).

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[5] National holidays were excluded from this analysis.
[6] National holidays were excluded from this analysis.

Figure 4.7. Average Weekday Pedestrian Crossings by Week (Tolman Hall Site)

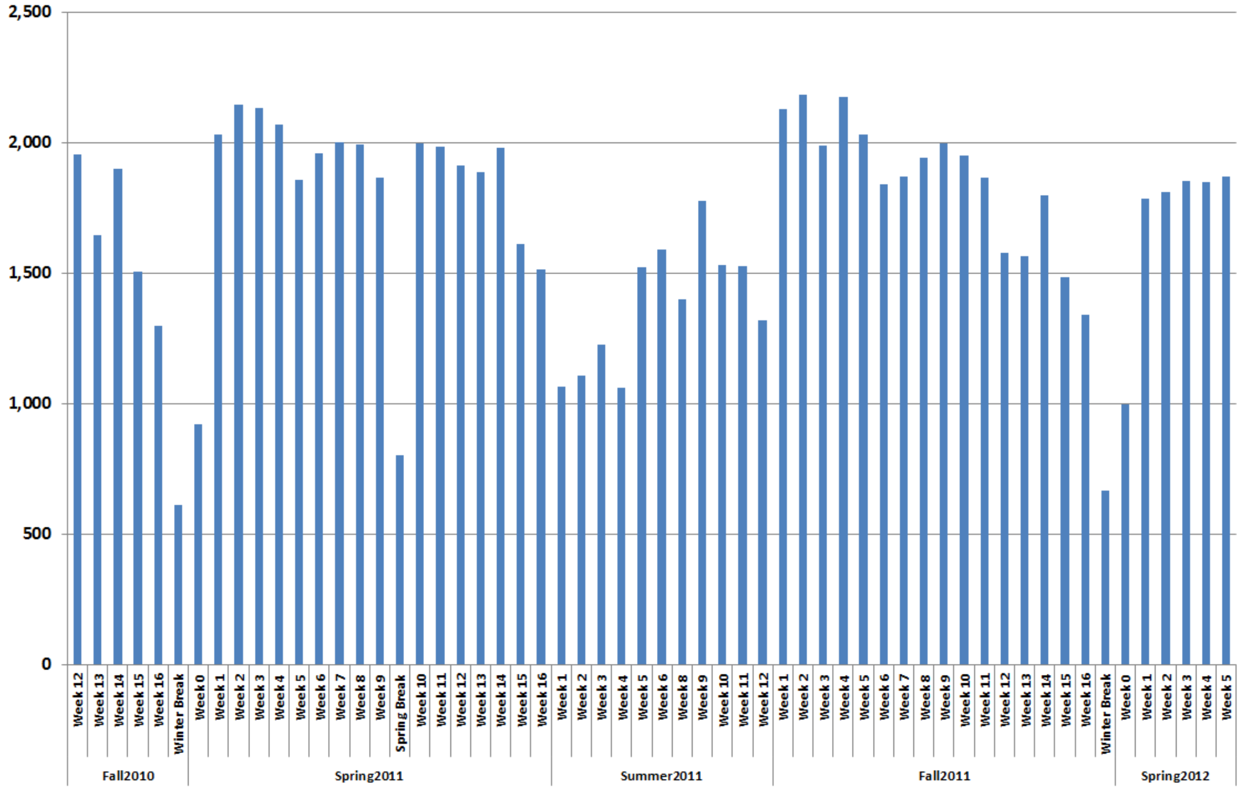


Figure 4.8 shows the data for different days of the week. The value for each week represents the average number of daily pedestrian crossings, in both directions, when classes are in session.[7] With respect to the different days of the week, the only minor fluctuations (less than 5%) were observed from Monday through Thursday, while Friday is consistently lower (15.8% less on average). This finding is maintained across the different academic semesters.

In addition to the consistency observed in daily flow, the distribution of hourly flow for a particular day also seems to be consistent. Figure 4.9 presents the cumulative hourly pedestrian flow for the different days of the week. The vertical axis represents cumulative pedestrian crossings in both directions for specific hours for the spring 2011 semester, when classes were in session.[7] It shows that the cumulative distribution is almost identical for Monday through Thursday, while Friday follows a similar pattern but with lower values. This shows that the pedestrian activity during a particular day of the week at the study location is to a large extent predictable.

[7] National holidays, and periods without classes (breaks, finals, etc.) were excluded from this analysis.

Figure 4.8. Average Pedestrian Crossings During Classes by Day of Week (Tolman Hall Site)

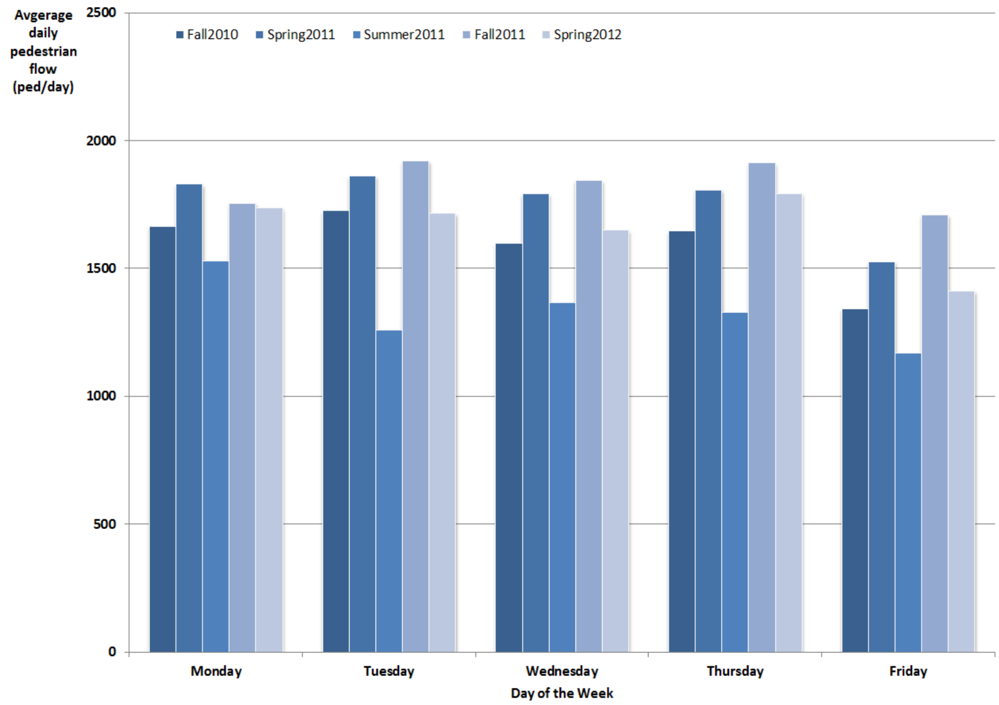
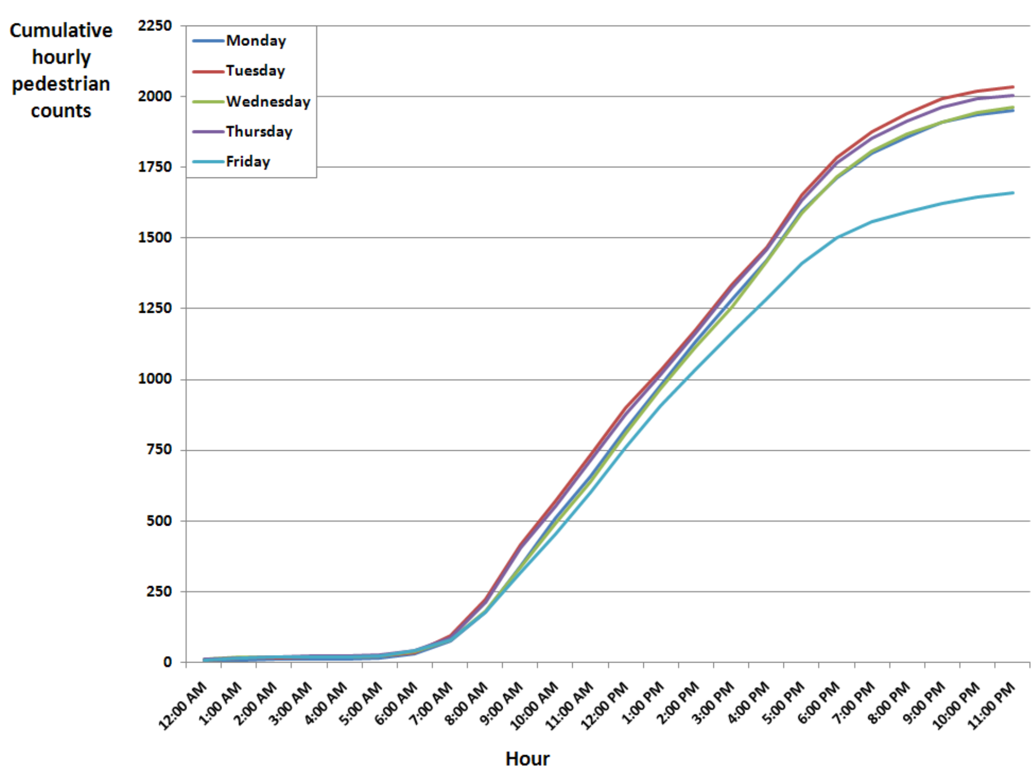
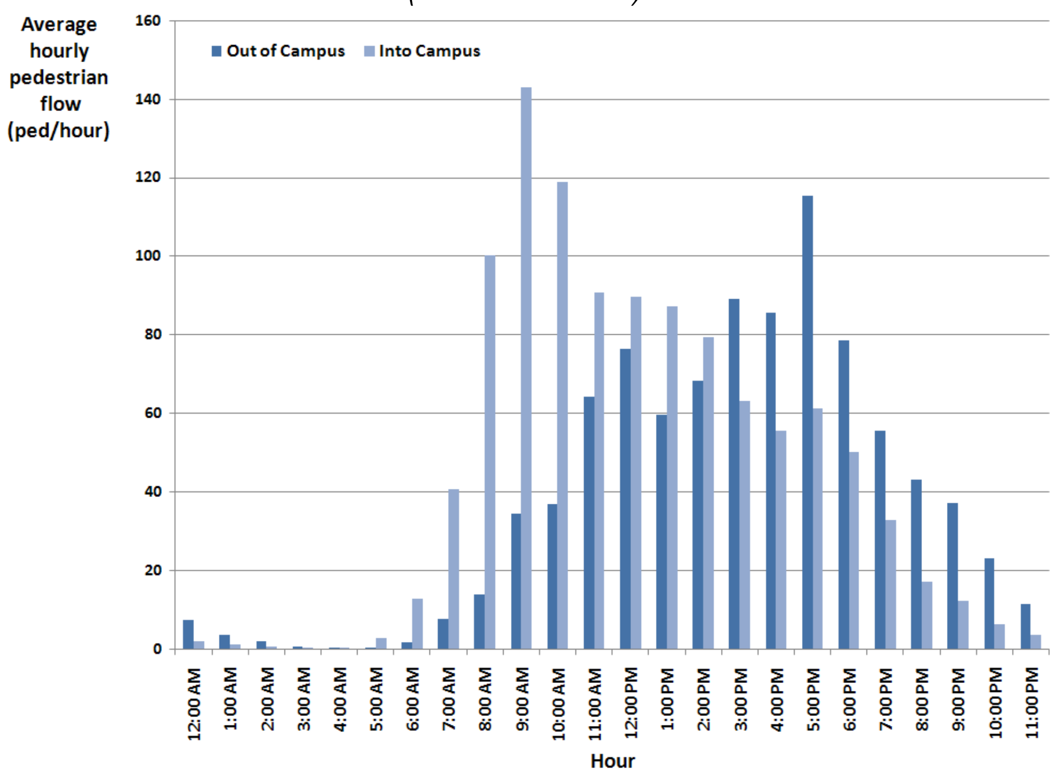


Figure 4.9. Cumulative Percentage of Hourly Pedestrian Crossing for Weekdays (Spring 2011) (Tolman Hall Site)



Since the automatic counter collects data by direction of crossing, it is also possible to study the patterns of entering and exiting pedestrians. Figure 4.10 presents the average hourly flow for each direction (out of campus or into campus) for weekdays (Monday to Thursday) of the Spring 2011 semester.[8] It shows that the highest flow into campus was observed between 9 a.m. and 10 a.m. (143 pedestrians/hour), while the highest exiting flow was from 5 p.m. to 6 p.m. (115 pedestrians/hour). Moreover, it shows that until 3 p.m. the number of pedestrians entering campus was larger than the number of pedestrians exiting campus, while after 3 p.m. the number of exits was larger.

Figure 4.10. Pedestrian Traffic by Direction by Hour for Weekdays during Spring 2011 Classes (Tolman Hall site)



Data Analysis—PFA Theater Site

This site is at the top of the stairs next to the intersection of Bancroft Way and Bowditch Street and was studied between February 2012 and April 2012. To date, there have been over 200,000 pedestrian crossings at this location, across different times, different weather conditions, and other factors which may affect pedestrian activity.

The data were processed and summarized over different time periods. Figure 4.11 shows the variation in the average daily pedestrian flow for different months. The value for each month represents the average number of daily pedestrian crossings, in both directions, for weekdays (Monday to Thursday).[9]

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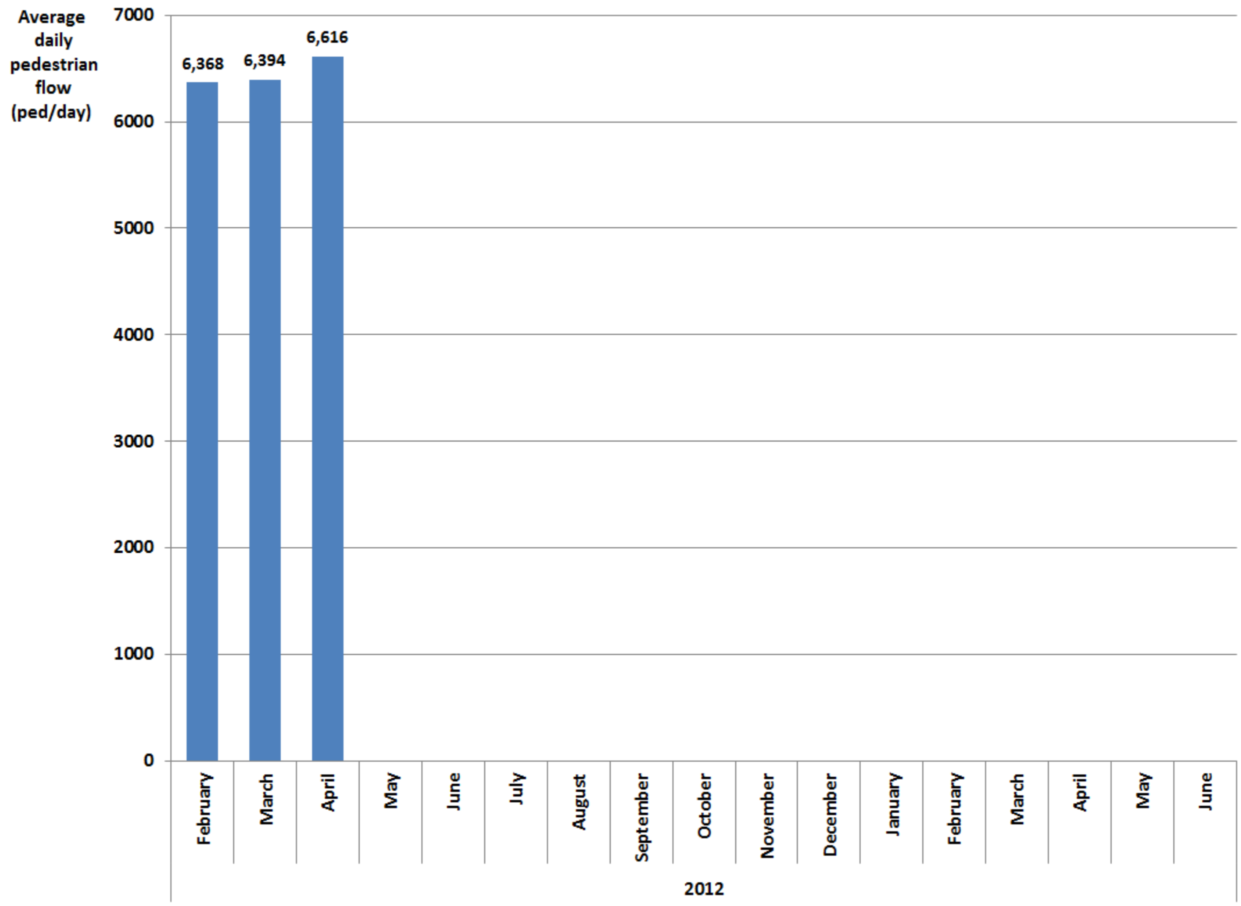
[8] National holidays, and periods without classes (breaks, finals, etc.) were excluded from this analysis.
[9] National holidays were excluded from this analysis.

Figure 4.11. Average Weekday Pedestrian Crossings, by Month (PFA Theater)



The count data were processed and summarized over different time periods. To investigate this variation further, the counts were separated by week, as shown in Figure 4.12. Again, the value for each week represents the average number of daily pedestrian crossings, in both directions, for weekdays (Monday to Thursday).[10] Naturally, this variation is associated with the academic calendar as seen in the low daily flow during Spring Break. The average daily flow for the eight weeks of classes included here was 6,486 pedestrians/day while the flow during Spring Break was only 938. This indicates that the pedestrian flow at this site is strongly affected by the academic calendar and is heavily dominated by undergraduate students.

[10] National holidays were excluded from this analysis.

Figure 4.12. Average Weekday Pedestrian Crossings by Week (PFA site)

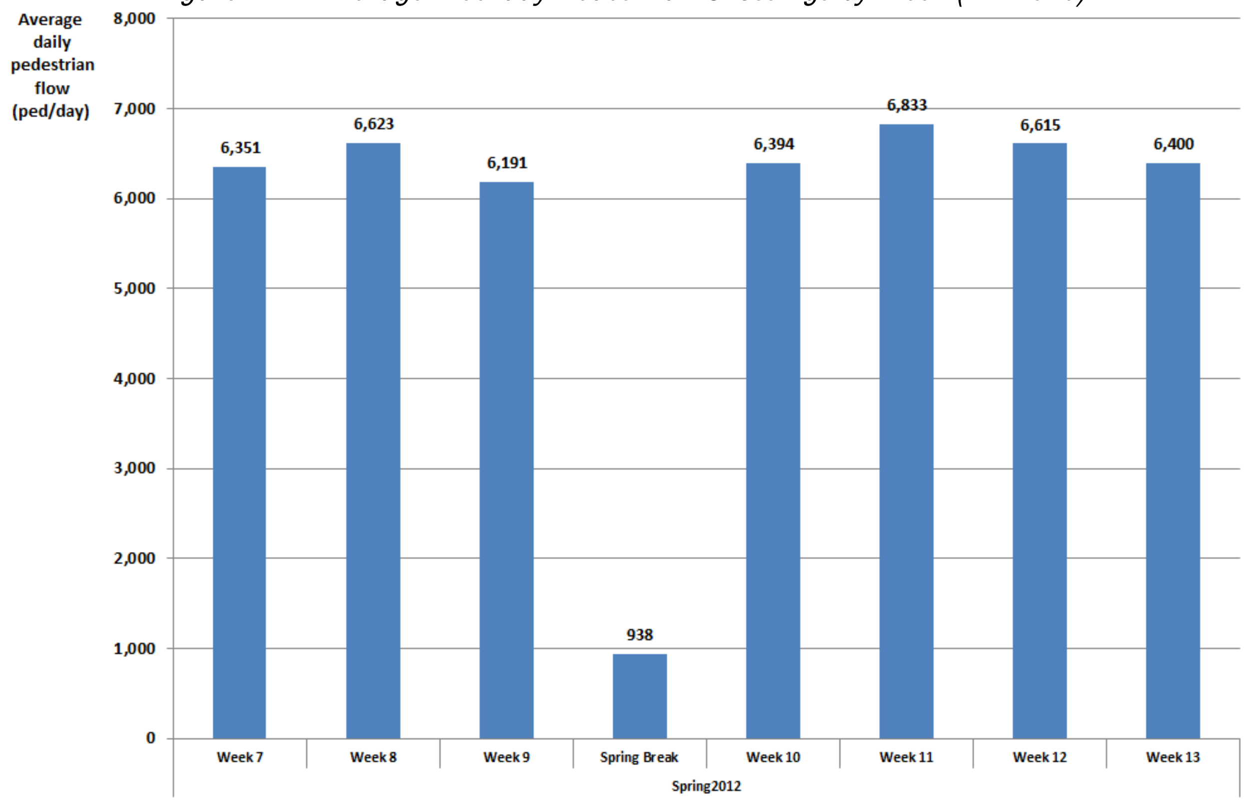


Figure 4.13 shows the data for the different days of the week. The value for each week represents the average number of daily pedestrian crossings, in both directions, when classes are in session.[11] With respect to the different days of the week, only minor fluctuations (less than 5%) were observed from Tuesday through Thursday, while Monday and Friday crossing activity was consistently lower.

The same pattern observed in daily flow is maintained for the distribution of hourly flow for a particular day. Figure 4.14 presents the cumulative hourly pedestrian flow, for the different days of the week. The vertical axis represents cumulative pedestrian crossings in both directions for specific hours during the spring 2012 semester, when classes were in session.[11] It shows that the cumulative distribution is similar for Tuesday through Thursday, while Monday and Friday follow a similar pattern but with lower values.

[11] National holidays, and periods without classes (breaks, finals, etc.) were excluded from this analysis.

Figure 4.13. Average Pedestrian Crossings During Classes by Day of the Week (PFA site)

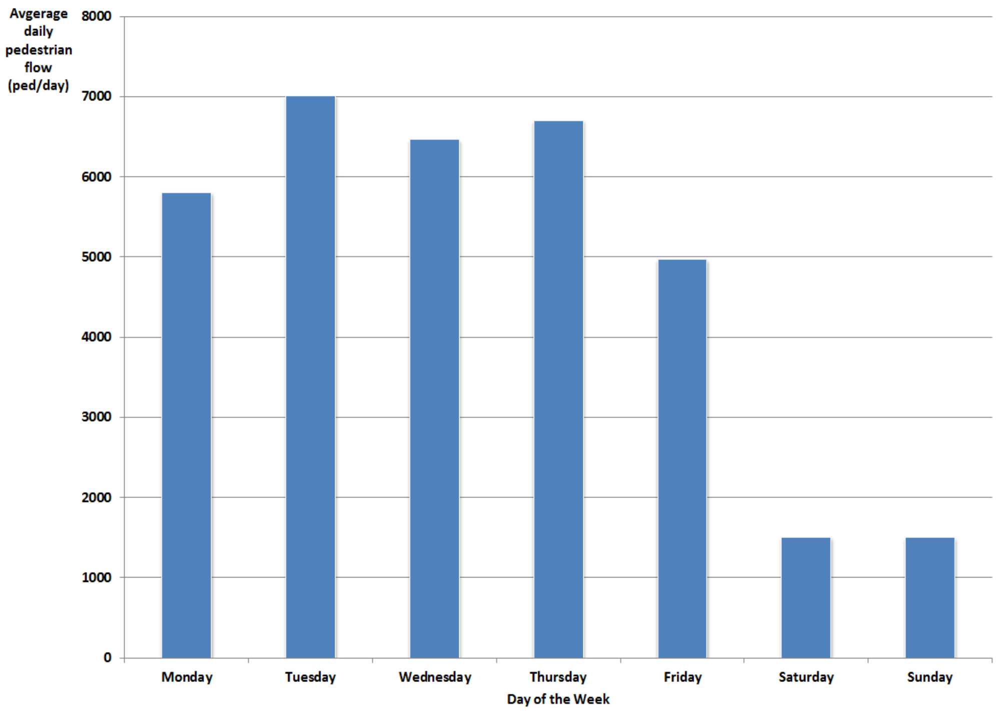
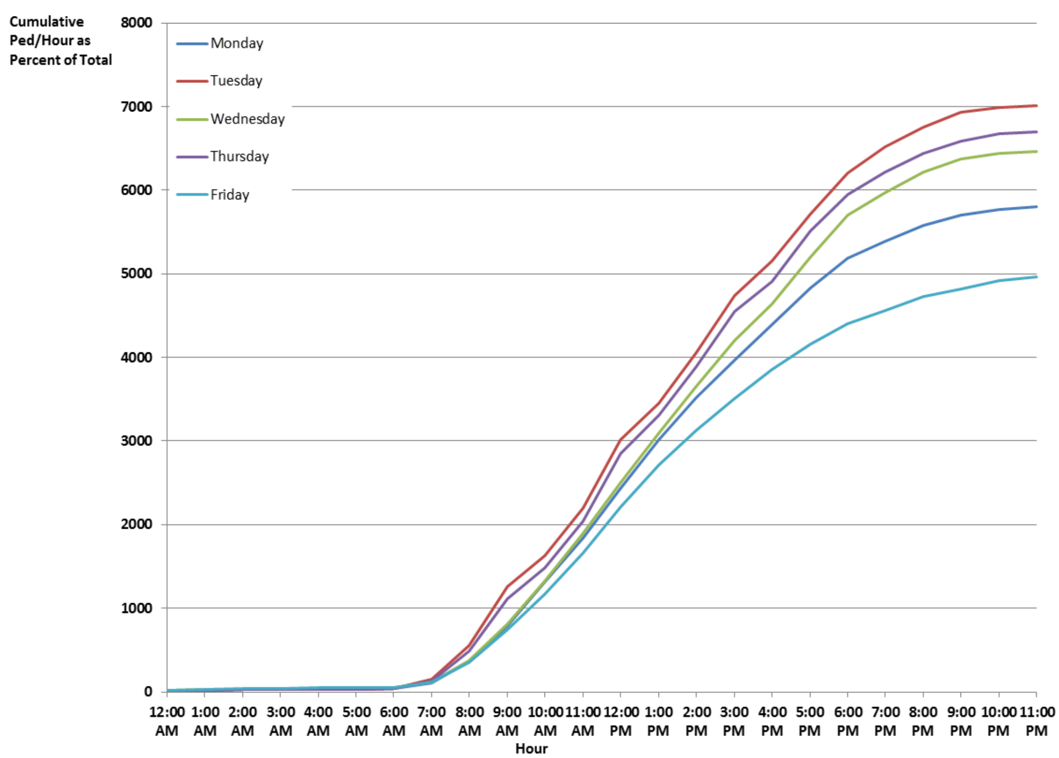
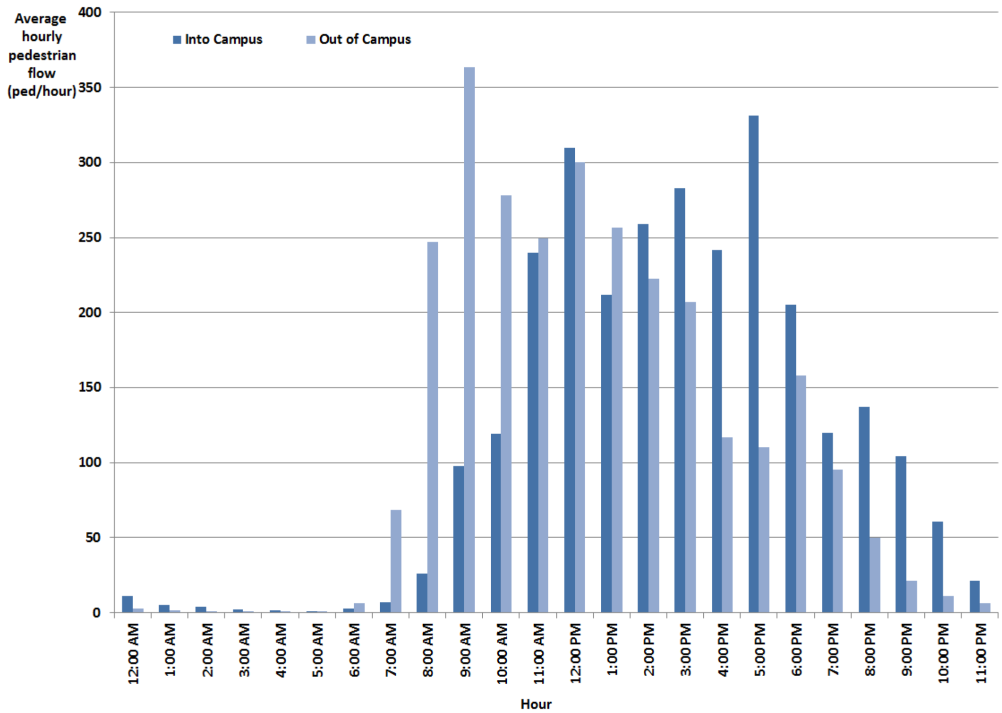


Figure 4.14. Cumulative Percent of Hourly Pedestrian Crossing for Days of Week (Spring 2012) (PFA site)



Since the automatic counter collects data by direction of crossing, it is also possible to study the patterns of entering and exiting pedestrians. Figure 4.15 presents the average hourly flow for each direction (out of campus or into campus) for weekdays (Monday to Thursday) of the Spring 2012 semester.[12] It shows that the highest flow into campus was observed between 9 a.m. and 10 a.m. (363 pedestrians/hour), while the highest exiting flow was observed from 5 p.m. to 6 p.m. (331 pedestrians/hour).

Figure 4.15. Pedestrian Traffic by Direction by Hour for Weekdays during Spring 2012 Classes (PFA site)



Data Analysis—Haviland Hall Site

This site is near Haviland Hall, south of the intersection of Hearst Avenue, Arch Street, and Le Conte Street. The data presented here is only for the walkway covered by the automatic counter (labeled "virtual gate" in Figure 4.5).[13] The counter collected data continuously at this location, aggregated in one-hour intervals, between May 2010 and October 2010. There have been over 140,000 pedestrian crossings at this location, across different times, different weather conditions, and other factors which may affect pedestrian activity.

The data were processed and summarized over different time periods. Figure 4.16 shows the variation in the average daily pedestrian flow for different months. The value for each month represents the average number of daily pedestrian crossings, in both directions, for weekdays (Monday to Thursday).[14] It demonstrates that the variation in pedestrian activity is strongly

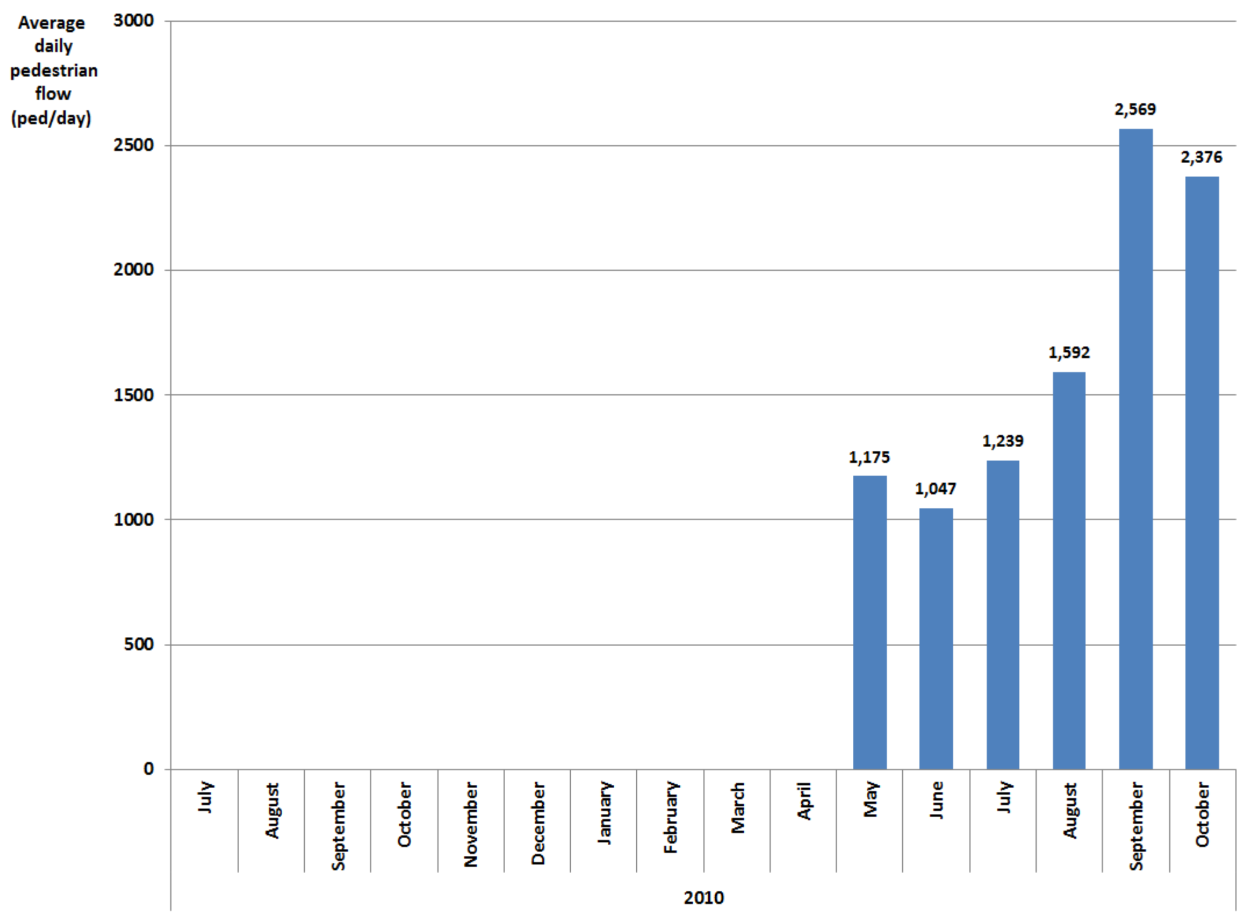
[12] National holidays, and periods without classes (breaks, finals, etc.) were excluded from this analysis

[13] An analysis of the ratio between pedestrian crossings of the area covered and not covered by the counter showed that the detector accounted for about 61% of entering pedestrians, and about 70% of exiting pedestrians.

[14] National holidays were excluded from this analysis.

associated with the academic calendar. For example, the summer months experience relatively low pedestrian activity, while months with regular academic activities (September and October) demonstrate high flows of about 2,500 pedestrian crossings per day.

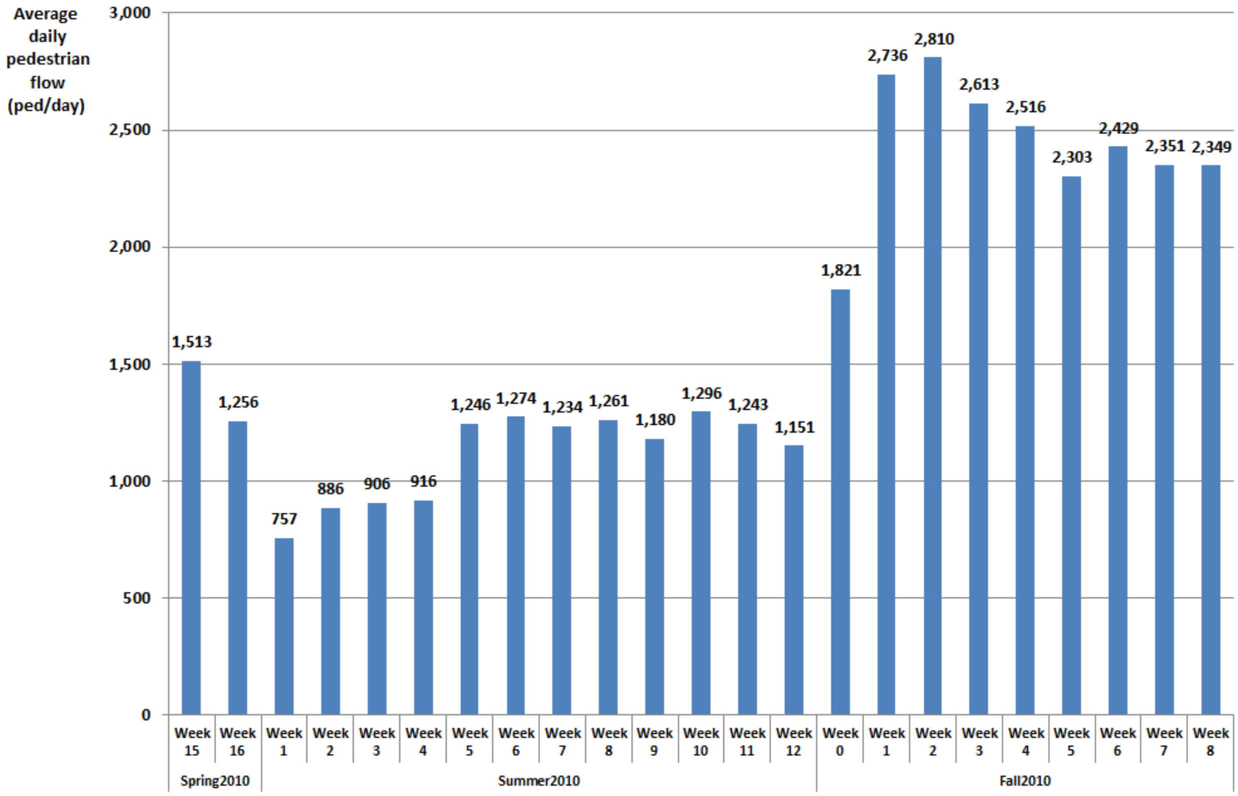
Figure 4.16. Average Weekday Pedestrian Crossings, by Month (Haviland Hall site)



To investigate this variation further, the counts were separated by week, as shown in Figure 4.17. Again, the value for each week represents the average number of daily pedestrian crossings, in both directions, for weekdays (Monday to Thursday).[15] Naturally, the weekly data shows even greater variation than in monthly variation, and this variation is again associated with the academic calendar. For example, the first week of classes of the Fall 2011 semester (week 1) has about 50% more pedestrian crossings than the prior week (week 0).

[15] National holidays were excluded from this analysis.

Figure 4.17. Average Weekday Pedestrian Crossings by Week (Haviland Hall site)



Data Analysis—Grinnell Pathway Site

This site is along a walkway for pedestrians entering from the west side of campus. The data presented here is for the walkway covered by the automatic counter (labeled "virtual gate" in Figure 4.5).[16] The counter collected data continuously at this location, aggregated in one-hour intervals, between October 2011 and April 2012. To date, there have been over 700,000 pedestrian crossings at this location, across different times, different weather conditions, and other factors which may affect pedestrian activity.

The data were processed and summarized over different time periods. Figure 4.18a shows the variation in the average daily pedestrian flow for different months. The value for each month represents the average number of daily pedestrian crossings, in both directions, for weekdays (Monday to Thursday).[17] It demonstrates that the variation in pedestrian activity is strongly associated with the academic calendar. For example, December has the lowest low pedestrian activity, while months with regular academic activities demonstrate high flows of about 9,000 pedestrian crossings per day. The weekly data in Figure 4.18b shows even greater variation than in monthly variation, and this variation is again associated with the academic calendar.

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[16] An analysis of the ratio between pedestrian crossings of the area covered and not covered by the counter showed that the detector accounted for about 61% of entering pedestrians, and about 70% of exiting pedestrians.
[17] National holidays were excluded from this analysis.

Figure 4.18a. Average Weekday Pedestrian Crossings, by Month (Grinnell Pathway site)

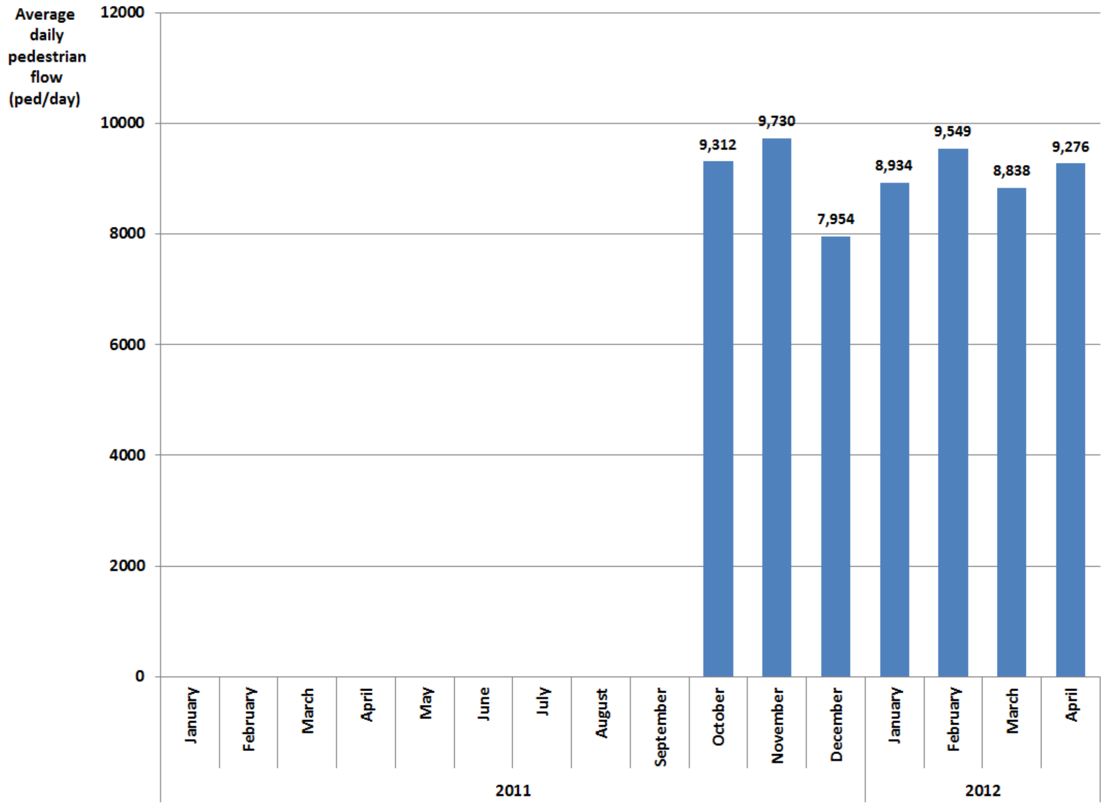
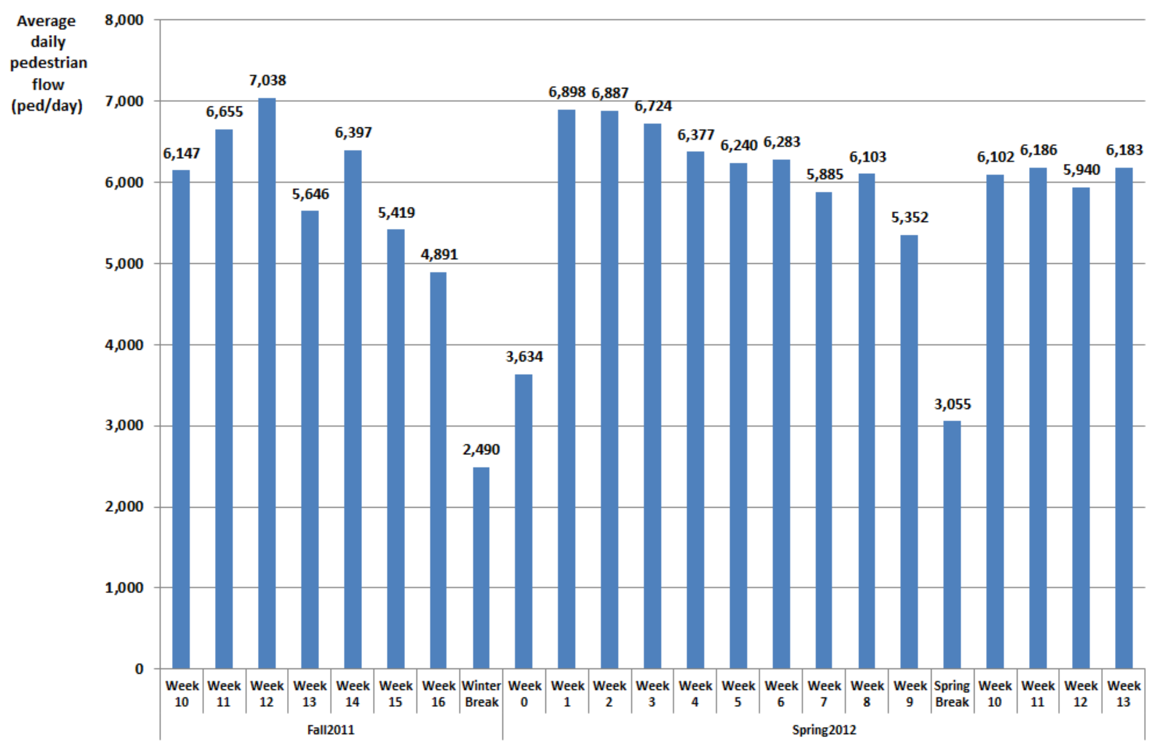


Figure 4.18b. Average Weekday Pedestrian Crossings, by Week (Grinnell Pathway site)



4.2.2. Pedestrian and Bicycle Activity in Different Parts of the Campus Periphery

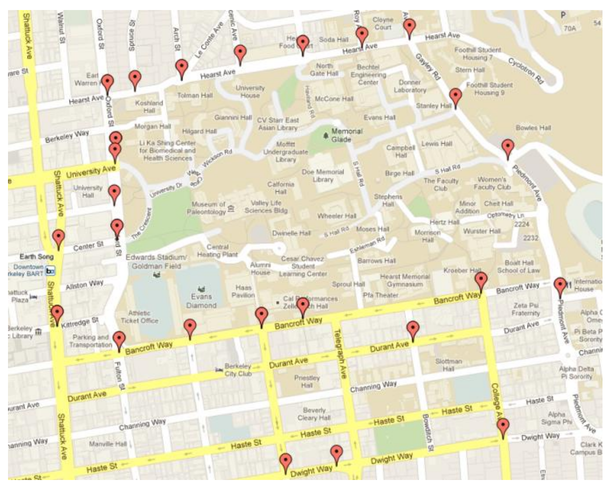
Background

To evaluate pedestrian and bicycle activity in different parts of the campus periphery, manual counts were taken at multiple intersections. Each intersection was sampled over a period of two hours, and counts for pedestrian, bicycles, and automobiles were taken. The counts were performed using TurnCount, which is a commercial application for traffic counts on mobile devices. This application allows data collectors to record pedestrian, bicyclist, and automobile traffic at the same time. Pedestrians were counted each time they crossed a leg of the intersection within 50 feet of the crosswalk. Both crossing directions were counted for each leg. If a pedestrian crossed two different legs of the intersection, he or she was counted twice. For bicycles and automobiles, they were counted each time they turned left, went straight, or turned right at the intersection.

Counts were taken between August and October 2011. They included the last few of weeks of the Summer 2011 term and the Fall 2011 semester. To date, 42 counting sessions have been completed across 24 different intersections, as shown in Figure 4.19. Of the study intersections, 11 were sampled multiple times.

Figure 4.19. Pedestrian and Bicycle Manual Count Locations (as of 10/26/11)

Hours of observation		Day of Week				
		Mon	Tue	Wed	Thu	Fri
Time	9:00			1		
	10:00			2		1
	11:00			5		3
	12:00			5		3
	13:00			2		3
	14:00			5		7
	15:00			8		8
	16:00			5		5
	17:00			1		2



Pedestrian Activity

The pedestrian counts for the study period are summarized in Figure 4.20. The bottom horizontal axis describes the location of the study, while the top horizontal axis describes the start of the two-hour count period. Locations that were sampled more than once are coupled together and separated by a dotted vertical line. The vertical axis presents the total pedestrian crossings observed over the two-hour study period. The dark light bars were observed during the Summer 2011 term and the dark bars were observed during the Fall 2011 semester.

The observations range from 108 pedestrians in two hours (Hearst Avenue & Scenic Avenue) to 10,210 pedestrians in two hours (Shattuck Ave. & Center St.). During the Summer 2011 term, the highest counts were observed at Shattuck Avenue & Kittredge Way, which is a downtown location and therefore may be less sensitive to the academic calendar. During the Fall 2011 semester, the highest counts were observed at Shattuck Ave. & Center St.

All intersections that were sampled more than once demonstrated an increase in pedestrian activity from the Summer 2011 term to the Fall 2011 semester. The smallest change in pedestrian activity was an average increase of 27% observed at Shattuck Avenue at Kittredge Street, which, again, may be less sensitive to the academic calendar. The largest change in pedestrian activity was a 125% increase at Bancroft Way & Telegraph Avenue, which is a central activity location for UC Berkeley students on the south side of campus. Another large increase of 81% was observed at Hearst Avenue & Euclid Avenue, which is a central activity location on the north side of campus.

Figure 4.20. Two-Hour Pedestrian Crossing Counts at Campus Periphery Intersections

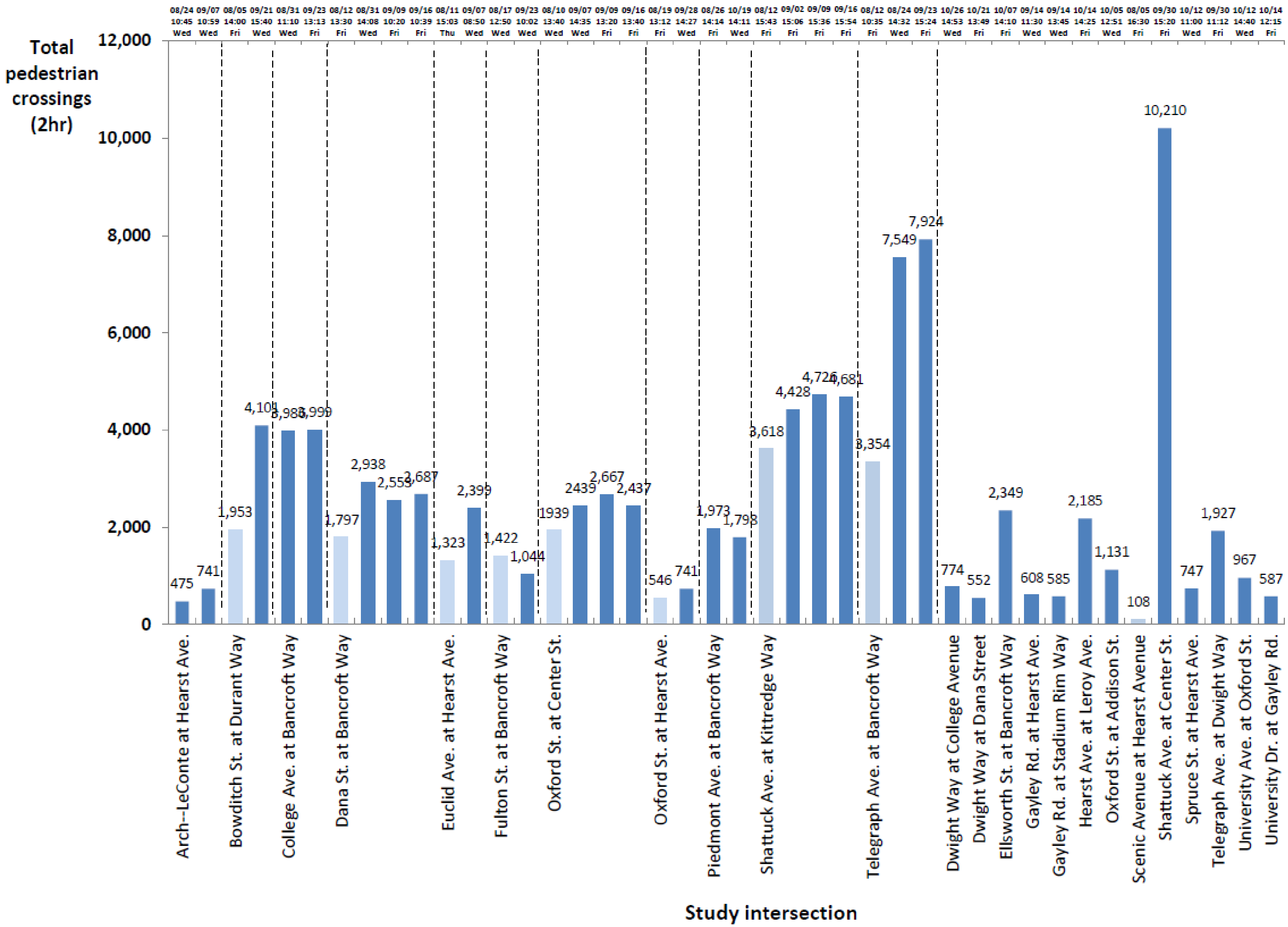
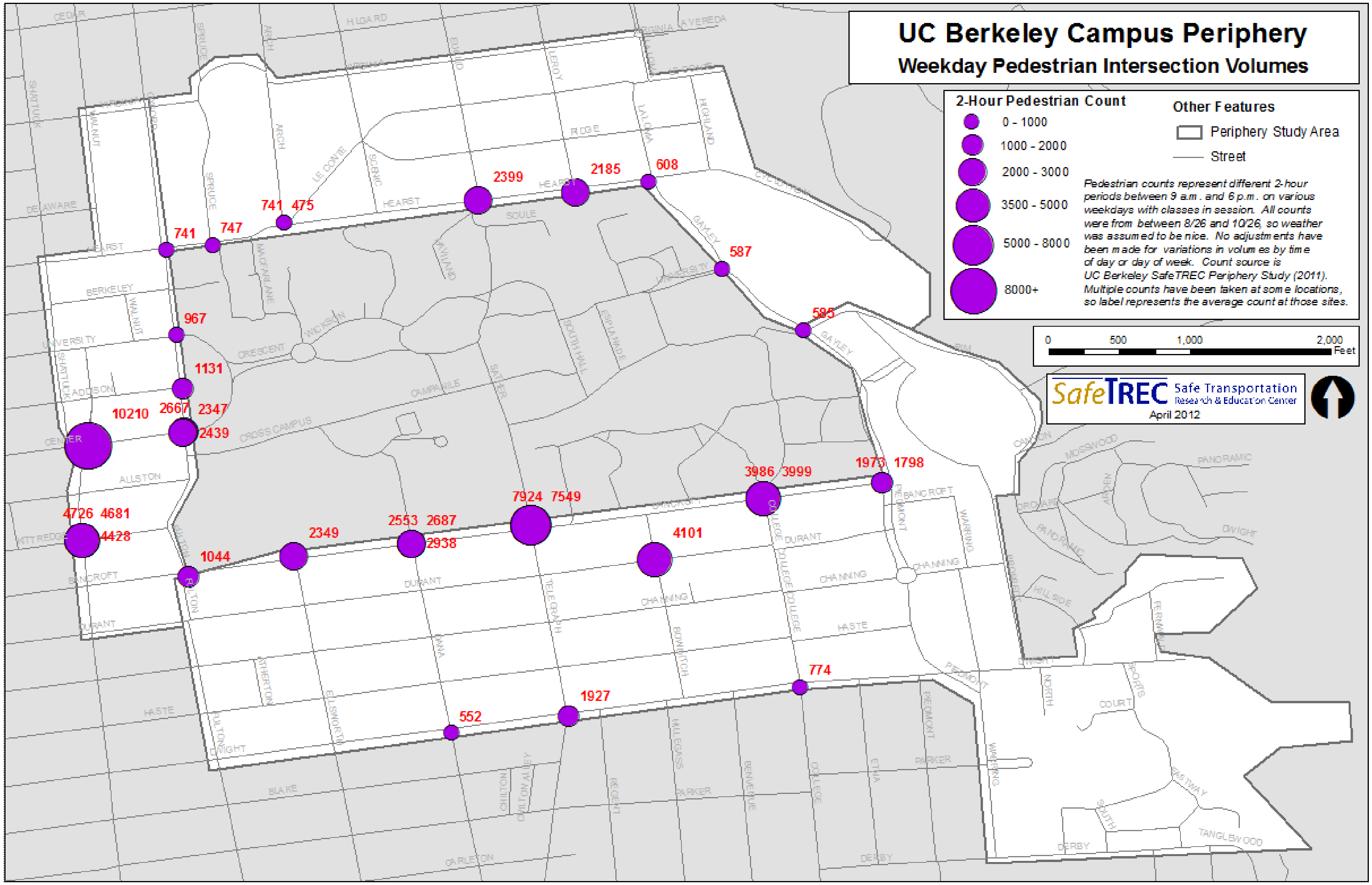


Figure 4.21 shows the pedestrian counts taken in 2011 to provide a sense of the spatial distribution of daytime pedestrian activity in the campus periphery area. Note that the counts represent different two-hour periods between 9 a.m. and 6 p.m. on various weekdays, so they do not account for differences in volume by time of day or day of week. However, hourly variations in the campus periphery pedestrian volumes may be minor, given the relatively consistent slopes between 9 a.m. and 6 p.m. in Figure 4.22. Regarding daily variations, the pedestrian counter near Tolman Hall showed that Fridays tended to have approximately 15% lower volumes than other weekdays, so this suggests that adjusting the Friday counts may be beneficial. Further study of pedestrian volume patterns in different locations is needed to determine if time-of-day or day-of-week adjustments should be used.

Figure 4.21. 2-Hour Weekday Daytime Manual Pedestrian Counts in the UC Campus Periphery Area



Bicycle Activity

The bicycle counts for the study period are summarized in Figure 4.22. The bottom horizontal axis describes the location of the study, while the top horizontal axis describes the start of the two-hour count period. Locations that were sampled more than once are coupled together and separated by a dotted vertical line. The vertical axis presents the total bicycle counts observed over the two-hour study period. The light bars were observed during the Summer 2011 term, and the dark bars were observed during the Fall 2011 semester.

The observations range from 46 bicyclists in two hours (Hearst Avenue & Scenic Avenue) to 331 bicyclists in two hours (Oxford Street & Center Street). During the Summer 2011 term, the highest counts were observed at Shattuck Avenue & Kittredge Way, which is a downtown location and therefore may be less sensitive to the academic calendar. During the first two weeks of the Fall 2011 semester the highest counts were observed at Oxford Street & Center Street.

All intersections that were sampled more than once demonstrated an increase in bicycle activity between the Summer 2011 term and Fall 2011 semester. The smallest change in pedestrian activity was an average increase of 19% observed at Shattuck Avenue & Kittredge Street, which may be less sensitive to the academic calendar. The largest change in pedestrian activity was an average increase of 154% at Dana Street & Bancroft Way, which is one of the main bicycle entrances for UC Berkeley students. Another large increase of 140% was observed at Euclid Ave. at Hearst Ave., which is another main bicycle entrance located on the North side of the UC Berkeley campus.

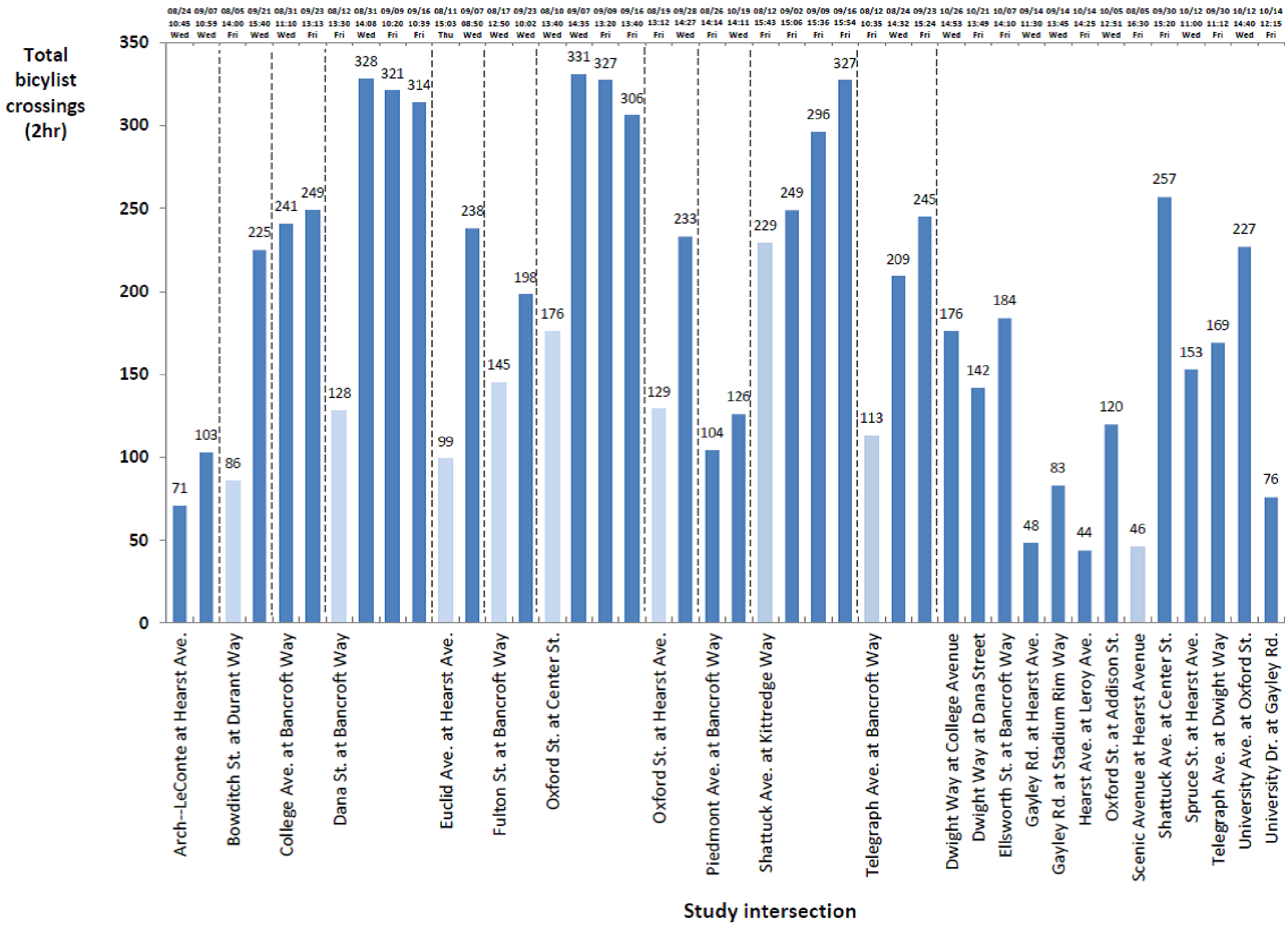
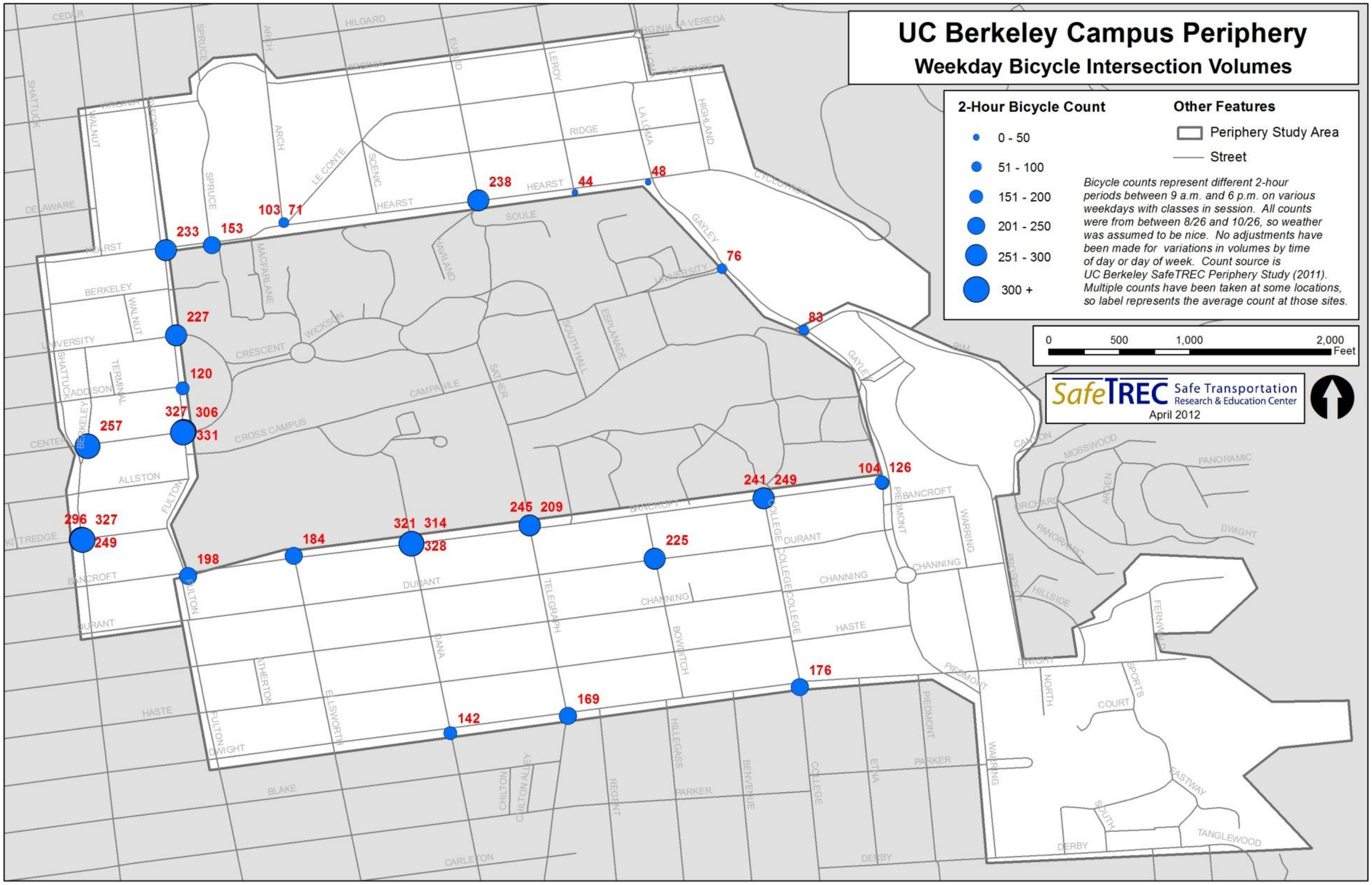


Figure 4.22. Two-Hour Bicycle Volume Counts at Campus Periphery Intersections

Figure 4.23 shows the bicycle counts taken in 2011 to provide a sense of the spatial distribution of daytime bicycle activity in the campus periphery area. Note that the counts represent different two-hour periods between 9 a.m. and 6 p.m. on various weekdays, so they do not account for differences in volume by time of day or day of week. Further study of bicycle volume patterns is needed to determine if time-of-day or day-of-week adjustments should be used.

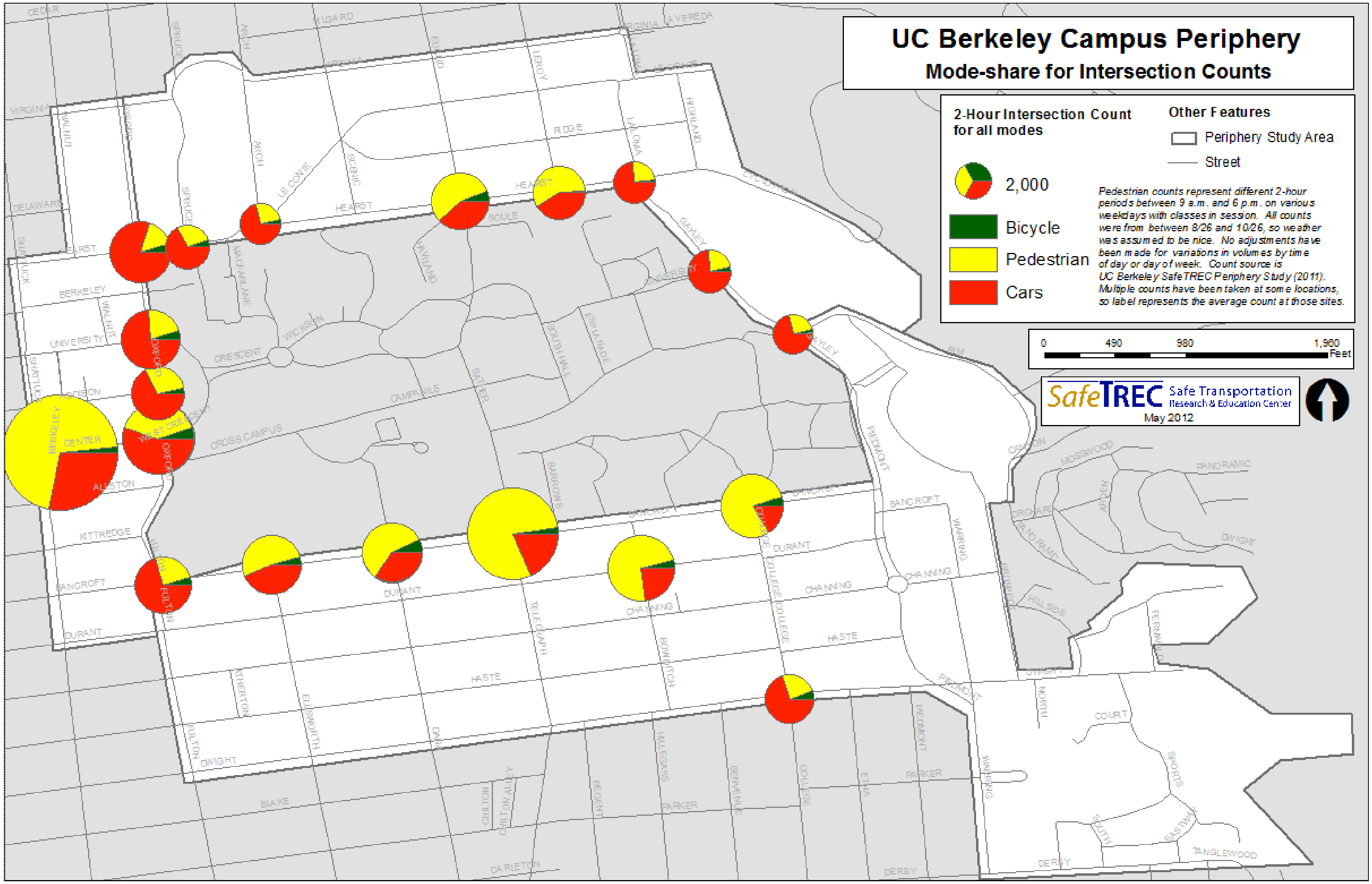
Figure 4.23. 2-Hour Weekday Daytime Manual Bicycle Counts in the UC Campus Periphery Area



Intersection Mode-Share

Since intersection counts were conducted for all modes it is possible to calculate the intersection mode-share as is shown in Figure 4.24. The figure shows that the south side intersections are dominated by pedestrians while the west side and the east side intersections are dominated by cars. It is important to note that the downtown location, which is also the busiest intersection, is dominated by pedestrian that need to cross the west-side campus boundary which has a lot of car traffic. Also, it seems that the north side is divided to two different sections where the upper part is dominated by pedestrian and the lower part is dominated by cars.

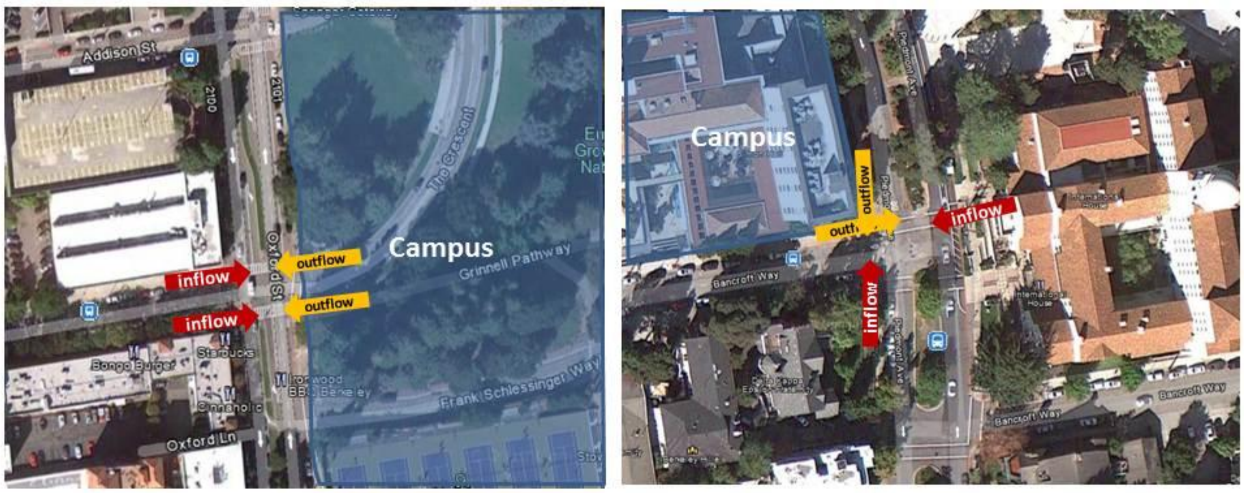
Figure 4.24. UC Berkeley Campus Periphery Intersection Mode-Share



4.2.4. Pedestrian Crossings Across the Campus Boundary

Among other features, the campus area is unique in the predictability of the pedestrian flow in and out of campus. By fusing the automatic counters with the manual counts around campus it is possible to estimate the inflow and outflow of pedestrians across the campus boundary. This was accomplished by identifying the crosswalks that lead to campus in each of the locations of the manual counts as shown in Figure 4.25 below.

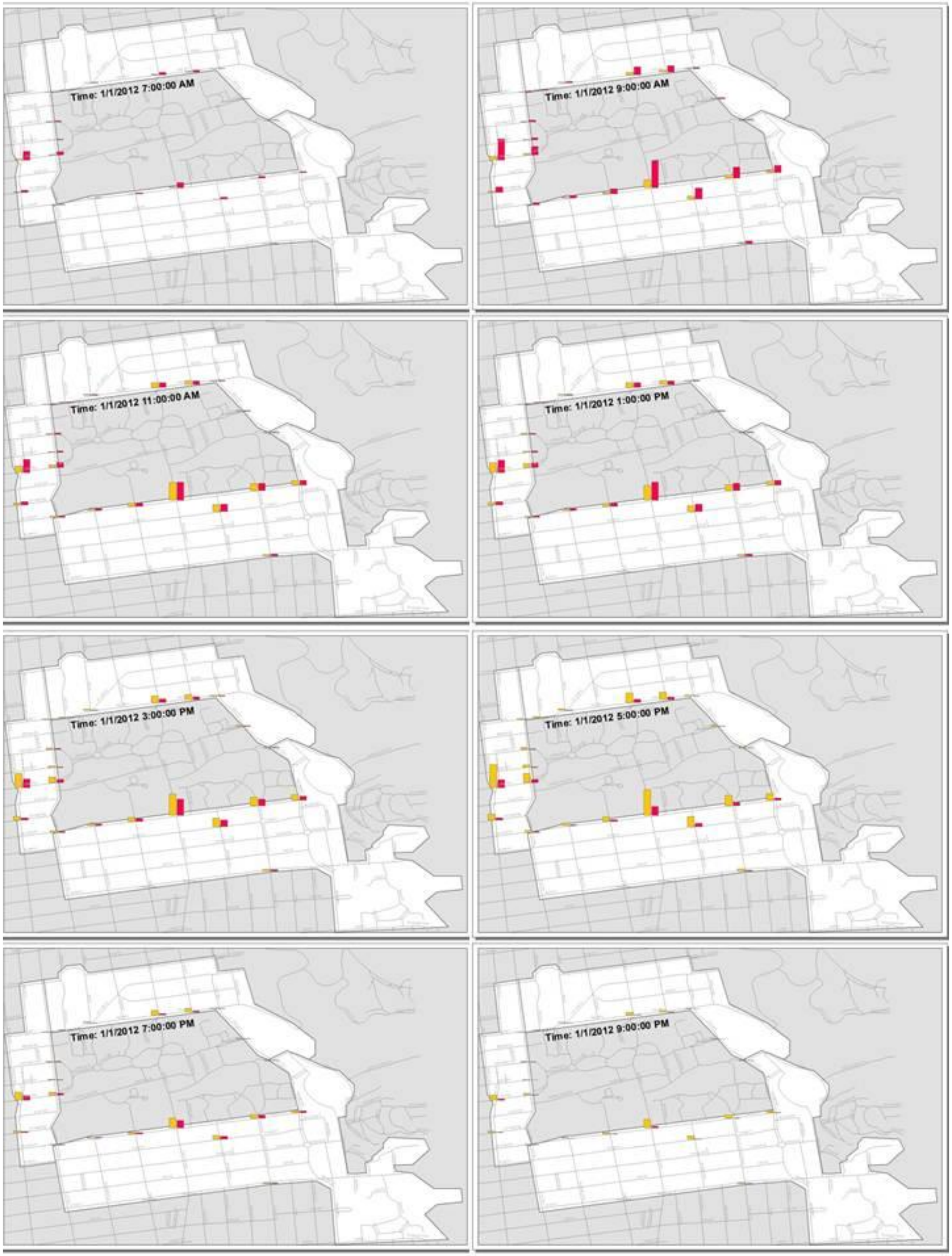
Figure 4.25. Example of Differences Between Inflow and Outflow of Pedestrians



Then each location was associated with an automatic counter which is used to approximate the 24-hour pedestrian volume pattern. The south side locations were associated with the PFA counter, the north side location was associated with the Tolman Hall counter, the west side locations were associated with the Grinnell pathway, and the east side locations were associated either with the PFA or the Tolman Hall location. The next step was an extrapolation of the two-hour manual counts to the estimate the weekly counts at each of the locations. The weekly counts were then divided according to the inflow and outflow ratio that was observed at that location. The final step was the use the average hourly distribution for weekdays to determine the hourly inflow and outflow at each location.

The results are shown in Figure 4.26 where the red bars represent campus inflow while the yellow bars represent campus outflow. We can see that the pedestrian entrances into campus begin around 7 a.m. and significantly increase by 9 a.m. Around 11 a.m. the inflow and outflow for the north and south sides of campus begin to level while for the west side of campus the inflow is still much greater than the outflow. Around 1 p.m. the inflow and outflow are somewhat balanced but by around 3 p.m. the rate of outflow becomes larger and is significantly larger by 5 p.m. after which both inflow and outflow volumes decrease to very small quantities.

Figure 4.26. UC Berkeley Campus Periphery Inflow and Outflow of Pedestrians



4.3. Pedestrian and Bicycle Safety

Safety is essential for encouraging walking and bicycling and reducing pedestrian and bicycle injuries near the UC Berkeley campus. Between 2000 and 2009, 261 pedestrians and 302 bicyclists were injured in traffic crashes in the campus periphery study area—an average of nearly five pedestrian or bicyclist injuries per month. This only includes incidents that were reported in official police crash databases and does not include 5 pedestrian and 33 bicycle crashes that occurred inside the main campus boundary.

Pedestrian crashes tended to be clustered in areas where there was more pedestrian activity. The highest concentrations of pedestrian crashes were along Telegraph Avenue and along Shattuck Avenue (Figure 4.27). Upper Hearst Avenue (Leroy Avenue to La Loma Avenue) and Lower Hearst Avenue (Oxford Street to Arch Street) also had high concentrations of pedestrian crashes.

Analysis of pedestrian crashes by month, weekday, and hour showed several patterns. Pedestrian crashes tend to be more frequent during fall and spring semester (Figure 4.28). This may be due to greater pedestrian and automobile activity in the periphery area when the majority of classes are in session. Although fall semester begins in September, October is the peak month for pedestrian crashes. This may be due partly to more darkness during evening hours, particularly after changing from daylight savings time to standard time. Analyzed by day of the week, pedestrian crashes are more common on weekdays than weekends (Figure 4.29). More pedestrian crashes occur during the afternoon and early evening hours than other parts of the day in the campus periphery area (Figure 4.30). The peak pedestrian crash period is between 5 p.m. and 7 p.m., corresponding to times when many people are leaving campus by automobile, transit, bicycle, and walking.

Figure 4.27. UC Berkeley Campus Periphery Pedestrian Crash Density (2000-2009)

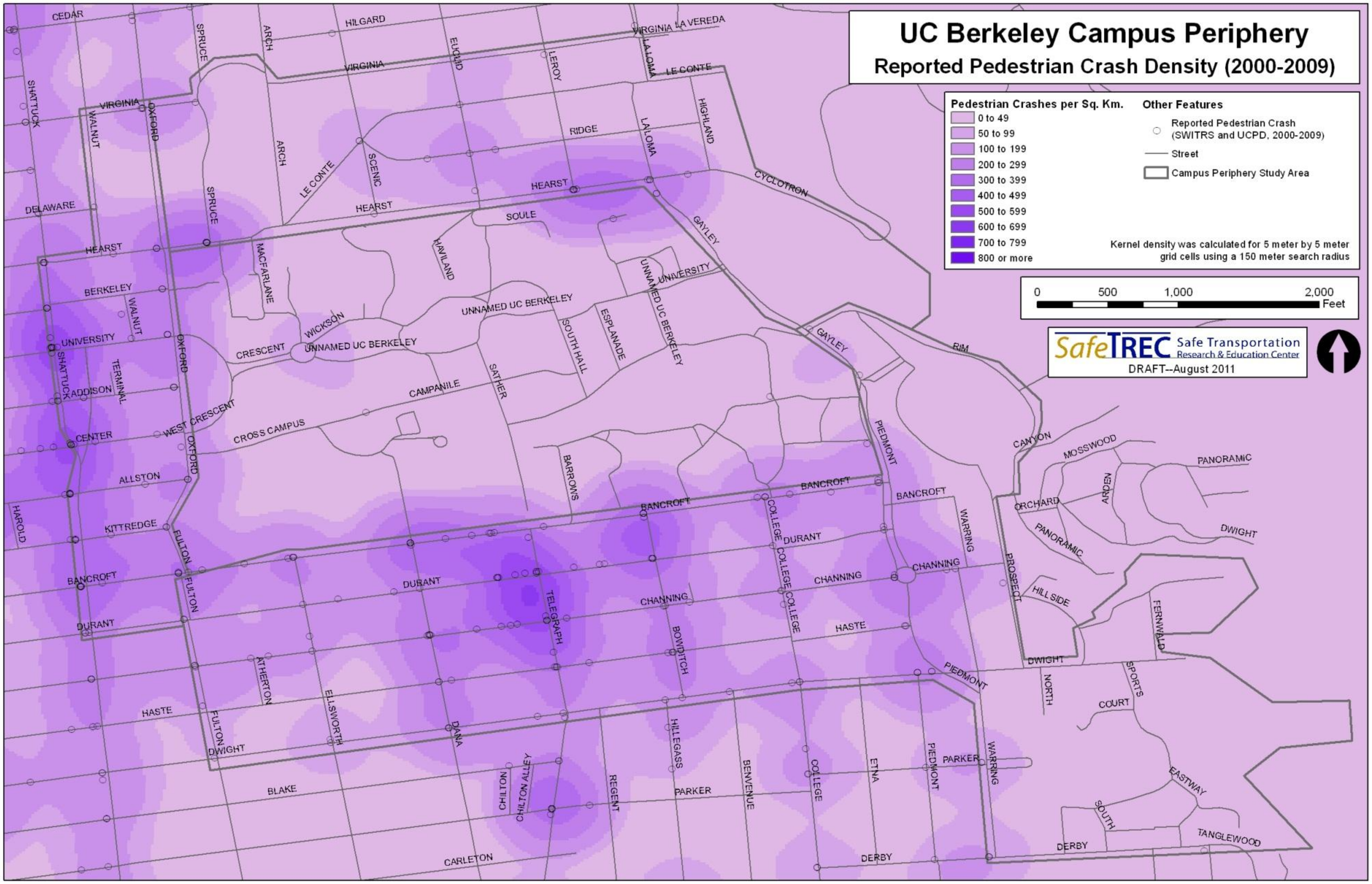


Figure 4.28. UC Berkeley Campus Periphery Reported Pedestrian Crashes by Month (2000-2009)

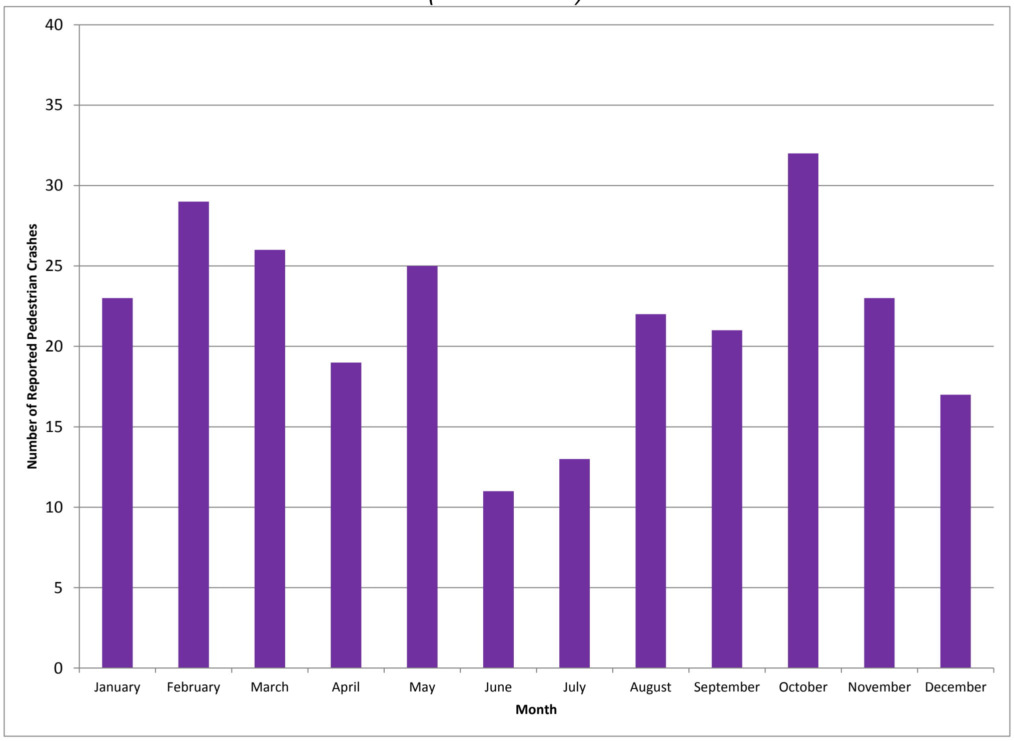
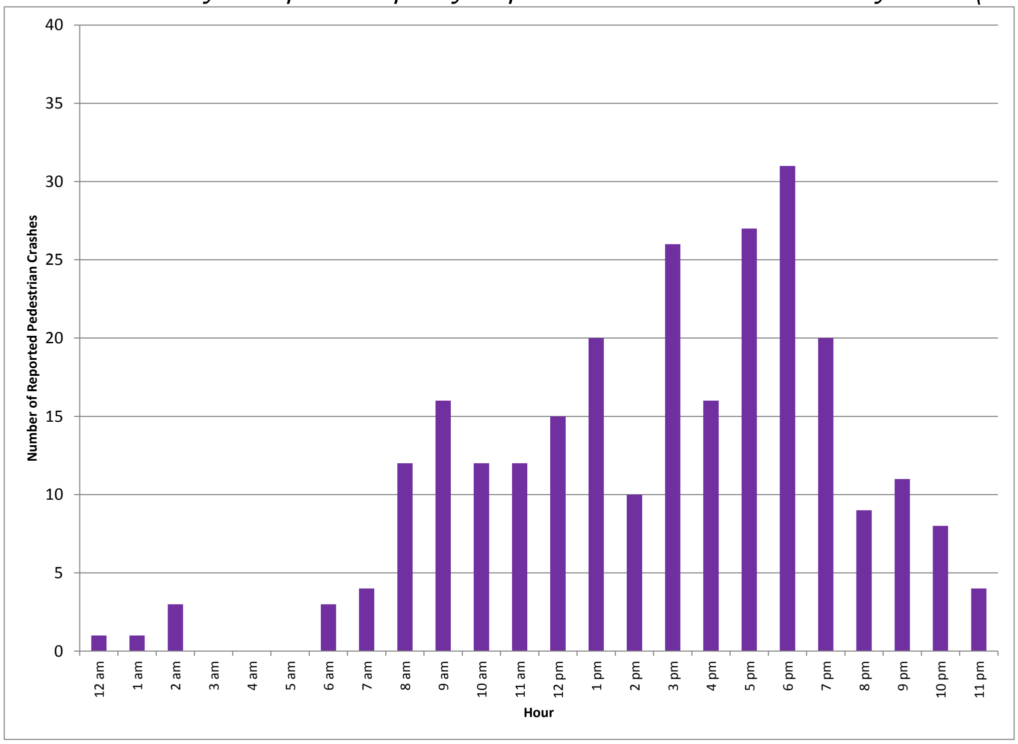


Figure 4.29. UC Berkeley Campus Periphery Reported Pedestrian Crashes by Day of the Week (2000-2009)

Figure 4.30. UC Berkeley Campus Periphery Reported Pedestrian Crashes by Hour (2000-2009)



Similar to pedestrian crashes, bicycle crashes were generally clustered in areas where there was more bicycle activity. Bicycle crashes were concentrated along the Oxford Street, Shattuck Avenue, Lower Hearst Avenue (between Shattuck Avenue and Arch Street), and Bancroft Avenue (Figure 4.31). The recommendations in this document are intended to reduce pedestrian and bicycle crashes and injuries in these and other areas around campus.

Bicycle crashes were also analyzed by month, weekday, and hour. Bicyclists were involved in more crashes during the spring and fall semesters when there is more activity on and around campus than other times of the year (Figure 4.32). September and October had the highest numbers of bicycle crashes, which may be related to higher bicycle use in these months. However, the pattern of bicycle crashes during the spring semester may not be completely explained by bicycle activity, since April and May are likely to have higher levels of bicycling than February and March due to typically nicer weather. The drop in bicycle crashes in April and May could be related to the start of daylight savings time and more light during evening bicycle commute times. Similar to pedestrian crashes, bicycle crashes are higher on weekdays than weekends (Figure 4.33). Thursday and Friday have the highest incidence of reported bicycle crashes. While bicycle crashes are highest during the afternoon and early evening, there are several hours with particularly high numbers of crashes (Figure 4.34). These include 2 p.m. to 3 p.m. and 7 p.m. to 8 p.m. It is possible that 2 p.m. to 3 p.m. represents a peak time for bicyclists to exit campus, so there are more potential conflicts during this hour. Many bicyclists may also commute from campus from 7 p.m. to 8 p.m., and this time involves bicycling in the dark during winter months. There is also a notable peak of bicycle crashes between 8 a.m. and 10 a.m. This time period corresponds with many bicyclists and drivers traveling to campus.

Figure 4.31. UC Berkeley Campus Periphery Bicycle Crash Density (2000-2009)

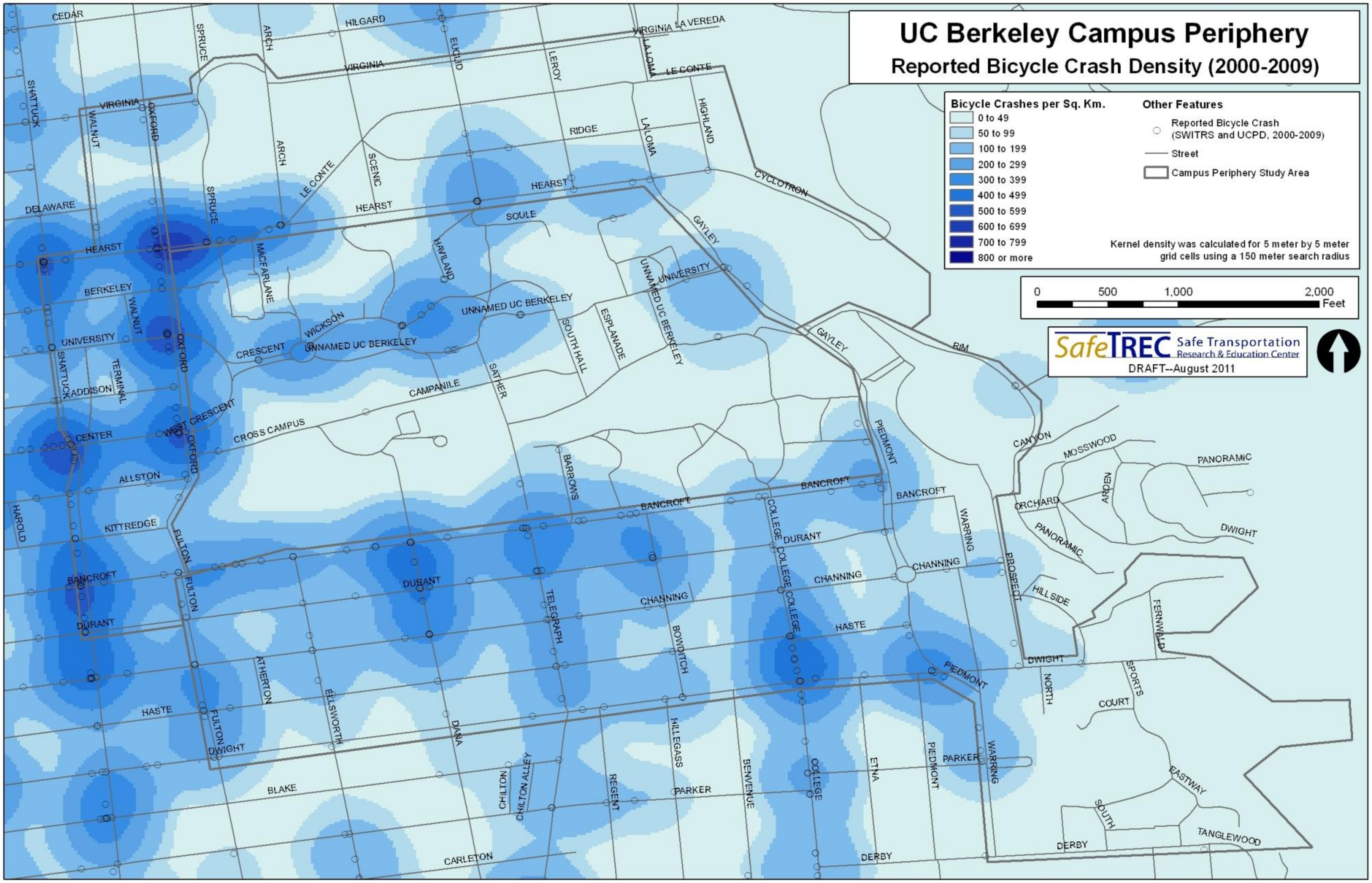


Figure 4.32. UC Berkeley Campus Periphery Reported Bicycle Crashes by Month (2000-2009)

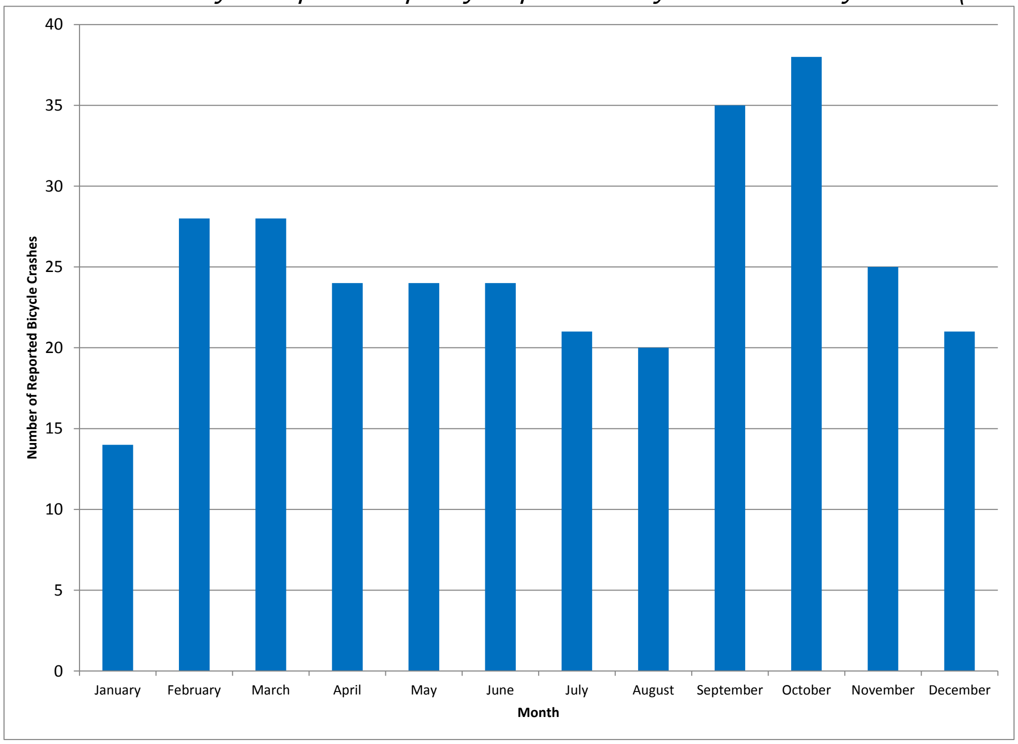


Figure 4.33. UC Berkeley Campus Periphery Reported Bicycle Crashes by Day of the Week (2000-2009)

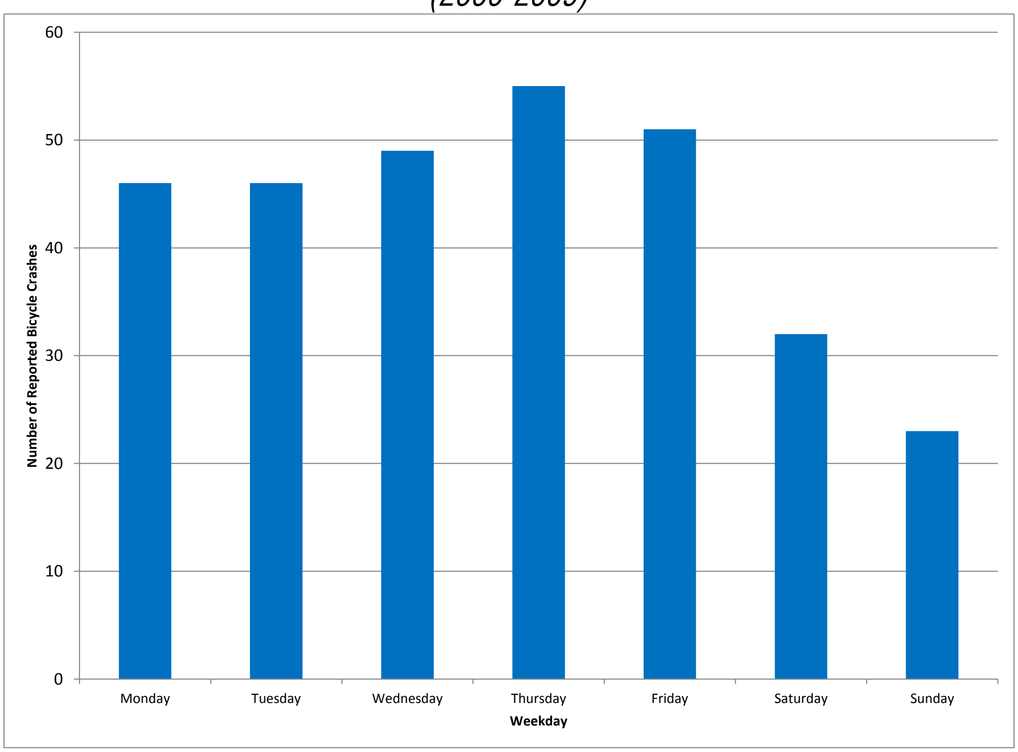
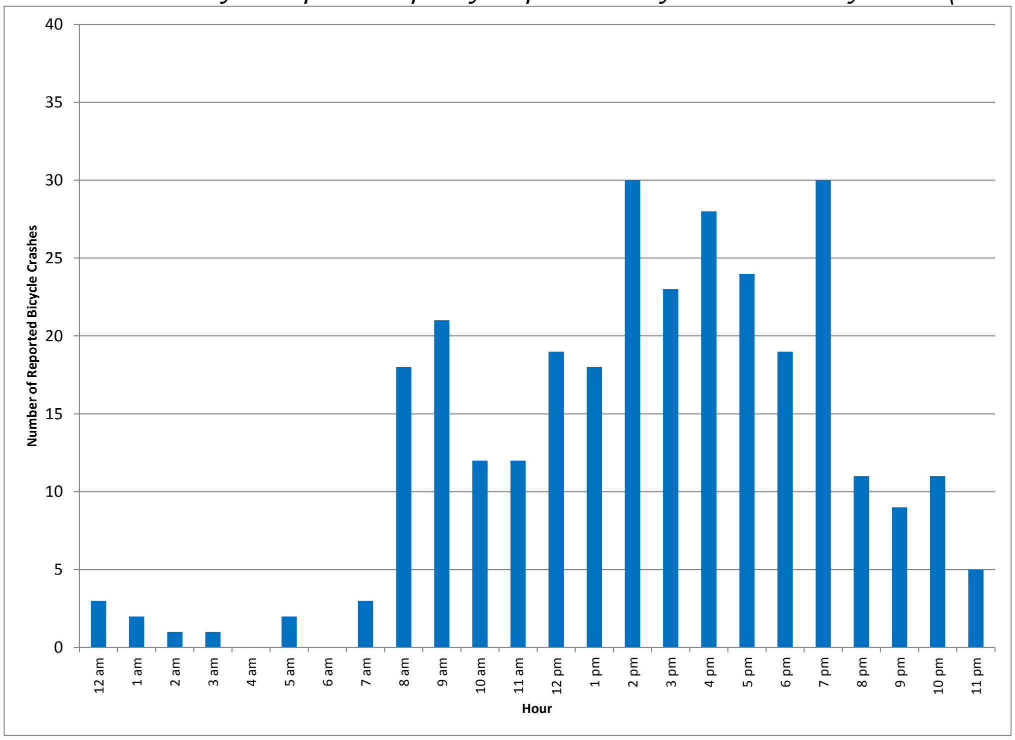


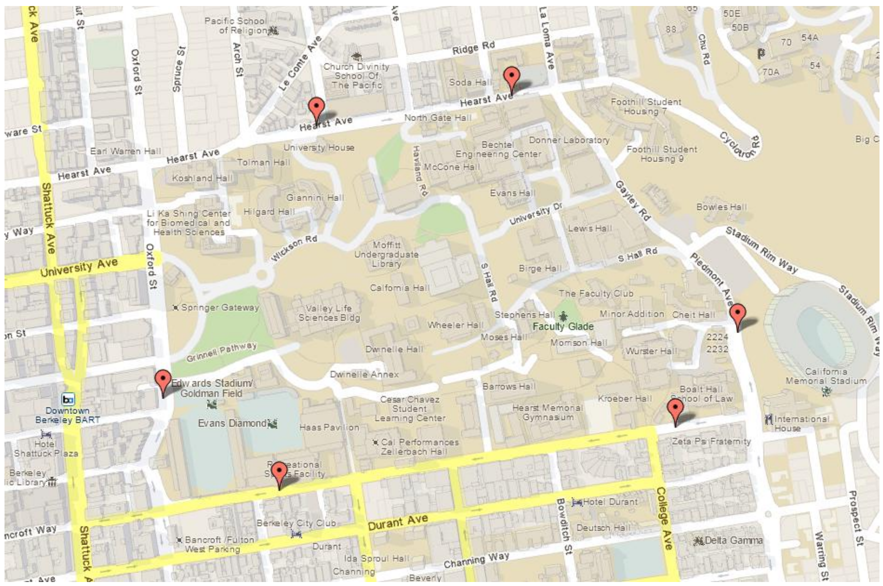
Figure 4.34. UC Berkeley Campus Periphery Reported Bicycle Crashes by Hour (2000-2009)



4.4. Vehicular Speeds

The greater mass and higher velocity of cars increases the vulnerability of pedestrians and bicyclists. Speed affects both the probability of preventing a crash and the severity of a crash. It is therefore important to measure the current travel speeds around the campus periphery area. Six campus locations were selected along the campus boundary roads as shown in Figure 4.35. The measurements were taken at off-peak hours and represent the free-flow speed. The observation periods and exact measurement location are described in Figure 4.36.

Figure 4.35. UC Berkeley Campus Periphery Locations of Vehicle Speed Study Sites



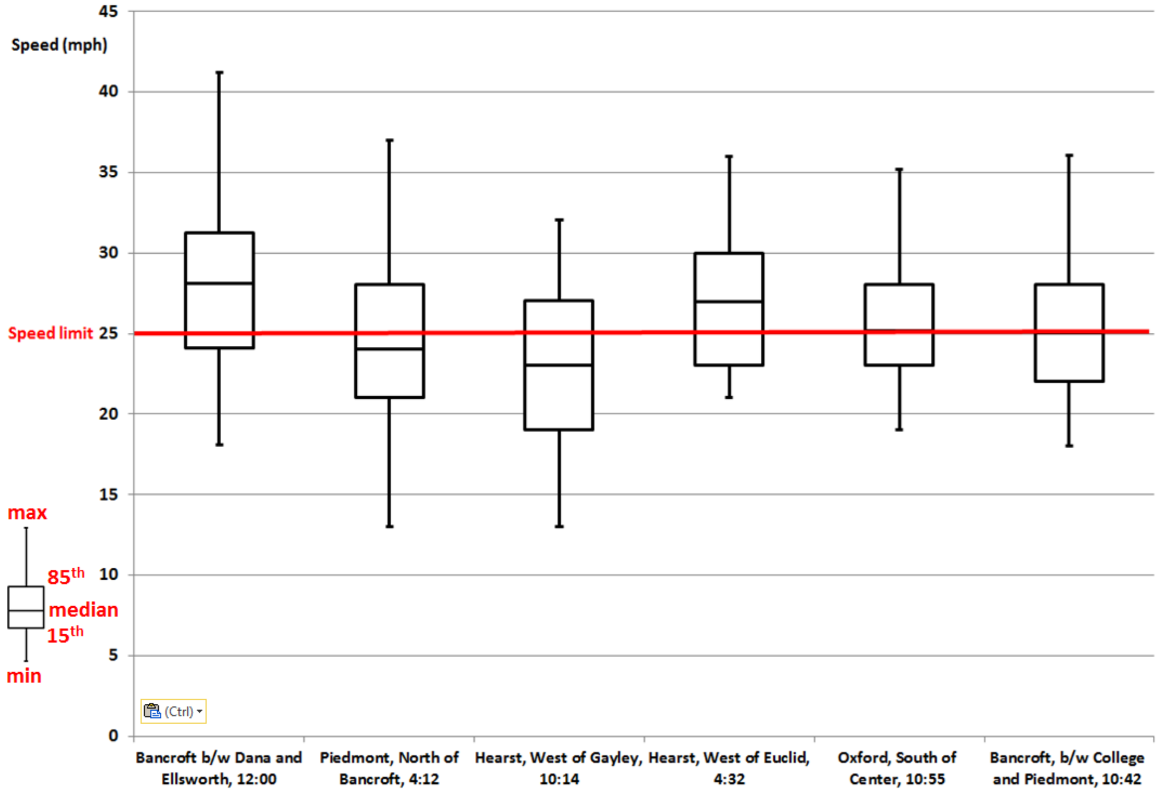
The speeds were measured using a laser speed gun (Bushnell Velocity) which provides instantaneous speed measurements to one-mile per hour accuracy. More details about the methodology used for the spot speed measurements are available in Appendix G.

Over 1,000 vehicle speed measurements were taken across the six sites. The minimum velocity, 15th percentile velocity, median velocity, 85th percentile velocity, and maximum velocity were estimated for each site and are plotted in Figure 4.37. The median of only two locations was below the speed limit, and the 85th percentile across all six sites was higher than the speed limit. This reveals that the speeds along the campus boundary may not sufficiently enforce and are higher than the design speed. The 85th percentile speed along Bancroft (between Dana and Ellsworth) was the highest, while upper Hearst was the lowest.

Figure 4.36. UC Berkeley Campus Periphery Details of Vehicle Speed at Six Study Sites

Date, Time	Name, Location	Photo ("A" - laser gun, "B" – car)
11/10/2011 12:00-1:00pm	*Lower Bancroft:* Bancroft between Dana and Ellsworth (Westbound)	
2/24/2012 4:12-5:12pm	*Gayley:* Piedmont, just North of Bancroft (Northbound)	
3/9/2012 10:14-11:13am	*Upper Hearst:* Hearst, just West of Gayley (Westbound)	
3/23/2012 4:32-5:32pm	*Lower Hearst:* Hearst, West of Euclid (Westbound)	
4/5/2012 10:55-11:55am	*Oxford:* Oxford, South of Center (Southbound)	
4/17/2012 10:42-11:42	*Upper Bancroft:* Bancroft, b/w College and Piedmont (Westbound)	

Figure 4.37. UC Berkeley Campus Periphery Distributions of Vehicle Speed at Six Study Sites



5. PRIORITIZATION PROCESS

The purpose of the prioritization analysis was to provide a strategic framework for implementing pedestrian and bicycle safety improvements in the campus periphery study area. Prioritization was conducted in a two-step process: 1) a pragmatic assessment of opportunities to implement specific projects, and 2) an objective evaluation of the need for pedestrian and bicycle safety improvements on campus periphery street corridors.[18]

The first step established a framework for evaluating opportunities to implement specific improvements. This pragmatic approach notes that there are greater opportunities to implement recommendations that are already supported by existing plans. Note that the City of Berkeley has implementation authority for projects on streets outside of campus and UC Berkeley has implementation authority for projects within the campus area. Therefore, the recommendations in this document are only considered to be supported by an existing plan if that plan was prepared by the agency with implementation authority. Recommendations for City of Berkeley streets from UC Berkeley plans should be viewed as supportive ideas that could be considered by the City of Berkeley. The opposite is true for UC Berkeley campus property.

The second step assigned objective priority rankings to street corridors based on suitability (e.g., street corridors with worse conditions for walking and bicycling were given higher scores), high approximated activity levels (e.g., street corridors with more walking and bicycling were given higher scores), and more reported crashes (e.g., street corridors with more pedestrian and bicycle crashes were given higher scores).

5.1. Step 1: Identify Implementation Opportunities

In order to develop pragmatic recommendations, the first step of the prioritization process considered how challenging it would be to implement specific improvements. Many potential improvements have already been recommended in plans that have been adopted by the City of Berkeley and UC Berkeley. In general, such actions will be easier to implement than other ideas that have not been adopted formally. In addition, there are some potential projects that are low-cost, already have an identified funding source, or can be made as a part of other planned projects. However, in other cases, a project may be very expensive and require extensive public outreach and additional study.

This pragmatic approach established four implementation categories and one subcategory of recommended projects. The groups are illustrated in Figure 5.1 and described below. Completion of projects in each implementation category will depend on staff time available and extent of technical analysis and public outreach.

[18] The campus periphery study area includes 42 street corridors. These street corridors are defined as one or more street blocks sharing the same street name. However, street corridors are divided into different units of observation where they crossed any of the following streets: Hearst Avenue, Oxford Street, Fulton Street, or Bancroft Avenue. Dwight Way was divided into west and east corridors at Warring Street. The prioritization methodology analyzes corridors because they are useful for thinking about continuity of travel along routes and for implementing projects as a part of street reconstruction, repaving, or other corridor-wide improvements. This approach does not preclude spot improvements being recommended in specific locations within corridors.

Group 1: Supported by Existing Plan, Straightforward to Implement

This group includes specific recommendations that are supported in official City of Berkeley or UC Berkeley planning documents.[19] Many of these recommendations have already gone through a public process and have been approved by governing bodies. Although these recommendations have come from official plans, this does not indicate that environmental studies or other steps have been completed to provide final approval to take action.

Support from an official planning document means either of the following:

- The recommendation in this study is identical to a recommendation in a City of Berkeley or UC Berkeley Plan.
- The recommendation in this study is a specific example of a general recommendation in a City of Berkeley or UC Berkeley Plan. This may include a specific location for a generally recommended pedestrian or bicycle facility or a specific facility in a location generally recommended for improvement.

In either case, the recommendation listed in this study is supported, even though it may be more specific than the original plan language. When recommendations in this group include additional detail that was not available in an official City of Berkeley or UC Berkeley document or require slight modifications to the recommended action, this detail is a result of extra analysis conducted for this study, and it is intended to clarify and move existing recommendations forward.

The projects in this group should also be relatively straightforward to implement, meaning that the projects may be relatively inexpensive, may not involve extensive analysis, or preliminary studies are already underway. Therefore, the City of Berkeley and UC Berkeley could begin to work on the recommendations in this group within a year after the completion of this study.

Group 2: Supported by Existing Plan, Challenging to Implement

Similar to those in Group 1, the recommendations in Group 2 are supported by existing City of Berkeley or UC Berkeley planning documents. However, they are more challenging to implement, possibly requiring more detailed design and analysis before a final project concept can be selected. They usually involve more public outreach and a large amount of staff time. Therefore, the City of Berkeley and UC Berkeley could begin to move forward with the recommendations in this group when resources are available in the next two years.

Group 3: New Suggestion, Straightforward to Implement

Similar to those in Group 1, the recommendations in Group 3 are anticipated to be relatively straightforward to implement. However, they are not currently supported by an official plan. For

[19] Recommendations in this document come from several types of approved plans. These plans have different degrees of public review and analysis, so recommendations from certain documents may be further from actual implementation (and barriers could be identified that prevent some recommendations from being feasible). City of Berkeley citywide master plans (e.g., Pedestrian Master Plan and Bicycle Plan) have a relatively higher level of analysis and review than the other types of plans. In addition, the City of Berkeley has jurisdiction over city rights-of-way, while UC Berkeley has jurisdiction over campus properties and rights-of-way, so collaborative suggestions for an improvement are ultimately considered by the body with jurisdictional authority.

recommendations that involve signage or striping, the City of Berkeley and UC Berkeley may be able to move forward toward implementation within a year after completion of this study with little additional planning. Other recommendations in this category may include new suggestions that need to go through a formal City of Berkeley or UC Berkeley planning process, including steps such as neighborhood involvement, traffic study, and design review, so they could take up to five years to begin.

Group 4: New Suggestion, Challenging to Implement

Recommendations in this group are new ideas that could be considered by the City of Berkeley and UC Berkeley in future planning processes. They are not supported by existing plans and they are also more challenging to implement. They would need to go through a formal City of Berkeley or UC Berkeley planning process. However, they will be important concepts to consider as the community seeks to develop a safer, more sustainable, multimodal transportation system.

Figure 5.1. Implementation Categories

		Anticipated Ease of Implementation	
		High	***Low***
Existing Plan Support	***Supported by Existing Plan***	Group 1	Group 2
	New Suggestion	Group 3	Group 4

Early Action Projects: This study also designates a key subcategory of recommendations labeled "Early Action Projects." These recommendations may come from any of the groups described above.

Early Action recommendations are projects that include signage and marking changes that can have an immediate impact on pedestrian and bicyclist comfort and safety. They also include projects for which detailed studies are currently underway. Most Early Action Projects come from groups 1 and 3, although some Early Action Projects may represent the first phase or a short-term component of recommendations from groups 2 or 4. UC Berkeley and the City of Berkeley could push to implement these projects within one year of the completion of this study.

5.2. Step 2: Rank Each Group of Recommendations Objectively

After each recommended improvement was assigned to one of the four implementation categories, it was ranked objectively against other projects in its group. Objective priority rankings were calculated according to suitability (Part A), approximated activity (Part B), and reported crash (Part C) categories. The prioritization scores for each category were then used to calculate overall scores for pedestrian crossing priorities, bicycle crossing priorities, walking along the roadway priorities, and bicycling along the roadway priorities (Part D). The weights for each prioritization category were developed by the project team in consultation with UC Berkeley and the Campus Transportation Advisory Group.

This prioritization method was modeled after the procedure described in the City of Berkeley Pedestrian Master Plan. However, the method used in this study focused in greater detail on the campus periphery study area. While the City of Berkeley prioritization incorporated factors that were useful for a citywide analysis (e.g., proximity to local parks, proximity to senior centers), this study considered characteristics specific to pedestrian and bicycle activity near the campus (e.g., proximity to campus boundary, proximity to commercial zones around the campus). The method described here also derived prioritization weights for several factors using established models from the National Cooperative Highway Research Program (NCHRP) and Federal Highway Administration (FHWA). Overall, this effort provided a framework that compiled and prioritized specific recommendations from the City of Berkeley Pedestrian Master Plan, City of Berkeley Bicycle Master Plan, and other adopted plans in the campus periphery study area. It also prioritized several new ideas that could be considered in future City of Berkeley and UC Berkeley planning efforts.

Objective prioritization was based on pedestrian and bicycle suitability, approximated activity, and reported crashes.

5.2.1. Step 2, Part A: Evaluate Suitability

Existing pedestrian and bicycle conditions were evaluated through four separate suitability analyses. These included: 1) walking along the roadway suitability, 2) bicycling along the roadway suitability, 3) pedestrian roadway crossing suitability, and 4) bicycle roadway crossing suitability. Higher scores were given to street corridors with worse conditions for walking and bicycling.

The primary factors used to evaluate conditions for walking and bicycling along roadways were selected from the Pedestrian Signalized Intersection Crossing LOS and Pedestrian Midblock Crossing LOS models in NCHRP Report 616 as well as FHWA crash reduction factors (Bahar, *et al.*, 2008) and the FHWA Bicycle Intersection Safety Index model (Carter, *et al.*, 2006). Conditions for walking and bicycling along roadways were assigned points based on the Pedestrian Segment Level of Service (LOS) and Bicycle Segment LOS equations listed in NCHRP Report 616: *Multimodal Level of Service Analysis for Urban Streets* (Dowling, *et al.* 2008).

The NCHRP Report 616 LOS models were the primary source used to determine the relative influence of roadway characteristics on pedestrian and bicycle suitability. This is because the models were developed through extensive research on user perceptions, were reviewed by NCHRP staff and a panel of experts, and are now included in the 2010 *Highway Capacity Manual*. However, the NCHRP models do not incorporate several factors that are likely to have a significant association with pedestrian and bicyclist satisfaction. For example, research has found the presence of median islands, traffic-signal-controlled crossings, and stop-controlled crossings to be associated with pedestrian crossing safety. Weights for these additional characteristics were assigned based on FHWA crash reduction factors. In addition, the NCHRP Bicycle Intersection LOS does not account for on-street parking or bicycle lane presence on the intersection approach, cross-street traffic volume, or overall intersection signalization, so the FHWA Intersection Safety Index model was determined to be more useful for the bicycle roadway crossing suitability analysis.

Initial weights for each factor were calculated from a sensitivity analysis. The weights represent the relative change in overall LOS (or safety index) score that would result from adjusting each individual measurement by a specified amount. Each of the weights was then scaled to a range of 0 to 100 points, while maintaining the relative importance of each factor. The points assigned for each component of the suitability analysis are shown in Table 5.1 through Table 5.5.

Note that this suitability analysis is based on factors that have been shown in existing studies to have a significant association with pedestrian or bicyclist comfort in the roadway environment. A number of other factors may also be related to pedestrian or bicycle suitability, such as sun in drivers' eyes at certain times of day,[20] one-way versus two-way streets,[21] and corner turning radii.[22] However, these variables have not been included in existing models of pedestrian or bicyclist comfort or safety, so they were not included. In addition, the buffering effect of on-street parking was not included in the walking along the roadway analysis[23] and driveway crossings were not considered in the walking and bicycling along the roadway analysis.[24] Finally, some of the prioritization variables were interrelated. Despite some correlation, each factor represented different aspects of suitability, and the final suitability rankings were intuitive.

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[20] Sun in drivers' eyes is a common factor cited in articles about traffic crashes, but little information is available on how many crashes are caused by this phenomenon. This factor is likely to be related to automobile speed, which is already included in the analysis.

[21] According to the Federal Highway Administration's Pedestrian Safety Guide and Countermeasure Selection System, one-way streets generally have fewer pedestrian crashes than two-way streets. This is because pedestrians only need to look in one direction for approaching traffic and drivers can more easily focus on pedestrians crossing the street when they do not need to concentrate on opposing traffic. However, one-way streets may facilitate higher automobile speeds because traffic signals may be coordinated for higher speeds and the simplicity of the roadway creates less "friction" than a two-way street. Therefore, the negative effects of one-way streets are already integrated into the automobile speed factors.

[22] According to the Federal Highway Administration's Pedestrian Safety Guide and Countermeasure Selection System, tighter turning radii can help reduce automobile turning speeds, shorten pedestrian crossing distance, and improve sight distance between pedestrians and drivers.

[23] On-street parking provides a physical barrier between moving vehicles and pedestrians walking along sidewalks. However, nearly all streets in the campus periphery study area have more than 50% parking coverage on both sides. Three of the streets with less than 25% parking coverage are Bowditch Street, Channing Way, and Kittredge Street, but the low traffic speeds and volumes on these streets offset the lack of parking coverage, so parking is assumed to play a minimal role in pedestrian suitability on these streets. The other street without on-street parking is Telegraph Avenue. However, parked delivery trucks and slow automobile speeds due to traffic congestion on this street are assumed to offset the lack of parking coverage. Therefore, parking coverage was not used to assess the suitability of walking along the roadway.

[24] Driveway crossings were not included in the general prioritization method presented here. If driveway crossings are considered in the future, it may be beneficial to only evaluate driveway crossings providing access to parking lots and parking structures. The suitability of each individual crossing could be determined using the same point scale that was used for roadway crossings (Table 5.1 and Table 5.2 for pedestrian crossings; Table 5.4 for bicycle crossings). The total score for driveway crossings along the entire street corridor could be the sum of driveway crossing scores weighted by the length of the street corridor. An overall walking along the roadway score could then be calculated using a weighted average of the initial walking along the roadway score (80%) and the pedestrian driveway crossings score (20%). An identical ratio could be used to derive the overall bicycling along the roadway score. This ratio would represent the relationship between the coefficients of the Bicycle Segment LOS model score and the number of unsignalized conflicts per mile in the overall NCHRP Recommended Bicycle LOS model.

5.2.2. Step 2, Part B: Approximate Pedestrian and Bicycle Activity

Higher priority was given to street corridors that were estimated to serve more pedestrian and bicycle activity. Pedestrian and bicycle activity on street corridors was approximated by evaluating surrounding residential density, proximity to specific activity locations, and frequency of transit service. The approximated activity scores represent a relative ranking of street corridors in terms of estimated pedestrian and bicycle activity on a typical weekday afternoon during UC Berkeley spring or fall semester. The points used to approximate pedestrian and bicycle activity are shown in Table 5.6 and Table 5.7.

5.2.3. Step 2, Part C: Quantify Reported Crashes

The analysis also accounted for reported crashes on each street corridor. Points were assigned based on the average reported pedestrian or bicycle crash density for the corridor.[25] Reported crashes were taken from the California Statewide Integrated Traffic Records System (SWITRS) and University of California Police Department (UCPD) records between 2000 and 2009. The points assigned to pedestrian and bicycle crashes are shown in Table 5.8 and Table 5.9.

[25] Crash density is the maximum pedestrian or bicycle crash density (crashes per km^2 within a 150m radius) at any point on each street block. For street corridors, the measure is the average maximum crash density for the street blocks within the corridor.

PART A: SUITABILITY FACTOR TABLES

Table 5.1. Points assigned to Evaluate Pedestrian Roadway Crossing Suitability based on Level of Service Models

Factor[1]	Base Measure	Interpretation of factors less than Base Measure[2]	Interpretation of factors greater than Base Measure[2]
Cross street number of lanes (XL)	4	**1 less lane = 30 fewer points**	**1 more lane = 36 more points**
Cross street 85th percentile speed (mph) (XS)	30	**1 less mph = 1.7 fewer points**	**1 more mph = 1.9 more points**
Cross street single direction AADT (XV)	5000	**1000 less AADT = 11 fewer points**	**1000 more AADT = 11 more points**
Crossing distance (ft) (CD)	50	**1 less foot = 4.3 fewer points**	**1 more foot = 4.3 more points**

Notes:
1) The Cross street number of lanes (XL), Cross street 85th percentile speed (XS), and Cross street single direction AADT (XV) factor scores were derived from a sensitivity analysis of the Pedestrian Signalized Intersection Level of Service (LOS) Model (NCHRP Report 616). The Crossing distance (CD) factor score was derived from a sensitivity analysis of the Bicycle Intersection LOS Model.
2) The Base LOS for the first three factors was the Pedestrian Signalized Intersection LOS score calculated for a typical urban crossing with 15 right-turn-on-red vehicles per 15 minutes, 15 left-turn vehicles per 15 mintues, 4 cross street lanes, a 30 mph cross street 85th percentile speed, a 5000 AADT cross street single direction traffic volume, a 20 second average pedestrian signal delay, and no right-turn channelization islands (Base LOS score = 2.47). The Base LOS for the fourth factor was the Bicycle Intersection LOS score calculated for a typical urban crossing with one lane in each direction on the intersection approach street, a 19 foot outside lane plus parking lane width on the intersection approach street, and a 50 foot cross street crossing distance (Base LOS score = 1.54).

Table 5.2. Points assigned to Additional Pedestrian Crossing Features based on Crash Reduction Factors

Factor[1]	Base Measure	Interpretation of factors less than Base Measure	Interpretation of factors greater than Base Measure
Signal control at crossing (1=yes; 0=no) (SI)	0	**No signal control = 0 points**	**Signal control = 25 fewer points**
Stop control at crossing (1=yes; 0=no) (SC)	0	**No stop control = 0 points**	**Stop conrol = 19 fewer points**
No right-turn-on-red allowed (1=yes; 0=no) (RR)	0	**No right-turn-on-red = 0 points**	**Right-turn-on-red = 43 more points**
Raised median island at crossing (1=yes; 0=no) (M)	0	**No median = 0 points**	**Median = 25 fewer points**

Notes:
1) The factor weights represent a conservative pedestrian crash reduction estimate from a range of studies in the FHWA Desktop Reference for Crash Reduction Factors. For example, installing a pedestrian signal was associated with 0%, 50%, 53% and 55% fewer pedestrian crashes in separate studies (25% was used), installing a raised median was associated with 25% to 69% fewer pedestrian crashes (25% was used), converting two-way to all-way stop control was associated with 19% to 39% fewer pedestrian crashes (19% was used), and allowing right-turn-on-red at signalized intersections is associated with 43% to 108% more pedestrian crashes (43% was used).

Table 5.3. Points assigned to Evaluate Walking Along the Roadway Suitability based on Level of Service Models

Factor[1]	Base Measure	Interpretation of factors less than Base Measure[2]	Interpretation of factors greater than Base Measure[2]
Lanes per direction (L)[3]	2	**1 less lane = 30 more points**	**1 more lane = 9.7 fewer points**
Average speed (mph) (AP)	30	**1 less mph = 1.2 fewer points**	**1 more mph = 1.6 more points**
Vehicle volume (AADT) (V)	10000	**1000 less AADT = 3.9 fewer points**	**1000 more AADT = 3.0 more points**
Outside lane + bicycle lane + parking lane width (ft) (W)	19	**1 less foot = 0.79 more points**	**1 more foot = 0.75 fewer points**
Sidewalk presence (assumes 6' wide) (1=yes; 0=no) (SP)	1	**No sidewalk = 50 more points**	**Sidewalk present = 0 points**

Notes:
1) The factor scores were derived from a sensitivity analysis of the Pedestrian Segment Level of Service (LOS) Model (NCHRP Report 616).
2) The Base LOS for these factors was the Pedestrian Segment LOS score calculated for a typical urban, two-way street with 2 lanes per direction, 30 mph average speed, 10000 AADT, a 19 foot outside lane plus parking lane width, 50 percent on-street parking coverage and a 6-foot sidewalk along the entire street (Base LOS score = 1.30).
3) For one-way streets, lanes per direction was divided by 2 so that the amount of traffic affecting the pedestrian environment on each side of the roadway was represented correctly.

Table 5.4. Points assigned to Evaluate Bicycle Roadway Crossing Suitability based on Intersection Safety Index Model

Factor[1]	Base Measure	Interpretation of factors less than Base Measure[2]	Interpretation of factors greater than Base Measure[2]
Bicycle lane present (1=yes; 0=no) (BL)	0	**No bicycle lane = 0 points**	**Bicycle lane = 8.0 fewer points**
Turning vehicles across bicycle movement (1=yes; 0=no) (TV)	1	**No turning vehicles = 23 fewer points**	**Turning vehicles = 0 points**
Cross street AADT (both directions) (CV)	10000	**1000 less cross street AADT = 0.80 fewer points**	**1000 more cross street AADT = 0.80 more points**
Main street AADT (boht directions) (MV)	5000	**1000 less main street AADT = 0.66 fewer points**	**1000 more main street AADT = 0.66 more points**
Main street speed limit >=35 mph (1=yes; 0=no) (HS)	0	**Main street speed limit <35 mph = 0 points**	**Main street speed limit >= 35 mph = 28 points**
Number of right-turn lanes on intersection approach (RL)	0	**Main street no right-turn lanes = 0 ponts**	**1 more main street right-turn lane = 16 more ponts**
Intersection is signalized (1=yes; 0=no) (SG)	0	**Unsignalized intersection = 0 points**	**Signalized intersection = 15 points**
On-street parking on intersection approach >25% cov. (1=yes; 0=no) (PC)	1	**Main street parking coverage <= 25% = 6.9 fewer points**	**Main street parking coverage > 25% = 0 points**

Notes:

1) All factor scores were derived from a sensitivity analysis of the Federal Highway Administration Bicycle Intersection Safety Index (ISI) (FHWA 2006).

2) The Base ISI for the factors was the Bicycle ISI score calculated for a typical urban intersection that has no bicycle lane present on the approach, has turning vehicles across the bicycle movement, has 10000 cross stret AADT, has 5000 main street AADT, has main street speed limit <35 mph, has 1 right-turn lane on the intersection approach, is unsignalized, and has on-street parking on the approach (Base ISI score = 2.31).

Table 5.5. Points assigned to Evaluate Bicycling Along the Roadway Suitability based on Level of Service Models

Factor[1]	Base Measure	Interpretation of factors less than Base Measure[2]	Interpretation of factors greater than Base Measure[2]
Lanes per direction (L)[3]	2	**1 less lane = 22 more points**	**1 more lane = 13 fewer points**
Average speed (mph) (AP)	30	**1 less mph = 7.1 fewer points**	**1 more mph = 2.2 more points**
Vehicle volume (AADT) (V)	10000	**1000 less AADT = 24 fewer ponits**	**1000 more AADT = 1.7 more points**
Outside lane + bicycle lane + parking lane width (ft) (W)[4]	19	**1 less foot = 7.8 more points**	**1 more foot = 11 fewer points**
Striped shoulder or bicycle lane width (ft) (S)	0	**No shoulder or BL = 0 points**	**1 more shoulder or BL foot = 10 fewer points**
On-street parking coverage (%) (PP)	50	**1% less coverage = 1.0 fewer ponits**	**1% more coverage = 0.74 more points**

Notes:

1) The factor scores were derived from a sensitivity analysis of the Bicycle Segment Level of Service (LOS) Model (NCHRP Report 616).

2) The Base LOS for the factors was the Bicycle Segment LOS score calculated for a typical urban, two-way stret with 2 lanes per direction, 30 mph average speed, 10000 AADT, a 19 foot outside lane plus parking lane width, no striped shoulder or bicycle lane, and 50 percent on-street parking coverage (Base LOS score = 3.94).

3) For one-way streets, lanes per direction was divided by 2 so that the amount of traffic affecting the pedestrian environment on each side of the roadway was represented correctly.

4) The measurement of W excludes the width of median-protected auxillary parking areas.

PART B: APPROXIMATED ACTIVITY FACTOR TABLES

Table 5.6. Points assigned to Approximate Pedestrian Activity

Factor[1]	Base Measure	Interpretation of factors less than Base Measure	Interpretation of factors greater than Base Measure
Distance to major campus entrance (m)[2] (DC)	500	**100 m closer = 5 more points**	**100 m further away = 5 fewer points**
Population density of adjacent blocks (pop/mi^2) (PD)	10000	**1000 less pop/mi^2 = 0.2 fewer points**	**1000 more pop/mi^2 = 0.2 more points**
Number of off-street parking spaces served[3] (OP)	100	**100 fewer spaces = 2 fewer points**	**100 more spaces = 2 more points**
Within a commercial zone (WC) (Yes = 1; No = 0)	0	**0 points**	**Within zone = 30 points**
Distance to commercial zone boundary (m) (DZ)	500	**100 m closer = 2 more points**	**100 m further away = 2 fewer points**
Distance to BART station (m) (DB)	500	**100 m closer = 5 more points**	**Further away = 0 points**
Operational bus stops in 24 hour period[4] (OB)	100	**1 less stop = 0.05 fewer points**	**1 more stop = 0.02 more points**

Notes:

1) Proximity is calculated as the distance between the centroid of the block or street corridor and the activity generator.

2) Major campus entrances are at Bancroft & College, Bancroft & Telegraph, Bancroft & Dana, Oxford & Center, Oxford & Addison, Hearst & Euclid, Gayley & University, and Gayley & S. Hall.

3) Off-street parking spaces served is calculated as the total number of parking spaces served by driveway entrance/exit points on each street corridor.

4) Operational bus stops in 24 hour period is calculated as the total number of times buses stop on the block or street corridor (includes all stops for all bus routes).

Table 5.7. Points assigned to Approximate Bicycle Activity

Factor[1]	Base Measure	Interpretation of factors less than Base Measure	Interpretation of factors greater than Base Measure
Distance to major campus entrance (m)[2] (DC)	500	**100 m closer = 2 more points**	**100 m further away = 2 fewer points**
Population density of adjacent blocks (pop/mi^2) (PD)	10000	**1000 less pop/mi^2 = 0.1 fewer points**	**1000 more pop/mi^2 = 0.1 more points**
Number of off-street parking spaces served[3] (OP)	100	**100 fewer spaces = 0.1 fewer points**	**100 more spaces = 0.1 more points**
Within a commercial zone (WC) (Yes = 1; No = 0)	0	**0 points**	**Within zone = 10 points**
Distance to commercial zone boundary (m) (DZ)	500	**100 m closer = 0.5 more points**	**100 m further away = 0.5 fewer points**
Distance to BART station (m) (DB)	500	**100 m closer = 1 more point**	**Further away = 0 points**
Operational bus stops in 24 hour period[4] (OB)	100	**1 less stop = 0.01 fewer points**	**1 more stop = 0.005 more points**
Has existing bicycle facility (EB) (1 = yes; 0 = no)	0	**0 points**	**Existing bicycle facility = 30 points**
Distance to existing bicycle facility (DF)	200	**100 m closer = 5 more points**	**100 m further away = 5 fewer points**

Notes:
1) Proximity is calculated as the distance between the centroid of the block or street corridor and the activity generator.
2) Major campus entrances are at Bancroft & College, Bancroft & Telegraph, Bancroft & Dana, Oxford & Center, Oxford & Addison, Hearst & Euclid, Gayley & University, and Gayley & S. Hall.
3) Off-street parking spaces served is calculated as the total number of parking spaces served by driveway entrance/exit points on each street corridor.
4) Operational bus stops in 24 hour period is calculated as the total number of times buses stop on the block or street corridor (includes all stops for all bus routes).

PART C: REPORTED CRASH FACTOR TABLES

Table 5.8. Points assigned to Account for Reported Pedestrian Crashes

Factor	Base Measure	**Interpretation of factors less than Base Measure**	**Interpretation of factors greater than Base Measure**
Reported pedestrian crash density (crashes per km^2) (P)	0	**0 points**	**100 more crashes per km^2 = 10 more points**

Table 5.9. Points assigned to Account for Reported Bicycle Crashes

Factor	Base Measure	**Interpretation of factors less than Base Measure**	**Interpretation of factors greater than Base Measure**
Reported bicycle crashes (crashes per km^2) (B)	0	**0 points**	**100 more crashes per km^2 = 10 more points**

5.2.4. Step 2, Part D: Apply Overall Category Weights

In addition to the weights assigned to individual factors within each category, the suitability, approximated activity, and reported crash categories were weighed against each other. This was accomplished by first standardizing the scores for each of the three categories on a scale of 0 to 100, then overall category weights were applied. Suitability accounted for 33%, approximated activity accounted for 33%, and reported crash density accounted for 33% of the initial prioritization ranking. Note that this proportion was selected based on internal discussion within the project team and consultation with the UC Berkeley Campus Transportation Advisory Group. A sensitivity analysis was conducted to determine the impact of assigning different weights to each category (e.g., 20% suitability, 40% approximated activity, 40% crash density), and it showed that the top 10 street corridors were similar for many different combinations of weights. Since the weights chosen for each category had only a minor influence on the overall street corridor priority ranking, the 33%, 33%, 33% split was determined to be sufficient for the purpose of this prioritization procedure. Results of this sensitivity analysis for the top five street corridors are shown in Appendix C.

Prioritization points were assigned using the following formulas:

- Pedestrian roadway crossing improvements = (Total pedestrian roadway crossing suitability points * 0.33) + (Total approximated pedestrian activity points * 0.33) + (Total reported pedestrian crash points * 0.33). Street corridors in this category received from 6 to 98 possible points.
- Walking along the roadway improvements = (Total walking along the roadway suitability points * 0.33) + (Total approximated pedestrian activity points * 0.33) + (Total reported pedestrian crash points * 0.33). Street corridors in this category received from 14 to 89 possible points.
- Bicycle roadway crossing improvements = (Total bicycle roadway crossing suitability points * 0.33) + (Total approximated bicycle activity points * 0.33) + (Total reported bicycle crash points * 0.33). Street corridors in this category received from 16 to 76 possible points.
- Bicycling along the roadway improvements = (Total bicycling along the roadway suitability points * 0.33) + (Total approximated bicycle activity points * 0.33) + (Total reported bicycle crash points * 0.33). Street corridors in this category received from 17 to 80 possible points.

Table 5.10 shows the prioritized lists of street corridors for: 1) walking along the roadway improvements, 2) bicycling along the roadway improvements, 3) pedestrian roadway crossing improvements, and 4) bicycle roadway crossing improvements. The scores for suitability, approximated activity, and crash density for each street corridor are included in Appendix D.

The overall priority ranking score for a specific recommended project was calculated using the relevant street corridor rankings in Table 5.10. Points were awarded to projects that should improve conditions in each category based on the following scale:

- Improve conditions in a corridor ranked 1^{st} to 5^{th} = 5 points
- Improve conditions in a corridor ranked 6^{th} to 10^{th} = 4 points
- Improve conditions in a corridor ranked 11^{st} to 15^{th} = 3 points

- Improve conditions in a corridor ranked 16th to 20th = 2 points
- Improve conditions in a corridor ranked 21st to 25th = 1 point

Points were awarded to all corridors and all categories addressed by the recommended improvement. For example, providing a leading pedestrian interval at the intersection of Shattuck Avenue and University Avenue would improve pedestrian crossing conditions in the Shattuck Avenue corridor and the University Avenue corridor. Within the "Pedestrian crossing the roadway" category, the Shattuck Avenue corridor ranked 1st (so the project was given 5 points in this category) and the University Avenue corridor ranked 2nd (so the project was given 5 points in this category). Therefore, the overall priority ranking score for that project was 10 points. Note that this project was not given any points for pedestrian along the roadway, bicycle crossing the roadway, or bicycle along the roadway improvements because it did not specifically address those issues.

Table 5.10. Objective Prioritization Rankings

	Ranking according to the prioratization scores			
	Pedestrian crossing the roadway	Pedestrian along the roadway	Bicycle crossing the roadway	Bicycle along the roadway
Addison	14 (54)	14 (64)	14 (54)	21 (47)
Allston	11 (58)	8 (72)	11 (60)	16 (54)
Arch	41 (14)	38 (27)	26 (41)	20 (47)
Atherton	36 (19)	37 (28)	37 (24)	39 (22)
Bancroft E	5 (74)	6 (73)	17 (51)	11 (62)
Bancroft W	12 (57)	12 (66)	7 (69)	15 (55)
Berkeley	9 (62)	7 (73)	10 (60)	8 (66)
Bowditch	21 (40)	20 (51)	25 (41)	27 (42)
Center	8 (69)	2 (85)	1 (76)	3 (77)
Channing	17 (49)	15 (62)	27 (40)	28 (40)
College	27 (29)	28 (39)	18 (49)	25 (44)
Dana	22 (39)	22 (50)	16 (53)	19 (47)
Durant E	6 (72)	9 (70)	13 (57)	10 (63)
Durant W	15 (53)	23 (49)	8 (67)	23 (45)
Dwight E	42 (6)	42 (14)	42 (16)	42 (17)
Dwight W	26 (36)	25 (44)	23 (43)	17 (53)
Ellsworth	38 (19)	41 (18)	30 (35)	40 (21)
Euclid	30 (25)	27 (39)	31 (34)	30 (38)
Fulton	19 (41)	26 (44)	19 (49)	14 (58)
Gayley	20 (41)	18 (54)	29 (37)	22 (46)
Haste	24 (38)	24 (47)	22 (44)	29 (39)
Hearst E	13 (55)	11 (66)	20 (48)	12 (60)
Hearst W	10 (60)	19 (52)	6 (71)	7 (67)
Kittredge	16 (52)	13 (65)	15 (54)	24 (44)
La Loma	31 (24)	34 (31)	36 (24)	41 (21)
Le Conte	37 (19)	36 (29)	35 (27)	34 (32)
Le Roy	35 (20)	31 (37)	39 (21)	38 (24)
Oxford N	18 (46)	17 (55)	9 (65)	6 (70)
Oxford S	7 (70)	10 (69)	2 (76)	1 (80)
Piedmont	23 (39)	16 (56)	24 (42)	18 (51)
Prospect	39 (15)	39 (26)	41 (20)	32 (32)
Ridge	34 (21)	32 (33)	38 (23)	37 (26)
Scenic	32 (23)	33 (32)	40 (20)	35 (28)
Shattuck	1 (98)	4 (83)	4 (72)	2 (77)
Shattuck SQ	3 (85)	3 (83)	5 (72)	5 (70)
Spruce	25 (36)	21 (51)	21 (48)	13 (59)
Telegraph	4 (76)	1 (89)	12 (57)	9 (63)
Univeristy	2 (88)	5 (74)	3 (73)	4 (73)
Virginia	40 (14)	40 (23)	34 (28)	36 (28)
Walnut	29 (28)	30 (39)	28 (37)	26 (43)
Warring N	33 (22)	35 (30)	32 (29)	33 (32)
Warring S	28 (28)	29 (39)	33 (28)	31 (37)

Notes: The values in each cell are the rankings along with the prioratization score in parenthesis
The colors are associated with the scores

6. RECOMMENDATIONS

This section recommends specific actions to improve pedestrian and bicycle safety and access in the vicinity of the UC Berkeley campus. These actions include implementing infrastructure projects and establishing education, enforcement, and encouragement programs.

6.1. Recommended Infrastructure Projects

Pedestrian and bicycle safety may be improved by implementing infrastructure projects in the campus periphery study area. The process used to prioritize these projects is described in Section 5. Section 5 includes important caveats about the level of support for recommendations in each of the four pragmatic groups. In particular, new suggestions that have not been specified in adopted City of Berkeley plans have not gone through a formal city process, including steps such as design review, traffic study, and neighborhood involvement.

These recommendations will help:

- Support projects that City of Berkeley and UC Berkeley staff are moving forward toward implementation.
- Advance general recommendations in existing plans to the next level of specificity.
- Provide additional comments related to existing plan recommendations and suggest ideas to be discussed in future planning processes.

6.1.1. Early Action Infrastructure Projects

The City and University are working together to implement a number of pedestrian and bicycle improvements within their near-term project plans. Many are low-cost and called for in existing City and University plans. Some are first steps toward implementing larger projects. Through this study, SafeTREC suggests that the City and University could complete the projects below within the next year (Figure 6.1).

Pedestrian Improvements

- E.1. Shattuck Ave. & Berkeley Way—Install flashing beacons (e.g., Rectangular Rapid Flashing Beacons or Pedestrian Hybrid Beacons) and pedestrian warning signs
- E.2. Oxford St. & Berkeley Way—Construct curb bulbouts
- E.3. Center Street midblock crossing between Shattuck Avenue and Oxford Street—Install flashing beacons and pedestrian warning signs
- E.4. Hearst Ave. & Walnut St.—Install flashing beacons and pedestrian warning signs

Rectangular rapid flashing beacons emphasize the pedestrian crossing of Bancroft Way at Dana Street.

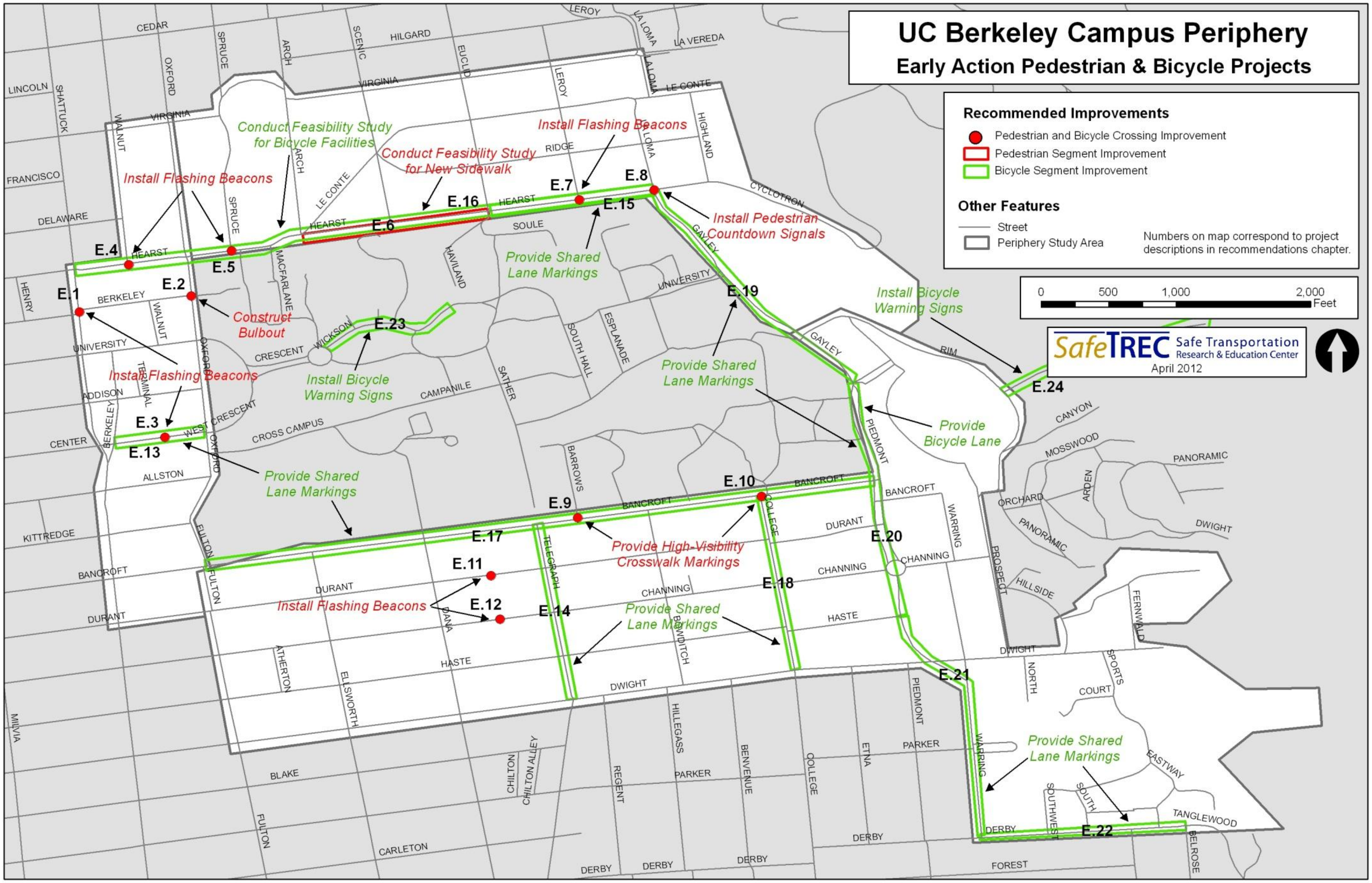
- E.5. Hearst Ave. & Spruce St.—Install flashing beacons and pedestrian warning signs
- E.6. Hearst Ave. between LeConte Ave. and Euclid Ave.—Conduct feasibility study for new sidewalk on south side of street
- E.7. Hearst Ave. & Leroy Ave.—Install flashing beacons and pedestrian warning signs
- E.8. Hearst Ave. & Gayley Rd.—Install pedestrian countdown signals
- E.9. Bancroft Way & Barrow Lane—Provide high-visibility ladder crosswalk markings
- E.10. Bancroft Way & College Ave.—Provide high-visibility ladder crosswalk markings
- E.11. Durant St. midblock crossing between Dana St. and Telegraph Ave.—Install flashing beacons and pedestrian warning signs
- E.12. Channing Way midblock crossing between Dana St. and Telegraph Ave.—Install flashing beacons and pedestrian warning signs

Bicycle Improvements


Bicycle warning signs could be installed on Wickson Drive.

- E.13. Center Street between Shattuck Ave. and Oxford St.—Provide shared lane markings
- E.14. Telegraph Ave.between Dwight Way and Bancroft Way—Provide shared lane markings
- E.15. Hearst Ave. between Euclid Ave.and Gayley Rd.—Provide shared lane markings
- E.16. Hearst Ave. between Oxford St. and Gayley Rd.—Conduct feasibility study for new bicycle facilities in corridor
- E.17. Bancroft Way between Piedmont Ave. and Shattuck Ave.—Provide shared lane markings
- E.18. College Ave. between Bancroft Way and Dwight Way—Provide shared lane markings
- E.19. Gayley Rd. between Hearst Ave. and Optometry Lane—Provide shared lane markings
- E.20. Piedmont Ave. between Optometry Lane and Haste St.—Provide bicycle lanes in northbound direction and shared lane markings in southbound direction
- E.21. Piedmont Ave./Warring St. between Haste St. and Derby St.—Provide shared lane markings
- E.22. Derby S. between Warring St. and Belrose Ave.—Provide shared lane markings
- E.23. Wickson Dr. between West Circle and Memorial Glade—Install bicycle warning signs
- E.24. Centennial Dr. between Stadium Rim Way and Grizzly Peak Dr.—Install “Share the Roadway with Bicycles” signs and provide shared lane markings

Figure 6.1. Recommended Early Action Pedestrian and Bicycle Projects



6.1.2. Specific Infrastructure Projects

Specific infrastructure recommendations are divided into the four main implementation categories described in Section 5, Step 1.[26] These are:

- **Group 1:** Supported by Existing Plan, Straightforward to Implement
- **Group 2:** Supported by Existing Plan, Challenging to Implement
- **Group 3:** New Suggestion, Straightforward to Implement
- **Group 4:** New Suggestion, Challenging to Implement

The recommendations within each group are ordered according to the objective priority ranking score calculated in Section 5, Step 2. The objective priority ranking score for each street corridor is shown in italics in the first column of the tables below. In general, recommendations in each category with higher objective rankings could be implemented sooner than recommendations with lower objective rankings. However, it is important for the City of Berkeley and UC Berkeley to take advantage of opportunities to implement all recommended infrastructure projects, regardless of their objective ranking. These opportunities include piggybacking on existing roadway reconstruction, repaving, maintenance, and other projects, as well as specific grant initiatives (see Section 6.1.3).

Possible design recommendations for each project are listed in the second column of the tables below. Many of the projects include common infrastructure elements, so the estimated cost of this infrastructure is also listed. These costs are generalized estimates made for planning purposes, not for specific project designs.[27] They reflect hardscape costs and do not include costs for right-of-way acquisition, planning, design, labor, maintenance of traffic during construction, mobilization, and future maintenance. Most of the cost estimates are based on recent City of Berkeley projects. The City of Berkeley typically uses the following assumptions for additional costs on construction projects: design (+20%), contingency (+15%), staff costs (+20%). Costs are not provided for less common project elements or for most Group 2 and Group 4 projects because they will require more extensive study. Dollar signs are used in the first column to provide a rough, order-of-magnitude cost estimate for the set of recommendations in each row of the table.

The third and fourth columns provide justification for the recommended improvements as well as important considerations that should be taken into account before implementing these recommendations. This list represents planning-level suggestions for the UC Berkeley campus and the City of Berkeley; it does not reflect the results of a design or engineering analyses. The

[26] Early Action Projects from the previous section are also included in the four main groups of recommended infrastructure projects. Early action components of projects are noted by early action project number.

[27] Generalized facility cost assumptions derived from City of Berkeley projects: New traffic signal = $250K per intersection; Rectangular Rapid Flashing Beacons (both sides of crosswalk) = $25K; Pedestrian countdown signals = $6K per signal head; Reconfigure existing four-lane, undivided roadway to one lane in each direction plus bicycle lanes, plus a raised median = $200K per mile; Bulbout = $50K per corner; Sidewalk = $20 per square foot; Curb and gutter = $160K per mile; Median island = $15K per island; Remove lane stripes and add bicycle lane (1 direction) = $24K; New bicycle lane (1 direction) = $18K per mile; Shared lane markings (1 direction) = $18K per mile; High-visibility crosswalk = $1.8K per crosswalk; Advance stop/yield markings = $4 per linear foot; Lighting = $10K per pole; Street tree = $350 per tree; Bicycle parking = $350 per rack; Traffic sign = $200 per sign. City of Berkeley has not installed any Pedestrian Hybrid Beacons to date, but they may cost at least $50K per crossing.

considerations would be addressed during a more detailed evaluation of each project by the implementing agency.

The final column lists the planning documents that support each recommended improvement. It is important to note that the City of Berkeley has implementation authority over streets outside of campus and UC Berkeley has implementation authority over streets within the campus area. Therefore, recommendations for City of Berkeley streets from City of Berkeley plans carry implementation authority. Recommendations for City of Berkeley streets from UC Berkeley plans should be viewed as supportive ideas that could be considered by the City of Berkeley. Likewise for for streets on UC Berkeley campus property, UC Berkeley would have implementation authority and its plans and recommendations would have precedence.

Group 1: Supported by Existing Plan, Straightforward to Implement

Recommendations are supported by a City or University plan and could be relatively straightforward to implement, meaning that the projects may be relatively inexpensive, may not require extensive analysis, or preliminary studies are already underway. The City and University could begin to work on recommendations in this group within a year after the completion of this study.

Location **(Priority Ranking Score)**	**Recommendation** **(Cost of common project components in parentheses. Only includes hardscape costs.)**	**Justification**	**Challenges**	**Support from Existing Plan(s)**
1.1. Hearst Avenue (Shattuck Avenue to LeConte Avenue) *(11)* $$$	• Conduct feasibility study for pedestrian and bicycle facilities in corridor (short-term). The recommendations below may be modified based on the results of the feasibility study. (E.16) • Reconfigure existing four-lane, undivided roadway to one lane in each direction plus a raised median (0.26 x $200K = $52K) with left-turn pockets and bicycle lanes. (0.26 x 2 x $24K = $12.5K).[a] • Provide accessible pedestrian cut-throughs at crosswalk locations along the new median (4 x $500 = $2K).[a] • Install pedestrian warning signs with push-button-operated flashing beacons[b] (2 x $25K = $50K), advance yield markings (100 x $4 = 400), and advance warning signs (4 x $200 = $800) at uncontrolled crosswalks at Spruce St. and Walnut St. (E.4 and E.5)[a] • Install bulbouts at intersections with Spruce St. and Walnut St. (4 x $50K = $200K).[a] • Plant landscaping in median and in buffer zone between curb and sidewalk on both sides	• Hearst Ave. is an important part of the Berkeley Bicycle Network, providing access to the north side of campus. • Hearst Ave. has bicycle lanes west of Shattuck Ave. and bikeway improvements are recommended east of LeConte Ave. • Reconfiguring the lanes provides an excellent opportunity to improve the safety of pedestrian crossings along Hearst Ave.	• A detailed study of the Hearst Ave. corridor is underway. Therefore, the ideas in this report should be considered in that study, but ultimately that study will provide the best guidance on specific pedestrian and bicycle facility designs in this location. • Reconfiguring roadway lanes will reduce the number of through lanes along Hearst Avenue, which may increase delays at intersections of Hearst Ave. & Shattuck Ave. and Hearst Ave. & Oxford St. • The City of Berkeley Downtown Area Plan presents a Hearst Ave. cross-section concept with one travel lane in each direction plus bicycle lanes and parking, but does not include a median.	• City of Berkeley Bicycle Plan recommends Class 2 bicycle lanes between Shattuck Ave. and LeConte Ave. • City of Berkeley General Plan, Transportation Element, Policy T-52, is to "Provide safe and convenient pedestrian crossings throughout the city." It also encourages accessible pedestrian medians in wide streets. • City of Berkeley Downtown Area Plan, p. AC-12 supports reducing the number of travel lanes from 4 to 2 and adding bicycle lanes to extend the Ohlone Greenway to campus. • City of Berkeley Downtown Area Plan, p. AC-8, states that the EIR has indicated that traffic lane reductions appear to be feasible on Hearst Ave. between Shattuck Ave. and Oxford St. • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends considering the feasibility of installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis where appropriate • City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis. • UC Berkeley and City of Berkeley Long Range Development Plan: Five Year Expenditure Plan states: "Hearst Avenue east of Oxford has been identified for improvements in many University and City of Berkeley planning documents. Given continued pedestrian risk in the area, this project is a high priority for UC Berkeley."

	of the street (20 x $350 = $7K).[a]			• UC Berkeley Campus Bicycle Master Plan supports a bicycle lane on Hearst Ave. between Oxford St. and Arch St. • UC Berkeley Landscape Master Plan recommends providing bicycle lanes where possible along Hearst Ave.
1.2. Bancroft Way & Dana Street *(10)* $$$	• Install traffic signal at intersection (1 x $250K = $250K).	• The uncontrolled crosswalk has the potential for multiple-threat crashes. • Important intersection on campus boundary for pedestrian and bicyclist access to campus. • If bicyclists were allowed to ride northbound, it would provide a direct connection into campus from the south. • Traffic signal can force automobiles to stop and provide pedestrians and bicyclists with safer crossing opportunities.	• Traffic study may be needed to explore potential effects of signalization. • Signal timing and coordination with other signals would be important for automobile and bus traffic flow on Bancroft Ave.	• City of Berkeley Bicycle Master Plan, #13b, recommends traffic signal or stop signs at intersection. • City of Berkeley Pedestrian Master Plan, Section 6.7.3, recommends redesigning intersection for better safety. • City of Berkeley Southside Plan, Policy T-D3, recommends adding a traffic signal at Bancroft Wy. & Dana St. • City of Berkeley Bicycle Plan recommends bicycle lanes on Dana St. and a Class 2.5 bikeway on Bancroft Wy. • City of Berkeley Southside Plan identifies this as an intersection with a high pedestrian collision rate that should be addressed. • UC Berkeley and City of Berkeley Long Range Development Plan: Five Year Expenditure Plan recommends a traffic signal or stop sign at Bancroft Wy. & Dana St. • UC Berkeley Campus Bicycle Master Plan supports a signal or stop sign at the Bancroft Wy. & Dana St. intersection.
1.3. University Avenue & Shattuck Avenue *(10)* $	• Change signal timing to provide a leading pedestrian interval signal phase ($0).	• Intersection serves high volumes of pedestrians, bicyclists, and automobiles and has high numbers of reported crashes. • Leading pedestrian interval can provide pedestrians a head start to cross the street so that they are more visible to drivers making turns.	• Adding a leading pedestrian interval may increase traffic delay at intersection. However, the Downtown Area Plan Program EIR shows that the 2008 a.m. and p.m. peak hour automobile level of service for the intersection was B (minimal delays). • Additional traffic analysis will be needed.	• City of Berkeley Pedestrian Master Plan, Section 6.11, #2 recommends considering a leading pedestrian signal phase.
1.4. Oxford Street & Berkeley Way *(9)* $$$	• Install bulbouts on northwest and southwest corners to reduce pedestrian crossing distance across Oxford Street, slow turning vehicles, and improve	• Oxford Street is a difficult street for pedestrians to cross at the west edge of campus. • Improving pedestrian crossings of Oxford Street will make it	• Special design treatment may be needed for bulbouts to maintain drainage.	• UC Berkeley and City of Berkeley Long Range Development Plan: Five Year Expenditure Plan states: "Staff anticipate a potential design of Oxford/Berkeley Way bulb-out…in FY10."

	sight lines between pedestrians and drivers (2 x $50K = $100K). (E.2)	easier to walk between Downtown Berkeley and the UC Berkeley campus.		
1.5. Bancroft Way (Piedmont Avenue to Shattuck Avenue) *(8)* $$	• Install shared lane markings in right lane (0.85 x $18K = $15.3K) (short-term improvement before more formal bicycle facilities can be provided in corridor). (E.17) • Add more street trees (10 x $350 = $3.5K). • Install additional sidewalk lighting (5 x $10K = $50K).	• Bancroft Wy. is an important part of the Berkeley Bicycle Network, providing access along the south side of campus. • Wrong-way riding is common on some sections of Bancroft Wy., so arrow markings can help discourage this behavior. • Street trees can improve the visual character of Bancroft Wy. and provide shade. • Pedestrian-scale lighting can improve pedestrian security at night.	• Education may help bicyclists and drivers understand shared lane markings. • Adequate space is needed to add street trees and lighting.	• City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Bancroft Wy. between Fulton St. and Piedmont Ave. • City of Berkeley Southside Plan, Policy T-F3, recommends adding sidewalk improvements, more street trees, and sidewalk lighting to the Bancroft Wy. corridor. • UC Berkeley Landscape Master Plan recommends adding lighting and street trees to both sides of Bancroft Wy.
1.6. Bancroft Way & Fulton Street *(7)* $$	• Install stop sign to control traffic using right-turn slip lane on northeast corner of intersection (1 x $200 = $200).[a] • Install countdown signals for all crossing legs (8 x $6K = $48K).	• Many pedestrians cross the uncontrolled, right-turn slip lane at this intersection to get to and from campus. • Many automobiles and bicyclists turn right from Bancroft Wy. onto Fulton St. at high speeds without yielding to pedestrians in this crosswalk. • A stop sign would ensure that the interaction between pedestrians and approaching vehicles at the right-turn slip lane would occur at slow speeds.	• Stop sign will require a warrant before installation. • Stop sign would cause some additional delay for automobiles (including buses) and bicyclists. • UC Berkeley New Century Plan recommends removing the right-turn slip lane from the northeast corner of this intersection, so this should also be considered in the future as an alternative to improve pedestrian safety.	• City of Berkeley Pedestrian Master Plan, Section 6.11, #13 recommends considering converting the existing free right-turn lane to a stop- or signal-controlled lane and installing warning signage indicating that motorists and bicyclists should yield to pedestrians. It also recommends installing countdown signals for all crossing legs. • UC Berkeley New Century Plan, Concept F4 is to "eliminate the turn lane at the corner of Bancroft and Oxford to improve pedestrian safety and comfort."
1.7. Bancroft Way & Ellsworth Street *(7)* $	• Install stop sign on Bancroft Wy. at intersection (1 x $200 = $200).	• The uncontrolled crosswalk has the potential for multiple-threat crashes. • Intersection provides pedestrian and bicyclist access to campus.	• Traffic study may be needed to explore potential effect of stop sign control. • The UC Berkeley Long Range Development Plan Environmental Impact Report, Mitigation Measure TRA-6-g, recommends signalizing this intersection.	• City of Berkeley Southside Plan, Policy T-D3, recommends adding a stop sign at Bancroft Wy. & Ellsworth St. • City of Berkeley Southside Plan, Objective T-D is to "Calm and guide traffic throughout the Southside."
1.8. Bancroft Way &	• Remove bus stop on the north	• Important intersection on	• Removing the bus stop would	• City of Berkeley Pedestrian Master Plan,

Bowditch Street *(7)* $	side of the intersection.[a]	campus boundary for pedestrian and bicyclist access to campus. • Bowditch St. is a bicycle boulevard. • Stopped buses block sight lines between pedestrians, bicyclists, and drivers on Bancroft Wy.	require coordination with transit providers and evaluation of potential impacts on transit user access to campus, but AC Transit is already removing this stop.	Section 6.7.3, recommends redesigning intersection for better safety. • City of Berkeley Southside Plan identifies this as an intersection with a high pedestrian collision rate that should be addressed.
1.9. Hearst Avenue (LeConte Avenue to Euclid Avenue) *(6)* $$$	• Conduct feasibility study for pedestrian and bicycle facilities in corridor (short-term). The recommendations below may be modified based on the results of the feasibility study. (E.16) • Conduct feasibility study for sidewalk on south side of street (short-term). The recommendations below may be modified based on the results of the feasibility study. (E.6) • Prohibit on-street parking on south side of street.[a] • Install 6'-wide sidewalk on south side of street (north of existing curb) (4800 x $20 = $96K).* • Install climbing lane (5'-wide bicycle lane on south/uphill side of street (0.2 x $18K = $3.6K) and shared lane markings on north/downhill side of street (0.2 x $18K = $3.6K). • Install new curb and gutter on south side of street (0.15 x $160K = $24K).[a] • Install pedestrian-scale lighting (8 x $10K = $80K).[a] • Consider planting street trees (16 x $350 = $5.6K).[a]	• Only missing sidewalk section on streets adjacent to campus • Prohibitively expensive to install sidewalk on south side of existing curb (would need to remove fence, regrade hill, and relocate utility poles adjacent to President's House). • Curb-to-curb width of south side of Hearst Ave. is ~23', so removing parking is necessary to provide space for sidewalk (minimum dimensions: 5' sidewalk, 11' travel lane, 10' parking with door zone shy area). • Removing parking also makes it possible to install 5' bicycle lane on segment. • Hearst Ave. is an important part of the Berkeley Bicycle Network, providing access to the north side of campus. • Hearst Ave. has bicycle lanes west of Shattuck Ave. and bicycle lanes are recommended between Shattuck Ave. and LeConte Ave. • South side of Hearst Ave. serves uphill bicyclists, so bicycle lanes provide important separation from automobiles. • Bicycle lane can be installed as a part of sidewalk installation project. • Shared lane markings are sufficient to serve higher-speed,	• A detailed study of the Hearst Ave. corridor is underway. Therefore, the ideas in this report should be considered in that study, but ultimately that study will provide the best guidance on specific pedestrian and bicycle facility designs in this location. • Prohibiting on-street parking will require public outreach, although there is available parking in several parking structures on north side of Hearst Ave. • Existing traffic pattern provides two through-lanes from 7 a.m. to 9 a.m., but this change would keep one through-lane plus one bicycle lane for entire day. • Planting street trees may not be possible if sidewalk is 6' wide.	• City of Berkeley Pedestrian Master Plan, Section 6.11, #32 recommends sidewalk, curb and gutter, pedestrian-scale lighting, and street trees. • City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Hearst Ave. between LeConte Ave. and Gayley Rd. • UC Berkeley and City of Berkeley Long Range Development Plan: Five Year Expenditure Plan states: "Hearst Avenue east of Oxford has been identified for improvements in many University and City of Berkeley planning documents. Given continued pedestrian risk in the area, this project is a high priority for UC Berkeley." • UC Berkeley New Century Plan, Concept C3 is to "remove the parking lane to provide a generous sidewalk with a landscaped parkway and pedestrian-scale lighting" on Hearst Ave. • UC Berkeley Landscape Master Plan recommends providing a sidewalk with pedestrian lighting and undergrounding the utilities on the south side of Hearst Avenue. • UC Berkeley Landscape Master Plan recommends providing bicycle lanes where possible along Hearst Ave.

		downhill bicyclists on north side of street.		
1.10. Hearst Avenue (Euclid Avenue to Gayley Road) *(6)* $$$	• Conduct feasibility study for pedestrian and bicycle facilities in corridor (short-term). The recommendations below may be modified based on the results of the feasibility study. (E.16)[a] • Install shared lane markings on both sides of street (0.18 x 2 x $18K = $6.5K). (E.15) • Provide pedestrian-scale lighting (9 x 2 x 10K = $180K) and wayfinding signs (4 x $200 = $800).[a]	• Hearst Ave. is an important part of the Berkeley Bicycle Network, providing access to the north side of campus. • These improvements could lead to the development of a slow traffic zone in this area.	• A detailed study of the Hearst Ave. corridor is underway. Therefore, the ideas in this report should be considered in that study, but ultimately that study will provide the best guidance on specific pedestrian and bicycle facility designs in this location. • Education may help bicyclists and drivers understand shared lane markings.	• City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Hearst Ave. between LeConte Ave. and Gayley Rd. • UC Berkeley College of Engineering Streetscape and Open Space Master Plan, p. 4-2, recommends pedestrian scale lighting and wayfinding.
1.11. Bancroft Way & Barrow Lane *(5)* $	• Install high-visibility ladder markings on crosswalk across Bancroft Wy. (1 x $1.8K = $1.8K). (E.9)[a]	• Important intersection because it serves many pedestrians crossing between campus and Telegraph/Bancroft Avenue commercial district. • High-visibility markings and rapid flashing beacons can improve driver awareness of pedestrians at uncontrolled crosswalk.	• Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate.	• City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends installing ladder crosswalk markings at all uncontrolled marked crosswalk locations. • City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis. • UC Berkeley and City of Berkeley Long Range Development Plan: Five Year Expenditure Plan supports recommendation of City of Berkeley Pedestrian Master Plan to install high visibility crosswalks at Bancroft Wy. & Barrow Ln.
1.12. Hearst Avenue & Gayley Road *(5)* $$	• Install pedestrian countdown signals (8 x $6K = $48K). (E.8)[a] • Install stop signs to control traffic using right-turn slip lanes (northwest, southwest, and southeast corners) (3 x $200 = $600).	• Only signalized intersection in UC Berkeley campus area without pedestrian signal heads. • Important intersection for pedestrian movements between residential areas, parking structures, Greek Theater, and campus buildings. • Stop signs would ensure that interactions between pedestrians and approaching vehicles at this location would occur at slow speeds.	• A detailed study of the Hearst Ave. corridor is underway. Therefore, the ideas in this report should be considered in that study, but ultimately that study will provide the best guidance on specific pedestrian and bicycle facility designs in this location. • City of Berkeley Pedestrian Master Plan recommends signalization of the right-turn lanes in coordination with Lawrence Berkeley Lab expansion, so it may make the	• City of Berkeley Pedestrian Master Plan, Section 6.11, #33 recommends modifying pedestrian crossing at right turn lanes to be stop- or yield- controlled in the short term and signal-controlled after Lawrence Berkeley Lab expansion. • City of Berkeley Pedestrian Master Plan identifies this intersection as not having pedestrian signals, but no specific recommendation was made regarding pedestrian signals at this location. • UC Berkeley and City of Berkeley Long Range Development Plan: Five Year Expenditure Plan states: “Hearst Avenue east of Oxford has been

			most sense to wait for this change. • Stop sign would cause some additional delay for automobiles (including buses) and bicyclists, so traffic study may be necessary. • UC Berkeley New Century Plan recommends removing the right-turn slip lane from the southwest corner of this intersection, so this should also be considered as an alternative to improve pedestrian safety. A bicycle slip lane could be provided to maintain right-turn bicycle access.	identified for improvements in many University and City of Berkeley planning documents. Given continued pedestrian risk in the area, this project is a high priority for UC Berkeley." • UC Berkeley Landscape Master Plan recommends eliminating vehicular use of free-right turn lanes at this intersection. • UC Berkeley New Century Plan, Concept A5, is to remove the right-turn slip lane on the southwest corner of this intersection.
1.13. Durant Street midblock crossing (between Dana Street and Telegraph Avenue) *(4)* $$	• Install pedestrian warning signs with push-button-operated flashing beacons[b] (1 x $25K = $25K), advance yield markings (40 x $4 = $160), and advance warning signs (2 x $200 = $400). (E.11)[a]	• Rectangular rapid flashing beacons would enhance driver awareness of pedestrians crossing at this mid-block crosswalk.	• Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate.	• City of Berkeley Southside Plan, Policy T-C7, recommends addressing street crossing safety concerns where pedestrian passageways are located. • City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis.
1.14. Telegraph Avenue (Dwight Way to Bancroft Way) *(4)* $	• Install shared lane markings in right lane (0.25 x $18K = $4.5K). (E.14)	• Telegraph Ave. is a core commercial area in Berkeley and provides a direct connection to campus. • Many bicyclists use Telegraph Ave. despite having no designated bicycle facilities. • Shared lane markings could improve bicycle legitimacy on Telegraph Ave. and possibly help reduce sidewalk bicycling.	• Education may help bicyclists and drivers understand shared lane markings.	• City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Telegraph Ave. from Bancroft Wy to Dwight Wy.
1.15. Fulton Street (Bancroft Way to Durant Avenue) *(3)* $	• Convert right lane in southbound direction (west side) into a bicycle lane (0.06 x $18K = $1.1K).[a] • Restripe existing 25' east side into single 10' northbound travel lane, 5' bicycle lane, 2' shy distance, and 8' parking	• Fulton Street is an extension of the bikeway along the west side of campus. • Bicyclists traveling southbound from the existing bicycle lanes on Fulton St. north of Bancroft Wy. are currently pinched into a shared travel lane south of	• Restricting private automobiles to one lane in southbound direction will require a traffic study.	• City of Berkeley Bicycle Plan recommends bicycle lanes on Fulton St. between Bancroft Wy. and Dwight Wy.

	lane (0.06 x $24K = $1.4K).[a]	Bancroft. • This bikeway would facilitate access between southwest corner of campus and surrounding neighborhoods.		
1.16. Fulton Street (Durant Avenue to Dwight Way—this section is currently one-way southbound) *(3)* $	• Convert right lane in southbound direction into a bicycle lane (0.19 x $18K = $3.4K).[a]	• Fulton Street is an extension of the bikeway along the west side of campus. • This bikeway would facilitate access between southwest corner of campus and surrounding neighborhoods.	• Restricting private automobiles to one lane in southbound direction will require a traffic study.	• City of Berkeley Bicycle Plan recommends bicycle lanes on Fulton St. between Bancroft Wy. and Dwight Wy.
1.17. Channing Way midblock crossing (between Dana Street and Telegraph Avenue) *(2)* $$	• Install pedestrian warning signs with push-button-operated flashing beacons[b] (1 x $25K = $25K), advance yield markings (30 x $4 = $120), and advance warning signs (2 x $200 = $400). (E.12)[a]	• Rectangular rapid flashing beacons would enhance driver awareness of pedestrians crossing at this mid-block crosswalk.	• Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate.	• City of Berkeley Southside Plan, Policy T-C7, recommends addressing street crossing safety concerns where pedestrian passageways are located. • City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis.
1.18. Piedmont Avenue (Optometry Lane to Haste Street) *(2)* $$	• Install climbing lane on east side of street (0.13 x $18K = $2.3K). (E.20)[a] • Stripe east side of the roadway (from outside to inside) with 8' motorcycle parking area), 5' bicycle lane, and 10' lane.[a] • Install bicycle lane or shared lane markings on west side of street (0.13 x $18K = $2.3K). (E.20)[a]	• Piedmont Ave. provides north/south bicycle access on the east side of campus and connects campus with neighborhoods to the southeast. • Bicycle lanes can help keep automobiles track closer to the center median and provide designated space for bicyclists. • Bicycle lanes can also increase driver awareness so they look more often for bicyclists.	• West side of the roadway is downhill, so it is even more important for bicyclists to stay away from parked cars. Therefore, shared lane markings may be preferable to bicycle lanes on this side. • Field measurements should be taken to ensure curb-to-curb widths are consistent throughout street segment before restriping street. If width is too narrow for bicycle lanes, shared lane markings should be used. • Consider adding extended parking "T" markings to indicate the potential extent of the door zone from parked cars. This is likely to help bicyclists ride to the left side of the bicycle lane.	• City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Piedmont Ave. • UC Berkeley New Century Plan, Initiative 5.3, recommends redesigning the roadway to provide bike lanes.
1.19. Gayley Road (Hearst Avenue to Optometry	• Install shared lane markings on both sides of street (0.38 x 2 x	• Gayley Rd. provides the most direct north/south bicycle access	• Education may help bicyclists and drivers understand shared	• City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Gayley Rd.

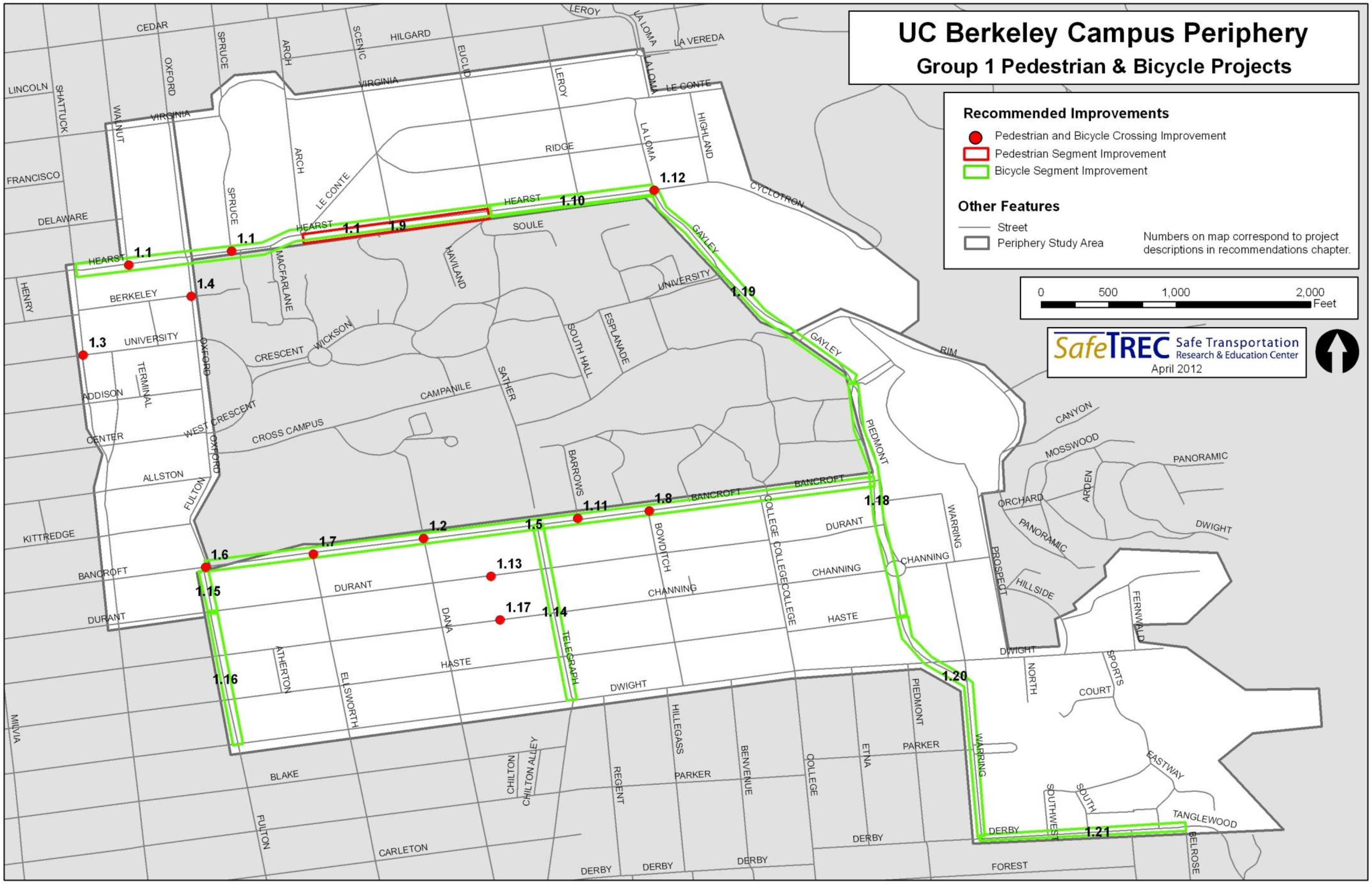
Lane) *(1)* $$	$18K = $13.7K). (E.19)	on the east side of campus.	lane markings. • If roadway is redesigned in the future, bicycle lanes should be added.	• UC Berkeley New Century Plan, Initiative 5.3 and Concept A1, recommend redesigning the roadway to provide bike lanes and extend the historic Piedmont medians north.
1.20. Warring Street/Piedmont Avenue (Haste Street to Derby Street) *(0)* $$	• Install shared lane markings on both sides of street (0.35 x 2 x $18K = $12.6K). (E.21)	• Warring St. serves the Clark Kerr campus and provides a bicycle connection to neighborhoods southeast of campus.	• Education may help bicyclists and drivers understand shared lane markings.	• City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Warring St. from Dwight Wy. to Derby St.
1.21. Derby Street (Warring Street to Belrose Avenue) *(0)* $	• Install shared lane markings on both sides of street (0.23 x 2 x $18K = $8.3K). (E.22)	• Derby St. serves the Clark Kerr campus and provides a bicycle connection to neighborhoods southeast of campus.	• Education may help bicyclists and drivers understand shared lane markings.	• City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Derby St. from Warring St. to Belrose Ave.

$$$$ Dollar signs are used in the first column to provide a rough, order-of-magnitude cost estimate for the set of recommendations in each row of the table: $$$$ = More than $1 million; $$$ = $100K to $1 million, $$ = $10K to $100K, $ = Less than $10K.

[a] This indicates that the recommendation listed in this study is supported but is more specific than the original plan language. The recommendation includes additional detail as a result of extra analysis conducted for this study, and this detail is intended to clarify and move existing recommendations forward.

[b] Push-button operated pedestrian flashing beacons could be Rectangular Rapid Flashing Beacons, Pedestrian Hybrid Beacons, or some other type of flashing device. The estimated cost is for Rectangular Rapid Flashing Beacons. Pedestrian Hybrid Beacons are likely to be more expensive ($50K or more per crosswalk).

Figure 6.2. Group 1 Pedestrian and Bicycle Infrastructure Projects



Group 2: Supported by Existing Plan, Challenging to Implement

Recommendations are supported by a City or University plan but usually involve significant public outreach and a large amount of staff time. The City and University could begin to move forward with the recommendations in this group when resources are available in the next two years.

Location **(Priority Ranking Score)**	**Recommendation** **(Cost of common project components in parentheses. Only includes hardscape costs.)**	**Justification**	**Challenges**	**Support from Existing Plan(s)**
2.1. Shattuck Avenue and Shattuck Square (University Avenue to Center Street) *(20)* $$$	• Convert Shattuck Square into a two-lane, two-direction slow street. • Add bicycle lanes on both sides of Shattuck Square (0.13 x 2 x $18K = $4.7K).[a] • Convert Shattuck Avenue into a two-lane, two-direction street.	• Shattuck Ave. is the main commercial street in Downtown Berkeley and provides access to the BART station. This street should be a place for pedestrians to stroll, socialize, and shop rather than as a major artery for through traffic. • Removing travel lanes on Shattuck Ave. will make it possible to provide bicycle facilities and reduce pedestrian crossing distance. • Lane configuration changes may also slow traffic speeds and improve pedestrian and bicyclist comfort and safety.	• Traffic impacts of reducing automobile travel lanes the street on the downtown area and surrounding neighborhoods should be studied. • Outreach to businesses on the street will be critical to explain the benefits of this change.	• City of Berkeley Downtown Area Plan, p. AC-2, recommends turning Shattuck Square into a plaza or slow street with two lanes and Shattuck Ave. into a two-way street with two lanes for through traffic. • City of Berkeley Downtown Area Plan, p. AC-8, states that the EIR has indicated that traffic lane reductions appear to be feasible on Shattuck Ave. and Shattuck Sq. between University Ave. and Allston St.
2.2. Shattuck Avenue (Allston Way to Kittredge Way and Durant Avenue to Haste Street) *(20)* $$$$	• Convert the median and existing travel lanes into a lawn with stage and restrooms. • Reconfigure parking bays to provide one lane of automobile travel and bicycle lanes in each direction.[a]	• Shattuck Ave. is the main commercial street in Downtown Berkeley and provides access to the BART station. This street should be a place for pedestrians to stroll, socialize, and shop rather than as a major artery for through traffic. • These improvements could lead to development of the Shattuck Ave. Park Blocks, which is suggested in the City of Berkeley Downtown Area Plan, p. OS-13.	• Traffic impacts of reducing automobile travel lanes the street on the downtown area and surrounding neighborhoods should be studied. • Outreach to businesses on the street will be critical to explain the benefits of this change.	• City of Berkeley Downtown Area Plan, p. OS-13 suggests developing this Park Blocks Concept

2.3. University Avenue (between Shattuck Square and Oxford Street) *(20)* $$$	• Reconfigure roadway so that there is only one travel lane in each direction plus bicycle lanes (0.09 x 2 x $18K = $3.2K). • Widen sidewalks.[a]	• University Avenue is a high-speed, high-volume arterial dividing Downtown Berkeley. • Reducing lanes would make pedestrian crossings safer. • Widening sidewalks would make street more attractive to pedestrians. • There improvements could create a University Avenue Gateway, which is suggested in the City of Berkeley Downtown Area Plan, p. OS-12.	• Widening sidewalks will require moving existing curb, which is relatively expensive. • Traffic analysis would be needed to test impact of removing travel lanes on all modes.	• City of Berkeley Downtown Area Plan, p. AC-2, recommends reducing University Ave. from 4 to 2 lanes between Shattuck Sq. and Oxford St. • City of Berkeley Downtown Area Plan, p. AC-8, states that the EIR has indicated that traffic lane reductions appear to be feasible on University Ave. between Shattuck Sq. and Oxford St.
2.4. Center Street (Shattuck Avenue to Oxford Street) *(19)* $$$	• Install shared lane markings on both sides of street (short-term) (0.10 x 2 x $18K = $3.6K). (E.13) • Close street to private through automobile traffic (allow buses, automobiles accessing Center Street parking lots, bicycles, pedestrians only) to create the Center Street Plaza. • Remove on-street parking and widen sidewalk into existing on-street parking areas.[a] • Install more bicycle parking.[a] • Plant more street trees on north side of street and improve landscaping along other sides of street.[a]	• Center Street is the direct connection between the Downtown Berkeley BART station and the west entrance to campus. • Center Street should be a welcoming place for pedestrians and bicyclists, providing opportunities for strolling, sitting, dining, and socializing. • These improvements could lead to development of the Center Street Plaza, which is suggested in the City of Berkeley Downtown Area Plan, p. OS-14.	• Education may help bicyclists and drivers understand shared lane markings. • Traffic impacts of closing the street on the Downtown area should be studied. • Outreach to businesses on the street will be critical to explain the benefits of this change. • If private automobile traffic were prohibited, Bank of America parking lot access would be eliminated. This would require agreement and compensation. However, redevelopment of the parking lot space would also enhance Center Street and Downtown Berkeley and provide an opportunity to provide green infrastructure (e.g., waterfall, water basin, raingarden, bioswale), as recommended in the City of Berkeley Downtown Area Plan, p. OS-14. • Sidewalk and landscaping improvements may be relatively expensive.	• City of Berkeley Bicycle Plan recommends a Class 2.5 bikeway on Center St. between Shattuck Ave. and Oxford St. • City of Berkeley Pedestrian Master Plan, Section 6.10.2, recommends that as the City continues to develop projects such as the Center Street Pedestrian Plaza, the city should ensure appropriate coordination among City departments and partner agencies, as well as through public outreach. • City of Berkeley Downtown Area Plan, p. AC-2, recommends closing Center St. to regular traffic between Shattuck Ave. and Oxford St. • City of Berkeley Downtown Area Plan, p. AC-8, states that the EIR has indicated that closing Center St. to regular traffic between Shattuck Ave. and Oxford St. appears to be feasible.

2.5. Shattuck Avenue & Berkeley Way *(10)* $$$	• Install bulbouts (curb extensions should extend into Shattuck Ave. on all four corners) (4 x $50K = $200K). • Install pedestrian warning signs with push-button-operated flashing beacons[b] (1 x $25K = $25K), advance yield markings (30 x $4 = $120), and advance warning signs (2 x $200 = $400) at crosswalk locations on Shattuck Ave. (E.1)[a]	• This is an important pedestrian crossing of Shattuck Avenue on the northwest side of campus. • Bulbouts will shorten the pedestrian crossing distance and improve sight lines between drivers and pedestrians waiting to cross at this uncontrolled intersection.	• Bulbouts will require four drainage inlets to be relocated. • Bulbouts should not extend into Berkeley Way because this is a major response intersection for Fire Department Number 2. • Design should be approved by Berkeley Fire Department. • Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate.	• City of Berkeley Pedestrian Master Plan, Section 6.11, #16 recommends considering constructing bulbouts on all intersection corners, and installing pedestrian warning signs. • City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis.
2.6. Bancroft Way & College Avenue *(7)* $$	• Install high-visibility ladder markings on west crosswalk across Bancroft Wy. (1 x $1.8K = $1.8K). (E.10)[a] • Install rolled curb on north (campus) side of intersection with signage or markings to indicate preferred location for bicyclists to travel.[a] • Do not change intersection from stop control to signal control.[a]	• Important intersection on campus boundary for pedestrian and bicyclist access to campus. • High-visibility markings can improve driver awareness of pedestrians at uncontrolled crosswalk. • This intersection is a major bicycle access point to and from campus. • Currently, bicyclists often compete for curb ramp space with pedestrians. • The existing curb access point is not designed for easy bicycle access and its location is not obvious to bicyclists.	• Traffic study may be needed to explore potential effect of signalization. • Design of the rolled curb should ensure that automobiles do not use this access point to drive onto campus pathways. • City of Berkeley Southside Plan, Policy T-D3, recommends adding a traffic signal at Bancroft Wy. & College Ave. However, it is not clear that signalizing this intersection would improve pedestrian and bicyclist safety. It may result in more turning conflicts and higher automobile speeds through the intersection.	• City of Berkeley Pedestrian Master Plan, Section 6.7.3, recommends redesigning intersection for better safety. • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends installing ladder crosswalk markings at all uncontrolled marked crosswalk locations. • City of Berkeley Southside Plan identifies this as an intersection with a high pedestrian collision rate that should be addressed. • UC Berkeley Campus Bicycle Plan, p. 37, recommends a rolled curb on the north side of the intersection.
2.7. Dana Street (Bancroft Way to Dwight Way—this section is currently one-way southbound) *(2)* $$$	• Reconfigure roadway as a two way street.[a] • Remove one of the two travel lanes so that the only northbound lane is a bicycle lane on the east side of the street.[a] • Install a southbound bicycle lane on the west side of the street.[a]	• Dana St. is an important Berkeley Bicycle Network connection to and from the UC Berkeley campus. • If bicyclists were allowed to ride northbound, it would provide a direct connection into campus from the south. • Bicyclists already ride northbound (wrong-way) in the existing east side bicycle lane on Dana St., so there is strong	• While the City of Berkeley Bicycle Plan recommends Class 2 bicycle lanes, the final City of Berkeley Southside Plan recommends Class 2.5 shared lane markings on Dana Street. • Dana St. is used by buses to access southbound Telegraph Ave., so improvements should maintain efficient transit service. One possible alternative would be to maintain the existing lane	• City of Berkeley Bicycle Plan recommends Class 2 bicycle lanes on Dana St. between Bancroft Wy. and Dwight Wy. • City of Berkeley Southside Plan, Policy T-C2, recommends changing Dana St. from one-way traffic to two-way traffic to improve its safety and functionality as a bike route. • City of Berkeley Southside Plan, Objective T-D is to “Calm and guide traffic throughout the Southside.” • UC Berkeley Campus Bicycle Master Plan supports a two-way street or a contraflow

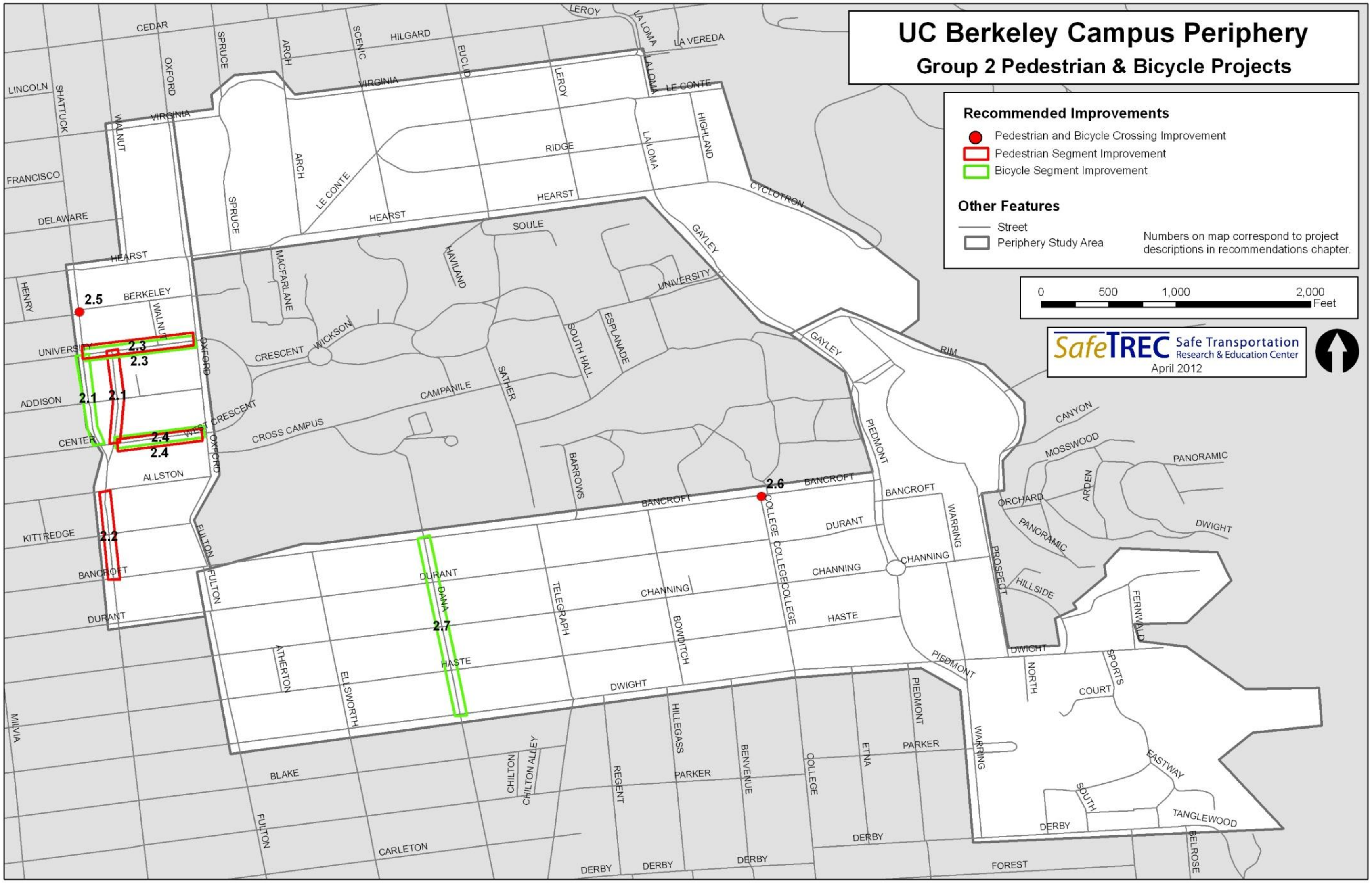
		evidence of desire for this change.	configuration, reverse the bicycle lane (make it contra-flow), and designate the right lane as bus/bike only. Shared bus/bike lane will require support from transit agencies. • Reconfiguring roadway as a two-way street will require traffic study. • Special markings, lane dividers, and signalization will be needed for bicyclists traveling in opposite direction of automobiles. • It will be important to improve bicyclist safety by signalizing (or adding a stop sign at) the crossing of Bancroft Wy.	bike lane on Dana St. (p. 37).

$$$$ Dollar signs are used in the first column to provide a rough, order-of-magnitude cost estimate for the set of recommendations in each row of the table: $$$$ = More than $1 million; $$$ = $100K to $1 million, $$ = $10K to $100K, $ = Less than $10K.

[a] This indicates that the recommendation listed in this study is supported but is more specific than the original plan language. The recommendation includes additional detail as a result of extra analysis conducted for this study, and this detail is intended to clarify and move existing recommendations forward.

[b] Push-button operated pedestrian flashing beacons could be Rectangular Rapid Flashing Beacons, Pedestrian Hybrid Beacons, or some other type of flashing device. The estimated cost is for Rectangular Rapid Flashing Beacons. Pedestrian Hybrid Beacons are likely to be more expensive ($50K or more per crosswalk).

Figure 6.3. Group 2 Pedestrian and Bicycle Infrastructure Projects



Group 3: New Suggestion, Straightforward to Implement

Recommendations may be relatively straightforward to implement but are not supported by an official plan. For signage or striping recommendations, the City and University may be able to move forward toward implementation within a year after completion of this study with little additional planning. Other recommendations in this category may involve a more formal planning process, so they could take up to five years to begin.

Location **(Priority Ranking Score)**	**Recommendation** **(Cost of common project components in parentheses. Only includes hardscape costs.)**	**Justification**	**Challenges**	**Support from Existing Plan(s)**
3.1. Bancroft Way & Dana Street *(10)* $$$	• Install bulbouts on south side of crosswalks across Bancroft Wy. (2 x $50K = $100K).	• The uncontrolled crosswalk has the potential for multiple-threat crashes. • Important intersection on campus boundary for pedestrian and bicyclist access to campus. • If bicyclists were allowed to ride northbound, it would provide a direct connection into campus from the south. • Bulbouts can shorten the crossing distance for pedestrians & bicyclists, increase pedestrian & bicyclist visibility, and potentially slow turning vehicles.	• Bulbouts should be considered at this intersection, but they should be consistent with other design changes to Bancroft Ave. and Dana St. and not impede transit service in this area. • Special design treatment may be needed for bulbouts to maintain drainage.	• City of Berkeley Pedestrian Master Plan, Section 6.7.3, recommends redesigning intersection for better safety. • City of Berkeley Southside Plan identifies this as an intersection with a high pedestrian collision rate that should be addressed. • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends considering the feasibility of installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis where appropriate.
3.2. Bancroft Way & Ellsworth Street *(7)* $$$	• Install bulbouts on south side of crosswalk across Bancroft Wy. (2 x $50K = $100K).	• The uncontrolled crosswalk has the potential for multiple-threat crashes. • Intersection provides pedestrian and bicyclist access to campus. • Bulbouts can shorten the crossing distance for pedestrians & bicyclists, increase pedestrian & bicyclist visibility, and potentially slow turning vehicles.	• Special design treatment may be needed for bulbouts to maintain drainage.	• City of Berkeley Southside Plan, Objective T-D is to "Calm and guide traffic throughout the Southside." • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends considering the feasibility of installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis where appropriate.
3.3. Bancroft Way & Bowditch Street *(7)* $$$	• Install bulbouts on south side of crosswalks across Bancroft Wy. (2 x $50K = $100K)	• Important intersection on campus boundary for pedestrian and bicyclist access to campus. • Bulbouts can shorten the crossing distance for pedestrians & bicyclists, increase pedestrian & bicyclist visibility, and potentially	• Special design treatment may be needed to maintain drainage. • Some bicyclists on east leg of intersection use curb lane to make left turn onto Bowditch St. If bulbout is added, this would require bicyclists to make turns	• City of Berkeley Pedestrian Master Plan, Section 6.7.3, recommends redesigning intersection for better safety. • City of Berkeley Southside Plan identifies this as an intersection with a high pedestrian collision rate that should be addressed.

		slow turning vehicles. • Bowditch St. is a bicycle boulevard.	from the travel lane.	
3.4. Durant Street (Shattuck Avenue to College Avenue) *(4)* $$	• Convert one lane to a bicycle-only lane (this could be either the right lane or the left lane) (0.73 x $18K = $13K).	• Durant Street serves many residences, the Telegraph Commercial District and other businesses, and provides access from Downtown Berkeley to the east side of Berkeley on the south side of campus. • Since Durant Street is an uphill grade, a designated bicycle facility can help provide a space where bicyclists can travel more slowly than automobile and bus traffic. • Since Durant Street has 3 lanes for most of this corridor, it is likely that this change would only have minor impact on traffic. • Reducing Durant Street from 3 automobile lanes to 2 may help reduce automobile speeds and shorten the distance pedestrians would need to cross automobile lanes.	• Removing a travel lane would require a traffic study. • Since Durant Street is an important bus route, bus travel times should be evaluated to ensure that there would not be significant adverse impacts on transit service. If transit service was impacted significantly, the bicycle lane could potentially be designated as a shared bus/bicycle lane. • Slow automobile speeds should be encouraged to facilitate bicyclists transitioning from one side of the street to the other (into and out of the designated facility).	• City of Berkeley Southside Plan, Policy T-C6, recommends ensuring that improved pedestrian and bicycle safety is included as a significant objective in all further studies of, and changes to, the Southside circulation pattern.
3.5. Center Street midblock crossing (between Shattuck Avenue and Oxford Street) *(4)* $$	• Install pedestrian warning signs with push-button-operated flashing beacons[b] (1 x $25K = $25K), advance yield markings (30 x $4 = $120), and advance warning signs (2 x $200 = $400) (short-term, before street is closed to thru-traffic). (E.3)	• Bulbout would improve sight lines between drivers and pedestrians and decrease the crossing distance at this mid-block crosswalk.	• Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate.	• City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis.
3.6. Durant Street midblock crossing (between Dana Street and Telegraph Avenue) *(4)* $$$	• Install bulbouts at both ends of crosswalk (2 x $50K = $100K).	• Bulbout would improve sight lines between drivers and pedestrians and decrease the crossing distance at this mid-block crosswalk.	• Bulbout design should accommodate driveway access on south side of crossing. • Special design treatment may be needed for bulbouts to maintain drainage.	• City of Berkeley Southside Plan, Policy T-C7, recommends addressing street crossing safety concerns where pedestrian passageways are located. • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends considering the feasibility of installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis where appropriate.

3.7. Channing Way & Piedmont Avenue *(4)* $$$	• Install bulbouts on all four corners of the intersection (4 x $50K = $200K). • Install a pedestrian refuge splitter island at the west side of the intersection (1 x $15K = $15K).	• Bulbouts would reduce the pedestrian crossing distance, increase pedestrian visibility, and reduce automobile turning speeds at this roundabout. • A splitter island would provide a refuge for pedestrians.	• Special design treatment may be needed for bulbouts to maintain drainage.	• City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends installing ladder crosswalk markings at all uncontrolled marked crosswalk locations. • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends considering the feasibility of installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis where appropriate.
3.8. Hearst Avenue and La Loma Avenue parking structure entrances *(3)* $	• Provide signage or other improvements to reduce the risk of pedestrian and motor vehicle conflicts at the entrances to the parking structure (4 x $200 = $800).	• Drivers turning left in and out of this parking structure are often focused on negotiating automobile traffic, so they may not see pedestrians where the entrance and exit driveways cross the sidewalk • Signage and markings at the driveway/sidewalk crossing could increase awareness.	• Restricting left turns would require signage and may require a minor traffic study. This treatment would force drivers approaching from the west to use different streets or make a U-turn before entering garage.	
3.9. Channing Way midblock crossing (between Dana Street and Telegraph Avenue) *(2)* $$	• Install bulbout on north end of crosswalk (1 x $50K = $50K).	• Bulbout would improve sight lines between drivers and pedestrians and decrease the crossing distance at this mid-block crosswalk.	• Special design treatment may be needed for bulbouts to maintain drainage.	• City of Berkeley Southside Plan, Policy T-C7, recommends addressing street crossing safety concerns where pedestrian passageways are located. • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends considering the feasibility of installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis where appropriate.
3.10. College Avenue (Bancroft Way to Dwight Way) *(1)* $	• Install shared lane markings on both sides of street (0.25 x 2 x $18K = $9K). (E.18)	• College Ave. provides a direct connection to campus from the south. It serves athletic facilities, dorms, and other housing areas. • Despite not having bicycle facilities, many bicyclists ride on College Ave. • Since many bicyclists ride to the right side of the travel lanes in the door zone of parked vehicles, shared lane markings could help increase the legitimacy of bicyclists riding in the roadway and help them move out of the door zone. They may also help reduce sidewalk bicycling.	• College Ave. is a major bus route to campus. • Education may help bicyclists and drivers understand shared lane markings.	

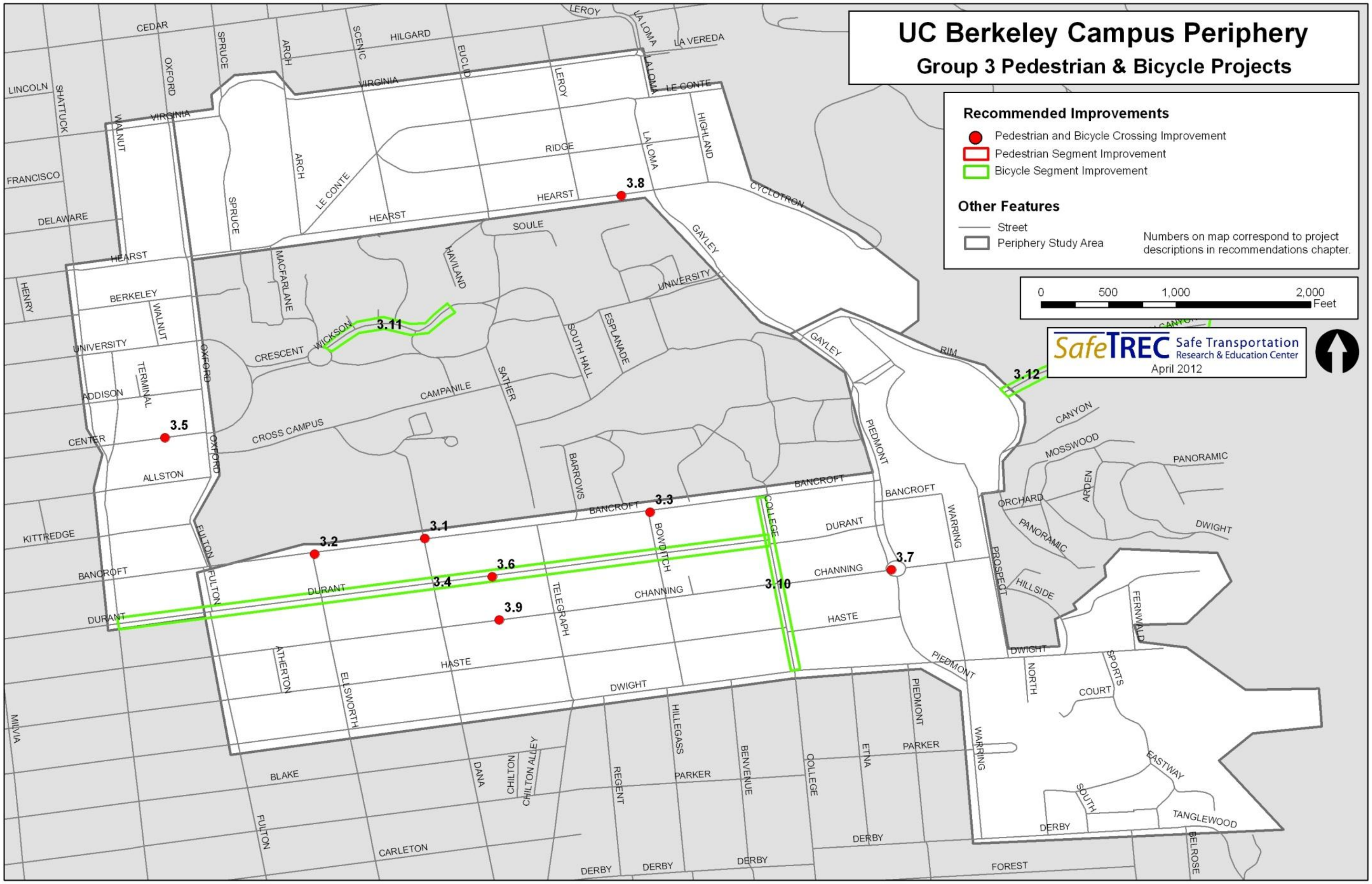
3.11. Wickson Drive (West Circle to Memorial Glade) *(0)* $	• Install bicycle warning signs along Wickson Drive (6 x $200 = $1.2K). (E.23)	• The section of Wickson Drive had a high concentration of bicycle crashes between 2000 and 2009. • The concentration of bicycle crashes may be due to bicyclists traveling at higher speeds on the downhill portions of Wickson Drive. • Pedestrian and bicycle conflicts are also likely in this area because of several pedestrian crossings and relatively short sight distances near Moffitt Library and the North Fork of Strawberry Creek. • Bicycle warning signs and other treatments may help alert bicyclists to maintain safe operating speeds.		
3.12. Centennial Drive (Stadium Rim Way to Grizzly Peak Drive) *(0)* $	• Install "Share the Roadway with Bicycles" signs and other bicycle warning signs (8 x $200 = $1.6K). (E.24) • Install shared lane pavement markings (1.1 x $18K = $20K). • Provide wider paved shoulders (where possible). • Institute targeted automobile speed enforcement on this roadway.	• Centennial Drive is a popular bicycle route between the main campus area and Grizzly Peak Drive. • This roadway experienced eight reported bicyclist crashes between 2000 and 2009. Three of these crashes were adjacent to the UC Berkeley Botanical Gardens.	• The roadway is relatively narrow with little additional space for shoulders. • Roadway curves create limited sight lines between bicyclists and motorists, which underscores the importance of safety treatments.	• City of Berkeley Bicycle Plan recommends Centennial Drive as a signed bicycle route.
3.13. Hearst Avenue & mid-block crossing between Euclid Avenue and Leroy Avenue *(0)* $	• Do not change crossing (Do not mark or signalize mid-block crossing) ($0).	• Pedestrians should be encouraged to cross Hearst Ave. at Euclid St. or Leroy St. • Additional traffic study would be needed to evaluate potential impact of a signal at this crossing. • Special design treatment may be needed for bulbouts to maintain drainage.	• A detailed study of the Hearst Ave. corridor is underway. Therefore, the ideas in this report should be considered in that study, but ultimately that study will provide the best guidance on specific pedestrian and bicycle facility designs in this location.	• UC Berkeley College of Engineering Streetscape and Open Space Master Plan, p. 4-10 recommends signalizing this crossing and providing bulbouts. • UC Berkeley Landscape Master Plan recommends pedestrian improvements at this location.
3.14. Durant Avenue & Piedmont Avenue *(0)* $	• Do not make changes at intersection (do not convert all-way stop to traffic signal) ($0).	• Traffic study would be needed to explore potential effect of signalization. • Traffic signal should only be installed when warranted. • A traffic signal does not have clear benefits for pedestrian or bicyclist	• Drivers turning from Durant Ave. onto Piedmont Ave. sometimes have conflicts with pedestrians traveling along the west side of Piedmont Ave.	• UC Berkeley Long Range Development Plan Environmental Impact Report, Mitigation Measure TRA-6-b, recommends installing a signal at this intersection when warranted.

		safety because it is likely to result in higher traffic speeds and volumes in this pedestrian-oriented area. In addition to the standard traffic signal warrant analysis, safety benefits of signalization should be clearly demonstrated before intersection is signalized.		
3.15. Bancroft Way & Piedmont Avenue *(0)* $	• Do not make changes at intersection (do not convert all-way stop to traffic signal) ($0).	• Traffic study would be needed to explore potential effect of signalization. • Traffic signal should only be installed when warranted. • The UC Berkeley Long Range Development Plan Environmental Impact Report recommends a signal in this location to reduce automobile delay at the intersection. However, this purpose does not have clear benefits for pedestrian or bicyclist safety because it is likely to result in higher traffic speeds and volumes in this pedestrian-oriented area. In addition to the standard traffic signal warrant analysis, safety benefits of signalization should be clearly demonstrated before intersection is signalized.	• Drivers turning from Piedmont Ave. onto Bancroft Wy. sometimes have conflicts with pedestrians crossing this intersection.	• UC Berkeley Long Range Development Plan Environmental Impact Report, Mitigation Measure TRA-7, recommends installing a signal at this intersection when warranted.

$$$$ Dollar signs are used in the first column to provide a rough, order-of-magnitude cost estimate for the set of recommendations in each row of the table: $$$$ = More than $1 million; $$$ = $100K to $1 million, $$ = $10K to $100K, $ = Less than $10K.

[b] Push-button operated pedestrian flashing beacons could be Rectangular Rapid Flashing Beacons, Pedestrian Hybrid Beacons, or some other type of flashing device. The estimated cost is for Rectangular Rapid Flashing Beacons. Pedestrian Hybrid Beacons are likely to be more expensive ($50K or more per crosswalk).

Figure 6.4. Group 3 Pedestrian and Bicycle Infrastructure Projects



Group 4: New Suggestion, Challenging to Implement

Ideas that could be considered by the City and University in future planning processes.

Location (Priority Ranking Score)	Recommendation (Cost of common project components in parentheses. Only includes hardscape costs.)	Justification	Challenges	Support from Existing Plan(s)
4.1. Oxford Street & Addison Street *(15)* $$$	• Install traffic signal (1 x $250K = $250K) at intersection of Oxford St. & Addison St. Alternatively, install push-button-operated flashing beacons[b] (1 x $25K = $25K), advance yield markings (30 x $4 = $120), and advance warning signs (2 x $200 = $400) across Oxford St. at Addison St.	• Oxford Street is a difficult street for pedestrians to cross at the west edge of campus. • Improving pedestrian crossings of Oxford Street will make it easier to walk and bicycle between Downtown Berkeley and the UC Berkeley campus.	• Additional traffic study will be needed to evaluate potential impact of a signal at this intersection. • Traffic signal should only be installed when warranted. • Until a signal is warranted, pedestrian warning signs with push-button-operated rectangular rapid flashing beacons could be installed. • Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate. • It will be important to study the impact of pedestrian rapid flashing beacons or other crosswalk enhancements on the safety of other crosswalks in the Oxford Street corridor that do not receive enhancements.	• City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis. • UC Berkeley and City of Berkeley Long Range Development Plan: Five Year Expenditure Plan states: "Improvements to the pedestrian crossing of Oxford at Addison (possibly including pedestrian beacons or in-road crosswalk lights) is planned…in FY10." • UC Berkeley Long Range Development Plan Environmental Impact Report, Mitigation Measure TRA-6-d, recommends installing a signal at this intersection when warranted. • UC Berkeley Campus Bicycle Master Plan supports a traffic signal at the intersection of Oxford St. & Addison St.
4.2. Oxford Street & Allston Way *(15)* $$$	• Install traffic signal (1 x $250K = $250K) at intersection of Oxford St. & Allston Wy. Alternatively, install push-button-operated flashing beacons[b] (1 x $25K = $25K), advance yield markings (30 x $4 = $120), and advance warning signs (2 x $200 = $400) across Oxford St. at	• Oxford Street is a difficult street for pedestrians to cross at the west edge of campus. • Improving pedestrian crossings of Oxford Street will make it easier to walk and bicycle between Downtown Berkeley and the UC Berkeley campus.	• Additional traffic study will be needed to evaluate potential impact of a signal at this intersection. • Traffic signal should only be installed when warranted. • Until a signal is warranted, pedestrian warning signs with push-button-operated rectangular rapid flashing beacons could be	• City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis. • UC Berkeley Long Range Development Plan Environmental Impact Report, Mitigation Measure TRA-6-e, recommends installing a signal at this intersection when warranted.

	Allston Wy.		installed. • Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate. • It will be important to study the impact of pedestrian rapid flashing beacons or other crosswalk enhancements on the safety of other crosswalks in the Oxford Street corridor that do not receive enhancements.	• UC Berkeley Campus Bicycle Master Plan supports a traffic signal at the intersection of Oxford St. & Allston Wy.
4.3. Hearst Avenue (Euclid Avenue to Gayley Road) *(11)* $$$	• Create a slow traffic zone using treatments such as colored pavement, curb extensions, street trees, street furniture, raised crosswalks and other physical design features (see Figure 6.6). • Use similar slow zone treatments on Ridge Rd. and LeConte Ave. to prevent vehicular traffic from diverting from Hearst Ave. to residential streets.	• High volumes of pedestrians already cross this corridor. • Ideally, vehicles would travel a maximum of 15 miles per hour, which would create a pedestrian-friendly extension of the campus environment. • Slower vehicle speeds lead to less severe pedestrian and bicyclist injuries if collisions occur. • This slow-zone could establish a model for other streets on the boundary of campus	• A detailed study of the Hearst Ave. corridor is underway. Therefore, the ideas in this report should be considered in that study, but ultimately that study will provide the best guidance on specific pedestrian and bicycle facility designs in this location. • A slow zone may reduce bus travel times slightly. • Truck access along Hearst Avenue should be maintained, so physical changes should slow but not inhibit truck movement. • A slow zone on Hearst Avenue could shift automobile traffic to parallel streets (Ridge Rd. and LeConte Ave.), so it would be important to provide similar treatments on these streets.	• UC Berkeley College of Engineering Streetscape and Open Space Master Plan, p. 4-2, recommends pedestrian scale lighting and wayfinding in this area. • UC Berkeley Landscape Master Plan recommends pedestrian improvements near the Hearst Ave. & Leroy Ave. intersection.
4.4. Fulton Street & Kittredge St. *(9)* $$$	• Install traffic signal (1 x $250K = $250K) at intersection of Oxford St. & Kittredge St. Alternatively, install push-button-operated flashing beacons[b] (1 x $25K = $25K), advance yield markings (30 x $4 = $120), and advance	• Oxford Street is a difficult street for pedestrians to cross at the west edge of campus. • Improving pedestrian crossings of Oxford Street will make it easier to walk and bicycle between Downtown Berkeley and the UC Berkeley campus.	• Additional traffic study will be needed to evaluate potential impact of a signal at this intersection. • Traffic signal should only be installed when warranted. • Until a signal is warranted, pedestrian warning signs with	• City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing beacons as one type of crosswalk enhancement to consider on a case-by-case basis. • UC Berkeley Long Range Development Plan Environmental Impact Report, Mitigation

	warning signs (2 x $200 = $400) across Oxford St. at Kittredge St.		push-button-operated rectangular rapid flashing beacons could be installed. • Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate. • It will be important to study the impact of pedestrian rapid flashing beacons or other crosswalk enhancements on the safety of other crosswalks in the Oxford Street corridor that do not receive enhancements.	Measure TRA-6-f, recommends installing a signal at this intersection when warranted. • UC Berkeley Campus Bicycle Master Plan supports a traffic signal at the intersection of Oxford St. & Kittredge St.
4.5. Bancroft Way & College Avenue *(7)* $$$	• Install bulbouts on south side of crosswalks across Bancroft Wy. (2 x $50K = $100K).	• Important intersection on campus boundary for pedestrian and bicyclist access to campus. • Bulbouts can shorten the crossing distance for pedestrians & bicyclists, increase pedestrian & bicyclist visibility, and potentially slow turning vehicles. • This intersection is a major bicycle access point to and from campus.	• Special design treatment may be needed for bulbouts to maintain drainage. • Design of the rolled curb should ensure that automobiles do not use this access point to drive onto campus pathways.	• City of Berkeley Pedestrian Master Plan, Section 6.7.3, recommends redesigning intersection for better safety. • City of Berkeley Southside Plan identifies this as an intersection with a high pedestrian collision rate that should be addressed. • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends considering the feasibility of installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis where appropriate.
4.6. Hearst Avenue & Leroy Avenue *(5)* $$$	• Install bulbouts into Hearst Ave. on both ends of both crosswalks (4 x $50K = $200K). • Mark west crossing with high-visibility crosswalk (1 x $1.8K = $1.8K). • Install push-button-operated flashing beacons[b] (1 x $25K = $25K), advance yield pavement markings (40 x $4 = $160), and pedestrian crossing warning signs (2 x $200). (E.7)	• This is an important pedestrian crossing to and from the northeast side of campus. • The crossing is currently marked but is not controlled. • These improvements could lead to the development of a slow traffic zone in this area.	• A detailed study of the Hearst Ave. corridor is underway. Therefore, the ideas in this report should be considered in that study, but ultimately that study will provide the best guidance on specific pedestrian and bicycle facility designs in this location. • Additional traffic study will be needed to evaluate potential impact of a signal at this intersection. • As an interim improvement, pedestrian warning signs with push-button-operated rectangular	• UC Berkeley College of Engineering Streetscape and Open Space Master Plan, p. 4-10 recommends signalizing this intersection and providing bulbouts. • UC Berkeley Landscape Master Plan recommends pedestrian improvements at this location. • City of Berkeley Pedestrian Master Plan, Section 6.4.1, recommends considering the feasibility of installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis where appropriate. • City of Berkeley Pedestrian Master Plan, Appendix B: Design Guidelines, Section 5.14, recommends pedestrian flashing

			rapid flashing beacons could be installed. • Pedestrian flashing beacons are listed seventh in the hierarchy of treatments in the City of Berkeley Pedestrian Master Plan Design Guidelines. They should be considered when other treatments do not appear to be adequate. • Special design treatment may be needed for bulbouts to maintain drainage.	beacons as one type of crosswalk enhancement to consider on a case-by-case basis.
4.7. Oxford Street (Hearst Avenue to Allston Way) *(5)* $$$	• Remove on-street automobile parking from east side of Oxford St. • Remove left-turn lane from northbound Oxford St. to Center St. when Center St. is closed to through automobiles. • Convert parking area to a 10' two-way bicycle facility separated from adjacent travel lane with a 42" high barrier (base of barrier would be approximately 2' wide). Facility design standards may change in the future to allow more flexibility for the design of this type of bikeway). • Add traffic control to intersections of Oxford St. & Addison St. and Oxford St. & Allston Wy. • Add bicycle traffic signals and a bicycle-only phase to allow bicyclists to travel between the west leg of the intersection of Oxford St. & Hearst Ave. and the bicycle facility entrance on the east side of the south leg.	• Oxford St. provides bicycle access along the west side of campus. • A two-way bicycle facility is likely to provide a more comfortable bicycling experience and attract more bicyclists than the existing bicycle lanes. • The UC Berkeley campus attracts more bicycle activity than any other location in the East Bay. A two-way bicycle facility would be a signature feature on the campus periphery that would highlight the importance of bicycling in the City of Berkeley and near the UC Berkeley campus. • Currently, parked cars open their doors into a portion of the existing bicycle lanes. Providing a different type of bicycle accommodation on this street corridor may reduce the risk of bicycle crashes.	• Removing automobile parking spaces will require campus and community input. • The bicycle lanes recommended for this street in City of Berkeley Bicycle Plan have already been implemented, so this change would require additional outreach. • Lane shift in northbound lanes near Oxford St. & Center St. will require design study. Lane shift is necessary to implement this bicycle facility because the curb on the east side of Oxford St. south of the west entrance to campus at Center St. is approximately 3' further to the west (narrowing the available space for the bicycle facility). Lane shift could be avoided by removing one of the northbound travel lanes in the corridor (in addition to parking), which would likely have significant impacts on automobile traffic. • Adding two new directions of traffic adjacent to campus means that all pedestrian crossings across Oxford St. to and from campus will involve looking for	

			southbound automobile traffic, northbound automobile traffic, southbound bicycle traffic, and northbound bicycle traffic separately. Therefore, traffic signals will be important for reducing the difficulty of pedestrian crossings. It is unlikely that other types of warning signs or stop signs will provide adequate control to reduce the risk of multiple-threat crashes. • Traffic study would be needed to explore potential effect of signalization.	
4.8. Fulton Street (Allston Way to Bancroft Way) *(5)* $$$	• Remove on-street automobile parking and motorcycle parking from east side of Fulton St. • Convert parking area to a 10' two-way bicycle facility separated from adjacent travel lane with a 42" high barrier (base of barrier would be approximately 2' wide). Facility design standards may change in the future to allow more flexibility for the design of this type of bikeway). • Add traffic control to intersection of Fulton St. & Kittredge St. • Convert right-turn slip lane on northeast corner to a bicycle-only turn lane. This should be designed with flexibility to potentially convert it to a two-way bicycle facility in the future.	• Fulton St. provides bicycle access along the west side of campus. • A two-way bicycle facility is likely to provide a more comfortable bicycling experience and attract more bicyclists than the existing bicycle lanes. • The UC Berkeley campus attracts more bicycle activity than any other location in the East Bay. A two-way bicycle facility would be a signature feature on the campus periphery that would highlight the importance of bicycling in the City of Berkeley and near the UC Berkeley campus. • Currently, parked cars open their doors into a portion of the existing bicycle lanes. Providing a different type of bicycle accommodation on this street corridor may reduce the risk of bicycle crashes. • The signalized intersection of Fulton St. & Bancroft Wy. could provide a connection between the proposed facility and another proposed two-way bicycle facility on the north side of Bancroft Wy.	• Removing automobile parking spaces will require campus and community input. • The bicycle lanes recommended for this street in City of Berkeley Bicycle Plan have already been implemented, so this change would require additional outreach. • Adding two new directions of traffic adjacent to campus means that all pedestrian crossings across Oxford St. to and from campus will involve looking for southbound automobile traffic, northbound automobile traffic, southbound bicycle traffic, and northbound bicycle traffic separately. Therefore, traffic signals will be important for reducing the difficulty of pedestrian crossings. It is unlikely that other types of warning signs or stop signs will provide adequate control to reduce the risk of multiple-threat crashes. • Traffic study would be needed to	

			explore potential effect of signalization.	
4.9. Bancroft Way (Telegraph Avenue to Barrow Lane) *(3)* $$	• Install a two-way bicycle facility on the north side of Bancroft Way between Telegraph Avenue and Barrow Lane. • Remove one of the travel lanes, and move the tour bus stopping area into that lane. • Create a cross-section that is (from south to north) 8' on-street parking, 10' lane, 11' lane, 12' parking area, 6' buffer with bollards, 12' two-way bicycle facility (cross section applies to part of segment with tour bus stopping area; narrower section would not include the 12' parking area).	• The two-way bicycle facility would connect the Telegraph Avenue with campus, providing an important south side access point. • Many bicyclists currently ride eastbound on the sidewalk of Bancroft Wy., creating conflicts with pedestrians. • Many bicyclists currently ride eastbound in the Bancroft Wy. travel lanes, creating conflicts with automobiles. • This project can be done as a part of comprehensive bicycle improvements to Bancroft Way.	• Moving the tour bus stopping area into an existing travel lane would require coordination UC Berkeley. • Special consideration will need to be given to safe pedestrian crossings of the two-way bicycle facility (especially for tour bus passengers). • Transitions on both ends of the bicycle facility will require careful design since curb-to-curb width narrows to 50' at these locations. • Intersection of Bancroft Wy. & Barrows Ln. will likely require enforcement for bicyclists entering the cycle track and crossing the pedestrian crosswalk (e.g., to obey the existing stop sign). • It would be essential to address intersection and pedestrian crossing safety issues caused by bicyclists traveling at high speeds in the downhill direction on a designated bicycle facility.	
4.10. Bancroft Way (Fulton St. to Dana St.—this section is currently one-way westbound) (Alternative 1) *(3)* $$	• Maintain one-way automobile traffic. • Change lane widths slightly so that cross section (from south to north) is 8' parking, 10' lane, 10' lane, 13' lane, 8' parking. • Mark the right (13') lane as bus/bike only. Allow right-turns from this lane near the intersection of Bancroft Wy. & Fulton St. • Add shared lane markings to bus/bike lane. • Install bulbouts at Bancroft Wy. & Ellsworth St.	• Bancroft Wy. provides bicycle access along south side of campus. • Bus/bike only lane could be implemented at low cost. • This section of bus/bike only lane could represent the initial phase of a bus/bike lane along Bancroft Wy. between Fulton St. and Piedmont Ave. • This bus/bike only lane could be paired with a bus/bike only lane or other facility on Durant Ave.	• Restricting private automobiles to two lanes will require a traffic study. • This alternative would not provide bicycle access eastbound on Bancroft Wy., so many bicyclists may still bicycle on sidewalks. • Shared bus/bike lane will require support from transit agencies. • Shared bus/bike lane could slow bus speeds. However, bicyclists would be traveling relatively fast because of downhill grade. • Shared bus/bike lane could be	

			uncomfortable for some bicyclists, especially less-experienced riders. • This alternative could be modified to designate the right lane as bicycle only. This would require buses to cross over bicycle lane to make stops. • It would be essential to address intersection and pedestrian crossing safety issues caused by bicyclists traveling at high speeds in the downhill direction on a designated bicycle facility.	
4.10. Bancroft Way (Fulton St. to Dana St.—this section is currently one-way westbound) (Alternative 2) *(3)* $$$	• Maintain one-way automobile traffic. • Remove one automobile travel lane. • Add two-way bicycle facility adjacent to north curb. • Change lane widths so that cross section (from south to north) is 8’ parking, 10’ lane, 10’ lane, 8’ parking, 3’ buffer with bollards, 10’ two-way bicycle facility. • Reconstruct right-turn lane and right-turn island at intersection of Bancroft Wy. & Fulton St. to provide transition to and from west end of bicycle facility. • Construct transition from bicycle facility to campus bicycle route and southbound bikeway on Dana St. at intersection of Bancroft Wy. & Fulton St. • Construct bus stop islands at all bus stops on south side of bicycle facility. • Construct bulbouts on south end of crosswalk and pedestrian refuge island adjacent to bicycle facility at Bancroft Wy.	• Bancroft Wy. provides bicycle access along south side of campus. • Bicycle facility would provide bicycle access eastbound on Bancroft Wy., which would improve conditions for many bicyclists who bicycle the wrong way on Bancroft Wy. or on the sidewalks. • Reducing automobile lanes from 3 to 2 would likely slow automobile speeds and make it easier for pedestrians to cross Bancroft Wy. • This section of bicycle facility could represent the initial phase of a bicycle facility along Bancroft Wy. between Fulton St. and Piedmont Ave. • This bicycle facility could be paired with another facility on Durant Ave.	• Restricting private automobiles to two lanes will require a traffic study. • Bicycle facility would create potential conflicts between bicyclists and pedestrians accessing campus from bus stops and parked cars. Clearly-marked pedestrian crossing areas and warning signs would be especially important for bicyclists traveling at higher speeds in downhill direction. Stop signs may be needed to control bicycle movements at pedestrian crossings. • The driveway crossing on the north side of the Bancroft Wy. & Ellsworth St. intersection represents a potential bicycle/automobile conflict point. Enhanced crossing design (such as green paint) would be needed to emphasize the bicycle facility right-of-way priority over automobiles entering/exiting garage. • Geometric changes, including bus stop islands, pedestrian refuge islands, and cycle track	

	& Ellsworth St. • Mark clear pedestrian crossing zones across bicycle facility at all pedestrian crossings and bus stop locations.		transition areas would be relatively expensive. • It would be essential to address intersection and pedestrian crossing safety issues caused by bicyclists traveling at high speeds in the downhill direction on a designated bicycle facility.	
4.10. Bancroft Way (Fulton St. to Dana St.—this section is currently one-way westbound) (Alternative 3) *(3)* $$$	• Maintain one-way automobile traffic. • Remove one automobile travel lane. • Add a one-way contra-flow (eastbound) bicycle facility adjacent to south curb. • Change lane widths so that cross section (from south to north) is 5' one-way contra-flow bicycle facility, 3' buffer with bollards, 8' parking, 10' lane, 15' bus/bike lane, 8' parking. • Mark the right (15') lane as bus/bike only. Allow right-turns from this lane near the intersection of Bancroft Wy. & Fulton St. • Add shared lane markings to bus/bike lane. • Construct transition from contra-flow bicycle facility to campus bicycle route and southbound bikeway on Dana St. at intersection of Bancroft Wy. & Fulton St. • Construct pedestrian refuge island adjacent to bicycle facility at Bancroft Wy. & Ellsworth St. • Mark clear pedestrian crossing zones across bicycle facility at all pedestrian crossings.	• Bancroft Wy. provides bicycle access along south side of campus. • One-way bicycle facility would provide bicycle access eastbound on Bancroft Wy., which would improve conditions for many bicyclists who bicycle the wrong way on Bancroft Wy. or on the sidewalks. • Shared bus/bike lane would provide space to facilitate transit and bicycle movement in the corridor. • Reducing automobile lanes from 3 to 2 would likely slow automobile speeds and make it easier for pedestrians to cross Bancroft Wy. • This section of bicycle facility could represent the initial phase of a bicycle facility along Bancroft Wy. between Fulton St. and Telegraph Ave. • This bicycle facility could be paired with a bicycle facility on Durant Ave.	• Restricting private automobiles to two lanes will require a traffic study. • Bicycle facility would create potential conflicts between bicyclists and pedestrians accessing the Tang Center and other activities on the south side of Bancroft Wy. from bus stops and parked cars. However, bicyclists would be traveling relatively slowly because of the uphill grade. Clearly-marked pedestrian crossing areas would still be important. • Several minor driveway crossings on the south side of Bancroft Wy. and the minor intersection of Bancroft Wy. & Ellsworth St. represent a potential bicycle/automobile conflict points. Enhanced crossing design (such as green paint) would be needed to emphasize the bicycle facility right-of-way priority over automobiles entering/exiting. • The transitions at each end of the bicycle facility would require signage, but the design would be less expensive than for the two-way bicycle facility option. • Shared bus/bike lane could slow bus speeds. However, bicyclists would be traveling relatively fast because of downhill grade.	

4.10. Bancroft Way (Fulton St. to Dana St.—this section is currently one-way westbound) (Alternative 4) *(3)* $$$	• Remove one automobile travel lane and all on-street parking. • Designate street as bus, bicycle, and local traffic only. • Convert the street to two-way flow (one lane in each direction). • Add median with pedestrian cut-throughs at crosswalk locations. • Add bicycle lanes on both sides of street. • Change lane widths so that cross section (from south to north) is 6' bicycle lane, 2' buffer with bollards, 11' bus lane, 11' median, 11' bus lane, 2' buffer with bollards, 6' bicycle lane. • Close Bancroft Ave. east of Dana St. and make Durant St. two-way. Re-route traffic on new two-way Dana St. or Dana St./Ellsworth St. pair.	• Bancroft Wy. provides bicycle access along south side of campus. • Designated bus lanes would facilitate transit movement and potentially Bus Rapid Transit in the corridor. • Reducing automobile lanes and adding a median would make it easier for pedestrians to cross Bancroft Wy.	• Removing private automobile access from Bancroft Wy. will divert traffic to other streets so this improvement would need to be part of a much larger circulation plan. This plan would require a traffic study • Removing on-street parking will require significant public outreach. • Private vehicle access should be maintained to driveways. • It would be essential to address intersection and pedestrian crossing safety issues caused by bicyclists traveling at high speeds in the downhill direction on a designated bicycle facility.	
4.11. Bancroft Way (Bowditch Street to path between Hearst Memorial Gymnasium and Hearst Tennis Courts) *(3)* $$$	• Remove approximately 9 on-street parking spaces on north side of street. • Install a two-way cycle track for one-half block on Bancroft Way. • Move existing retaining wall and sidewalk 3' north and change cross-section (from south to north) to 10' sidewalk, 8' on-street parking, 10' lane, 10' lane, 5' buffer with bollards, 10' two-way cycle track (at street level), and 10' sidewalk. (Alternatively, use a 42" barrier to separate the 10' bicycle facility from adjacent traffic and leave the existing sidewalk and retaining wall in place.)	• The two-way bicycle facility would connect the Bowditch Street Bicycle Boulevard with campus, providing an important south side access point. • Many bicyclists currently ride eastbound on the sidewalk of Bancroft Wy., creating conflicts with pedestrians. • This project can be done as a part of comprehensive bicycle improvements to Bancroft Way.	• Removing 9 street parking spaces will require public outreach and coordination with general parking policies of City of Berkeley and UC Berkeley. • Transitions on either end of the cycle track (at intersection of Bancroft Wy. & Bowditch St. and path between gym and tennis courts will require careful design, which may be expensive. • Intersection of Bancroft Wy. & Bowditch St. has bus stop on north side, so this would need to be removed or accommodated in cycle track transition area. • City of Berkeley and UC Berkeley would need to coordinate closely because the project would involve changes at	• City of Berkeley Southside Plan, Objective T-C1, recommends encouraging UC Berkeley to improve north-south and east-west bicycle routes through campus that connect to the bicycle routes on Bowditch Street and Dana Street.

	• Install shared lane markings on path between Hearst Memorial Gymnasium and Hearst Tennis Courts (0.11 x 2 x $18K = $4.0K). • Install pedestrian warning signs and mark sidewalk crossing zone where sidewalk on north side of Bancroft Wy. intersects the bicycle facility.		edge of both jurisdictions. • An alternative to this design would be to install the contra-flow (eastbound) bicycle lane between the south curb and parked cars and then provide an enhanced mid-block crossing across Bancroft at the entrance point to the path between the gym and tennis courts. Cross section (from south to north) would be 5' contra-flow cycle track, 3' buffer with bollards, 8' parking, 9' lane, 10' lane, 5' bicycle lane. • It would be essential to address intersection and pedestrian crossing safety issues caused by bicyclists traveling at high speeds in the downhill direction on a designated bicycle facility.	
4.12. Gayley Road at East Gate *(2)* $	• Install stop signs to control right-turn slip lanes at intersection (2 x $200 = $400)	• East Gate is an important campus access point, and many pedestrians cross this intersection as they travel along Gayley Road. • Stop signs will force vehicle drivers to yield to pedestrians crossing the slip lanes.	• A traffic analysis may be needed to determine the impact of these changes on automobile travel. However, if automobile access onto campus is limited, these traffic impacts are likely to be minimal.	• UC Berkeley New Century Plan, Concept A2, is to remove turn lanes and redesign East Gate to improve pedestrian safety and visual image. • UC Berkeley Landscape Master Plan recommends redesigning East Gate to improve pedestrian safety.
4.13. Ellsworth Street (Dwight Way to Bancroft Way—this section is currently one-way northbound) *(0)* $$	• Convert street from one-way to two-way. • Install shared lane markings on both sides of the street.	• Ellsworth St. provides bicycle access to the UC Berkeley campus, but does not facilitate bicycle travel away from campus. • Allowing two-way travel on the street will make it possible for bicyclists to travel away from campus. • Ellsworth St. currently has no bicycle facilities. • Automobile traffic on Ellsworth St. is light (<5,000 ADT) and backups are uncommon. Serving automobile traffic with one lane in each direction could slow automobile traffic.	• Conversion to a two-way street would require a traffic study and would make pedestrian crossings more complex. • Education may help bicyclists and drivers understand shared lane markings. • An alternative to shared lane markings would be to keep the one-way configuration and convert the right lane on Ellsworth St. to a bicycle lane. This new northbound bicycle lane could facilitate some southbound (wrong-way) bicycling. This is unlikely since	• City of Berkeley Southside Plan, Objective T-D is to "Calm and guide traffic throughout the Southside." • City of Berkeley Southside Plan, Policy T-D1, recommends converting Dana Street and Ellsworth Street to two-way traffic to calm traffic on these streets and allow for less circuitous travel through the area.

			southbound bicyclists would likely use Dana St. or Fulton St.	
4.14. Telegraph Avenue & Dwight Way *(0)* $$$	• Install bulbouts on both sides of crosswalks across Dwight Wy. (4 x $50K = $200K).	• Important intersection because it serves many pedestrians, bicyclists, and turning automobiles. • Bulbouts can shorten the crossing distance for pedestrians & bicyclists, increase pedestrian & bicyclist visibility, and potentially slow turning vehicles.	• Special design treatment may be needed to maintain drainage.	• City of Berkeley Pedestrian Master Plan, Section 6.7.3, recommends redesigning intersection for better safety. • The City of Berkeley Southside Plan, Policy T-C5, recommends developing and implementing intersection improvements for major pedestrian intersections such as Telegraph Ave. & Dwight Wy.
4.15. Warring Street & Derby Street *(0)* $$$	• Install traffic signal (1 x $250K = $250K) and redesign intersection to remove exclusive right-turn lane on the northeast corner.	• Drivers turning between Warring St. on the north side of the intersection and Derby St. on the east side of the intersection may have conflicts with pedestrians crossing the north and east crosswalks as well as the crosswalk across the right-turn lane.	• Traffic study would be needed to explore potential effect of signalization. This traffic study should also evaluate the impact of redesigning the intersection without the right-turn lane on the northeast corner. • Traffic signal should only be installed when warranted. • In addition to the standard traffic signal warrant analysis, safety benefits of signalization should be clearly demonstrated before intersection is signalized. • The UC Berkeley Long Range Development Plan Environmental Impact Report also recommends providing an exclusive right-turn lane on the east leg of this intersection, but this measure could increase automobile speeds, decrease drivers' awareness of pedestrians, and reduce pedestrian safety.	• UC Berkeley Long Range Development Plan Environmental Impact Report, Mitigation Measure TRA-6-c, recommends installing a signal at this intersection when warranted.
4.16. Stadium Rim Way (Gayley Road to Prospect Street) *(0)* $$$	• Construct sidewalks on the west side of Stadium Rim Way (unknown cost).	• Stadium Rim Way serves many pedestrians running for exercise, accessing athletic activities, and traveling to the Strawberry Canyon trail. It also serves motor vehicles and bicyclists traveling to the Lawrence Berkeley Lab facilities and Grizzly Peak Drive. • The only space for pedestrians on	• The existing roadway is relatively narrow due to Memorial Stadium to the west and hills to the east. Therefore, it may be most cost-effective to install the sidewalk when the roadway is reconstructed.	

		most of Stadium Rim Way is designated by bollards on the west side of the street. Pedestrians passing each other must often walk in the automobile travel lanes. • A sidewalk would improve the safety and comfort of pedestrians.		

$$$$ Dollar signs are used in the first column to provide a rough, order-of-magnitude cost estimate for the set of recommendations in each row of the table: $$$$ = More than $1 million; $$$ = $100K to $1 million, $$ = $10K to $100K, $ = Less than $10K.

[b] Push-button operated pedestrian flashing beacons could be Rectangular Rapid Flashing Beacons, Pedestrian Hybrid Beacons, or some other type of flashing device. The estimated cost is for Rectangular Rapid Flashing Beacons. Pedestrian Hybrid Beacons are likely to be more expensive ($50K or more per crosswalk).

Figure 6.5. Group 4 Pedestrian and Bicycle Infrastructure Projects

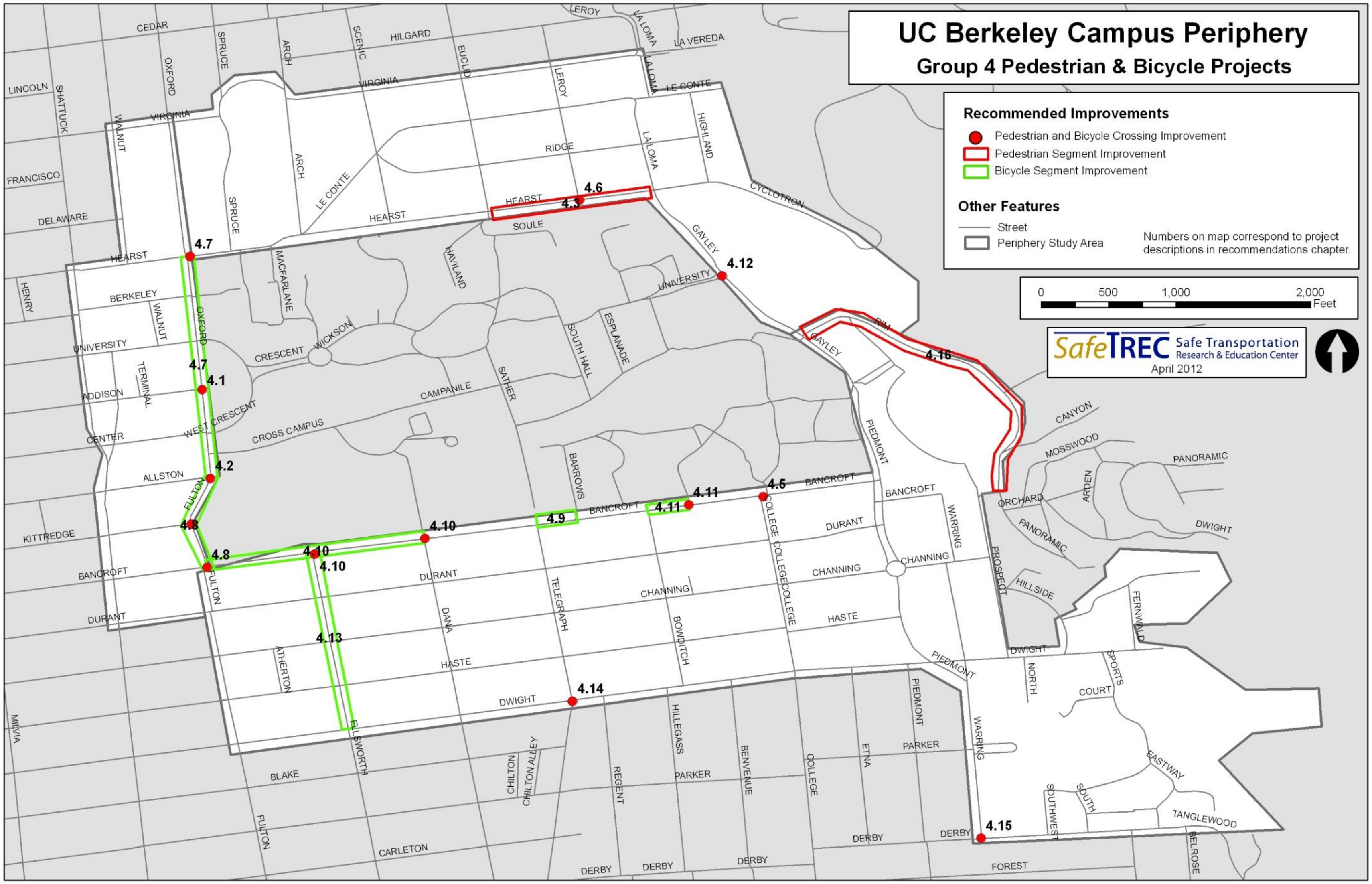
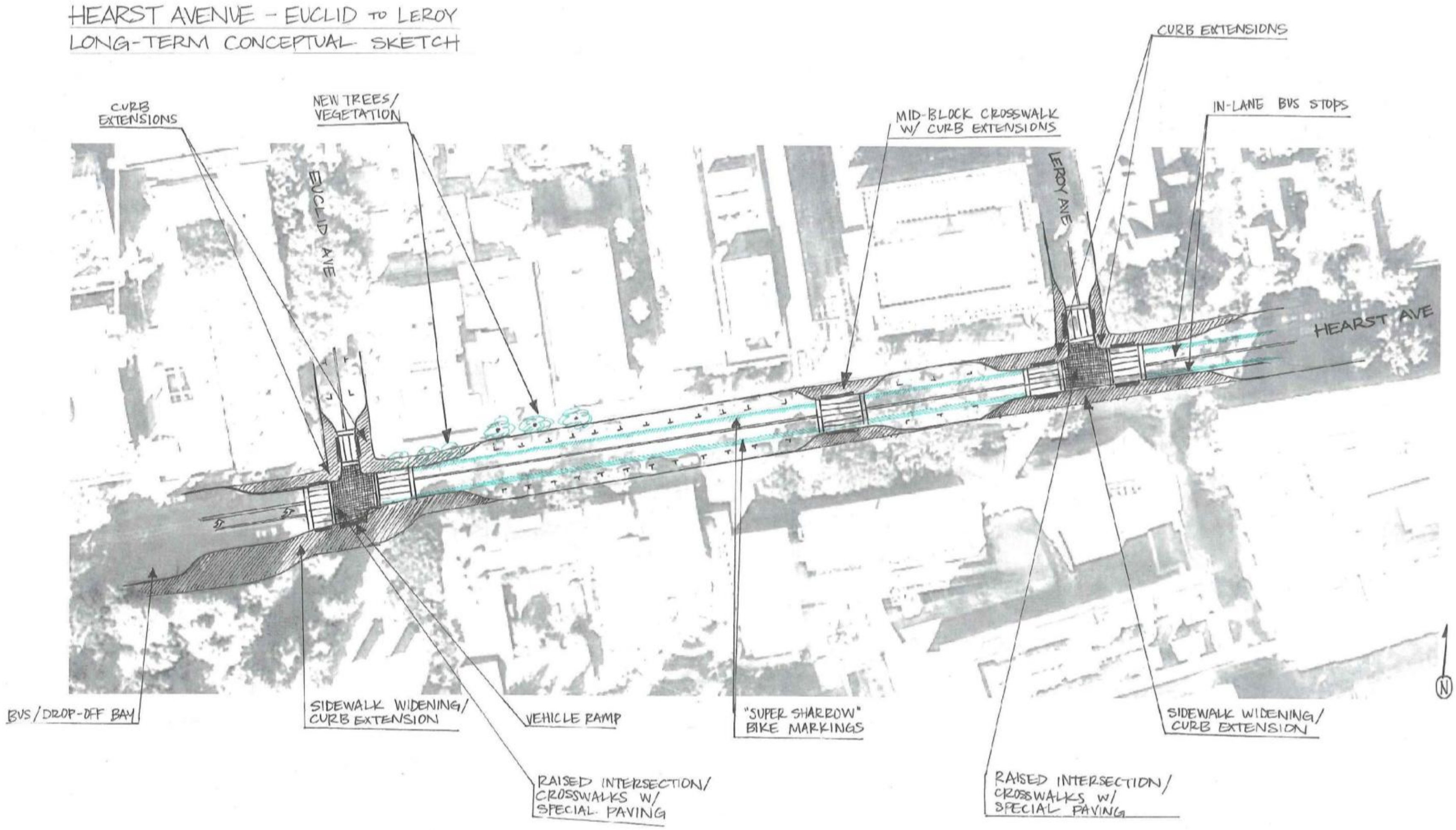
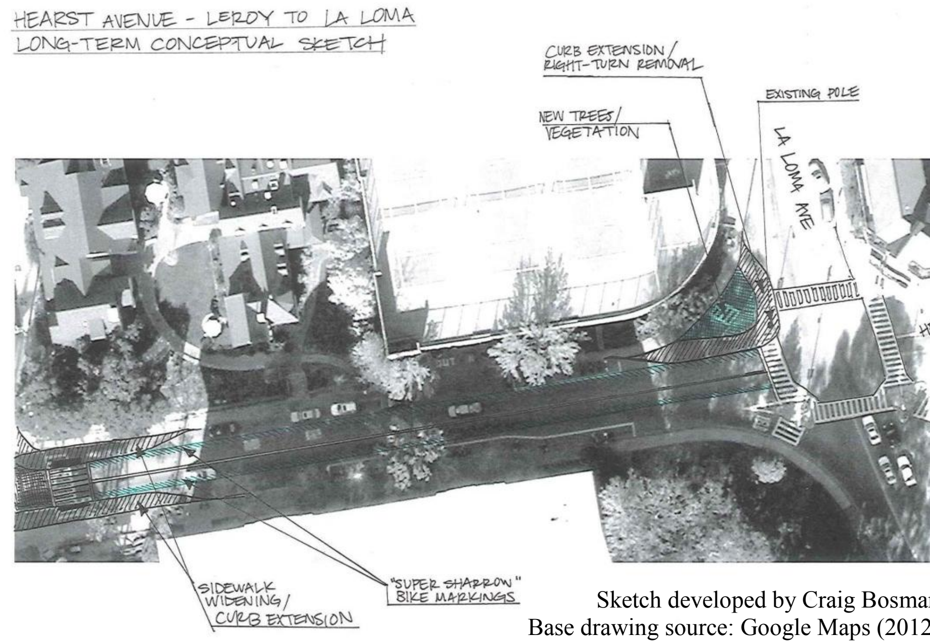


Figure 6.6. Long-Term Conceptual Sketch of Hearst Avenue between Euclid Avenue and Leroy Avenue

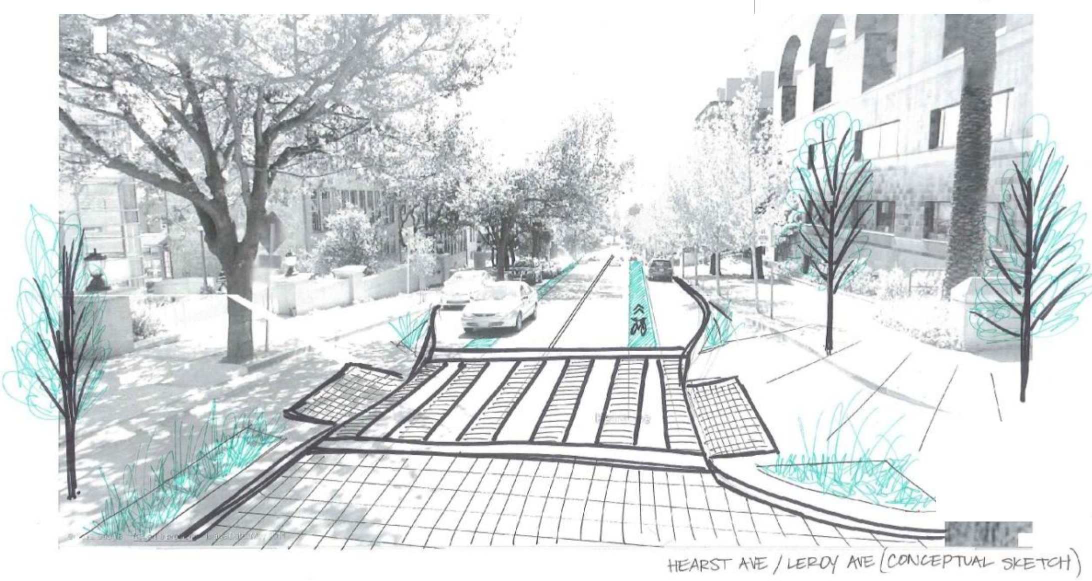


Sketch developed by Craig Bosman
Base drawing source: Google Maps (2012)

Figure 6.6. Long-Term Conceptual Sketch of Hearst Avenue between Leroy Avenue and La Loma Avenue and Hearst Avenue & Leroy Avenue Intersection



Sketch developed by Craig Bosman
Base drawing source: Google Maps (2012)



Sketch developed by Craig Bosman
Base drawing source: Google Street View (2012)

6.1.3. Opportunity-Based Pedestrian and Bicycle Infrastructure Improvements

Several pedestrian and bicycle infrastructure improvements could be made on the UC Berkeley campus and throughout the Campus Periphery Study Area when opportunities become available. These include maintaining existing pedestrian and bicycle facilities, installing bulbouts at appropriate crossing locations, modifying pedestrian signal timing, providing pedestrian-level lighting, using green paint to supplement shared lane markings, and installing additional bicycle parking. Examples of opportunities for providing these types of facilities include roadway and sidewalk reconstruction, routine repaving, new traffic signal installation, and signal retiming projects.

Some of these general recommendations, such as maintaining existing facilities, have been adopted in existing UC Berkeley and City of Berkeley planning documents. Others, such as using green paint to supplement shared lane markings, are potential improvements that should be considered by UC Berkeley and the City of Berkeley in future planning processes. These potential improvements are being suggested so that they may be considered when implementation opportunities arise. Therefore, they are not prioritized using the groups in the tables above.

The cost of opportunity-based improvements in this section will depend on the overall scope of the broader projects that include them. The costs presented in Section 6.1.2 can be used for general guidance, but the marginal cost of adding pedestrian or bicycle facilities as a part of repaving, reconstruction, redevelopment, or other larger projects may be lower than adding a specific facility as a stand-alone retrofit project.

Maintain Pedestrian and Bicycle Infrastructure

Maintenance of pedestrian and bicycle facilities in the campus periphery study area could be conducted as a part of City of Berkeley and UC Berkeley routine maintenance activities. At a most basic level, the following actions could be taken on a routine basis:

- Monitor and repair pedestrian crossing signals and other pedestrian crossing devices (e.g., in-pavement crosswalk lights, pedestrian warning beacons).
- Re-mark crosswalks. The City of Berkeley Southside Plan recommends adding zebra-striped crosswalks at major intersections.
- Repair sidewalks to maintain ADA accessibility. The City of Berkeley Southside Plan recommends repaving or repairing sidewalks on Telegraph Avenue when feasible and repairing damaged sidewalks throughout the neighborhood (Policy T-C5).
- Repair curb ramps to maintain ADA accessibility. The City of Berkeley Southside Plan recommends adding disabled access ramps at major intersections (Policy T-C5).
- Monitor and replace burned out street and pedestrian level lighting.
- Re-mark bicycle lanes and other bicycle facilities.
- Replace missing pedestrian and bicycle signs.
- Repair damaged bicycle parking facilities.

Locations with missing sidewalks, crosswalks, and curb ramps at the time of the City of Berkeley Pedestrian Master Plan pedestrian facility inventory (2006-2007) are identified on the

Existing Pedestrian Facilities map. This map also shows narrow sidewalks and worn crosswalks, which could be improved, as necessary.

Install Bulbouts at Intersections and Mid-Block Crosswalks
Bulbouts, or curb extensions, reduce pedestrian crossing distance, increase visibility between drivers and pedestrians, and may reduce motor vehicle turning speeds. Potential disadvantages of bulbouts include more restricted bus turning movements, as well as drainage and other physical modifications. The Berkeley Pedestrian Master Plan recommends considering installing bulbouts at uncontrolled crosswalk locations on a case-by-case basis as appropriate (Recommendation 6.4.3). The City of Berkeley Southside Plan recommends considering adding bulbouts at intersections (Policy T-D3).

Given the high pedestrian activity levels surrounding campus and potential conflicts between turning vehicles and pedestrians, bulbouts should not be limited to uncontrolled crosswalks in the Campus Periphery Study Area. However, street grades and drainage structures should be considered carefully in determining appropriate locations for bulbouts. If bulbouts require significant modification to drainage and grading, they may be prohibitively expensive. Bulbouts are only appropriate on streets where on-street parking is provided. In addition, bulbouts may limit long-term options to re-allocate street space between general purpose travel lanes, bicycle lanes, and on-street parking. Therefore, they should be implemented with future design proposals in mind. While bulbouts may not be feasible on all corners of an intersection, this should not prevent them from being installed on certain corners.

Bulbouts have been constructed on Addison Street in Berkeley (left) and Adeline Street in Emeryville (right).

Key locations for bulbouts are recommended in the tables above. The bulbouts specified in the Group 1, 2, 3, and 4 recommendation tables above could be considered the highest-priority locations for this type of improvement in the campus periphery area. These locations include:

- Hearst Avenue & Walnut Street
- Hearst Avenue & Spruce Street
- Hearst Avenue & Leroy Avenue
- Shattuck Avenue & Berkeley Way
- Oxford Street & Berkeley Way (bulbouts at the east end of the crosswalks at this intersection would make it difficult to implement a two-way bicycle facility on the edge

of campus along Oxford Street, so bulbouts may only be appropriate for the west end of the crosswalks)
- Bancroft Way & Ellsworth Street (a bulbout at the north end of the crosswalk across Bancroft Way would make it difficult to implement a two-way bicycle facility on the edge of campus along Bancroft Way, so a bulbout may only be appropriate for the south end of the crosswalk)
- Bancroft Way & Dana Street (a bulbout is only appropriate for the south end of the crosswalk across Bancroft Way)
- Bancroft Way & Bowditch Street (a bulbout at the north end of the crosswalk across Bancroft Way would make it difficult to implement a two-way bicycle facility on the edge of campus along Bancroft Way, so a bulbout may only be appropriate for the south end of the crosswalk)
- Bancroft Way & College Avenue (a bulbout at the north end of the crosswalk across Bancroft Way would make it difficult to implement a two-way bicycle facility on the edge of campus along Bancroft Way, so a bulbout may only be appropriate for the south end of the crosswalk)
- Durant Avenue mid-block crosswalk between Telegraph Avenue and Dana Street
- Channing Way mid-block crosswalk between Telegraph Avenue and Dana Street
- Channing Way & Piedmont Avenue
- Telegraph Avenue & Dwight Way

Opportunities to install bulbouts as a part of other projects could be explored at the following additional locations:
- Euclid Avenue & Virginia Street
- Euclid Avenue & LeConte Avenue
- Euclid Avenue & Ridge Road
- Oxford Street & University Avenue (bulbouts at the east end of the crosswalks at this intersection would make it difficult to implement a two-way bicycle facility on the edge of campus along Oxford Street, so bulbouts may only be appropriate for the west end of the crosswalks)
- Oxford Street & Addison Street (bulbouts at the east end of the crosswalks at this intersection would make it difficult to implement a two-way bicycle facility on the edge of campus along Oxford Street, so bulbouts may only be appropriate for the west end of the crosswalks)
- Fulton Street & Allston Street (bulbouts at the east end of the crosswalks at this intersection would make it difficult to implement a two-way bicycle facility on the edge of campus along Fulton Street, so bulbouts may only be appropriate for the west end of the crosswalks)
- Fulton Street & Kittredge Street (bulbouts at the east end of the crosswalks at this intersection would make it difficult to implement a two-way bicycle facility on the edge of campus along Fulton Street, so bulbouts may only be appropriate for the west end of the crosswalks)
- Fulton Street & Durant Avenue (A bulbout from the northeast corner into Durant Ave. should also be accompanied by additional warning signs because two lanes of left-turning vehicles cross the east side crosswalk during its walk signal phase. The design of this

bulbout should accommodate potential bicycle facility improvements on Durant Ave., which could include a left-side bikeway.)

- Fulton Street & Channing Way
- Fulton Street & Haste Street
- Fulton Street & Dwight Way
- Bancroft Way & midblock crossing between Dana Street and Telegraph Avenue (a bulbout is only be appropriate for the south end of the crosswalk across Bancroft Way)
- Bancroft Way & Barrow Lane (a bulbout at the north end of the crosswalk across Bancroft Way would make it difficult to implement a two-way bicycle facility on the edge of campus along Bancroft Way, so a bulbout may only be appropriate for the south end of the crosswalk)
- Bancroft Way & Piedmont Avenue (a bulbout at the north end of the crosswalk across Bancroft Way would make it difficult to implement a two-way bicycle facility on the edge of campus along Bancroft Way, so a bulbout may only be appropriate for the south end of the crosswalk)
- Durant Avenue & Ellsworth Street
- Durant Avenue & Dana Street
- Durant Avenue & midblock crossing between Dana Street and Telegraph Avenue
- Durant Avenue & Bowditch Street
- Durant Avenue & College Avenue
- Durant Avenue & Piedmont Avenue
- Haste Street & Ellsworth Street
- Haste Street & Dana Street
- Haste Street & Bowditch Street
- Haste Street & College Avenue
- Dwight Way & Ellsworth Street
- Dwight Way & Dana Street
- Dwight Way & College Avenue

Provide Leading Pedestrian Intervals and Accessible Pedestrian Signals at Appropriate Locations when New Traffic Signals are Installed

The City of Berkeley should explore leading pedestrian intervals of three to five seconds at signalized intersections with high volumes to give pedestrians a head start before vehicles proceed. This may help increase pedestrian visibility to turning motorists. Signalized intersections adjacent to campus and signalized intersections in the Telegraph Avenue and Shattuck Avenue corridors could be given the greatest consideration for this type of treatment. A leading pedestrian interval is recommended at Shattuck Avenue and University Avenue intersection in the tables above. The City of Berkeley Pedestrian Master Plan suggests leading pedestrian intervals as a potential treatment (p. B-30) but only recommends one specific application of this strategy.

In addition, new signals could be installed with accessible pedestrian signals to provide better information to pedestrians of all abilities. The City of Berkeley Pedestrian Master Plan (p. B-48) establishes clear criteria for determining where audible pedestrian signals should be considered, so these criteria should be followed. Two intersections in the campus periphery that may be good candidates for audible signals are University Avenue and Oxford Street and Hearst Avenue and Oxford Street.

The City of Berkeley Southside Plan recommends all-way-stop phases that allow pedestrians to cross in any direction and for new signals to be Accessible Pedestrian Signals (Policy T-D3). All-way-stop phases (e.g., pedestrian-only or pedestrian scramble phases) can allow pedestrians to cross in any direction without conflicting with automobile turning movements. However, these phases add to total signal length, which may add delay to pedestrians, bicyclists, and drivers. According to the City of Berkeley Pedestrian Master Plan, "Pedestrian scramble phases are only recommended where pedestrian volumes are very high and should be used sparingly, given that the additional phase increases wait times for all modes" (p. B-30).

If the City of Berkeley is able to choose particular intersections to make traffic signal improvements for pedestrians, these locations could be prioritized according to the street corridor ranking for the "pedestrian crossing the roadway" category in Table 5.10. For example, signalized intersections along the Shattuck Avenue corridor would be the top priority, followed by University Avenue, Shattuck Square, Telegraph Avenue, and the rest of the corridors. Otherwise, signalization improvements could be made when opportunities arise.

Use Green Paint to Guide Bicyclists to Ride in the Appropriate Space on Streets with Shared Lane Markings

Green paint could be used to encourage bicyclists to ride in the appropriate space on streets with shared lane markings. The appropriate bicycling space is in the center of the shared lane marking, but many bicyclists in Berkeley still ride to the right of the markings. This puts them at risk for crashes involving opened doors from parked cars. A 5- to 6-foot wide green stripe in the travel lane along the length of the street can help reinforce the laws allowing bicyclists to travel in roadway lanes and help them avoid potential door crashes. The per-mile cost of this treatment would be higher than a simple shared lane marking application. Initial experiments with this treatment could be done on key roadways recommended for shared lane markings, including College Avenue (Bancroft Way to Durant Street) and Hearst Avenue (Euclid Street to Gayley Road). If it is not possible to use green paint, the City of Berkeley could also experiment with reducing the spacing between shared lane markings, such as installing one shared lane marking every 50 to 100 feet.

The cities of Long Beach, CA; Minneapolis, MN; and Salt Lake City, UT have used this treatment on an experimental basis. This experimental treatment was allowed by the Federal Highway Administration and the California Traffic Control Devices Committee. Although this is not an approved treatment at this time, it may receive approval in the future. The Federal Highway Administration granted approval for the State of California to use green paint to mark bicycle lanes and bicycle lane extensions on August 12, 2011. To implement an experimental application of highlighting shared lane markings with green paint or increasing the frequency of shared lane markings in Berkeley, the City of Berkeley could partner with a UC Berkeley research organization to collect data and evaluate its safety impacts. It may be possible to pursue a grant from the California Department of Transportation for this purpose.

Add Pedestrian Level Lighting

More lighting on and around campus at night will help pedestrians and bicyclists feel more secure and may help reduce the risk of pedestrian and bicycle crashes. The City of Berkeley Southside Plan recommends installing pedestrian level lighting wherever and whenever feasible (Policy T-C5). In particular, it emphasizes the need to improve lighting in the Telegraph Avenue Commercial District (Policy T-F3).

Install Additional Bicycle Parking

Some streets near campus do not have sufficient bicycle parking

Additional bicycle parking could be provided near the entrance to all campus academic and administrative buildings. More bicycle parking could also be provided on city streets surrounding campus. In some locations around campus, there is limited sidewalk space available for bicycle parking. Therefore, the City of Berkeley could consider providing more high-capacity bicycle stations (e.g., Berkeley Bike Station on Shattuck Avenue) and on-street bicycle corrals (e.g., south side of Center Street near Oxford Street). The City of Berkeley Bicycle Master Plan Update identifies the west side (downtown Berkeley) and south side of the periphery study area as a future bicycle parking target area. Additional bicycle parking is also recommended for the Telegraph Avenue Commercial Area in the UC Berkeley and City of Berkeley Long Range Development Plan, Five Year Expenditure Plan. The City of Berkeley Downtown Area Plan recommends increasing the availability of convenient, secure, and attractive short- and long-term bicycle parking throughout downtown (Policy AC-5.2). In addition, the City of Berkeley Southside Plan recommends more short-term and all-day and nighttime bike parking in the Southside and on campus. This includes adding bicycle parking in the Telegraph/Channing Garage and all UC parking structures (Policy T-C3). It also recommends incorporating bicycle parking into all future parking facilities (Policy T-H3). Bicycle parking facilities in these garages should be for long-term parking (e.g., bike cages or self-serve bicycle stations). In general, more bicycle parking will be important since bicycle parking still overflows onto sign posts and trees in many locations, and shifting more travel from automobiles to bicycles will require additional bicycle parking. While it is not currently identified in the Berkeley Bicycle Master Plan, additional bicycle parking could also be provided in the Euclid Street commercial zone north of campus.

New bicycle racks were installed on the south side of Wurster Hall.

Install Bicycle Stair Ramps

The UC Berkeley Campus Bicycle Master plan recommends providing bicycle stair ramps along existing staircases on secondary bikeways. It also states that, "new staircases should be designed with bicycle stair ramps as part of a whole, aesthetic design" (p. 66). Examples of staircases that are used by bicyclists and would benefit from stair ramps include:

- The staircase on the north side of Bancroft Way between Barrow Lane and Bowditch Street that leads towards Barrows Hall.
- The staircases between Moses Hall and Stephens Hall.

Continue Implementation of the UC Berkeley Campus Bicycle Master Plan

The UC Berkeley Campus Bicycle Master Plan (2006) recommends many bicycle improvements within the main campus area, including improved bikeway connections through campus; fewer prohibitions against bicycling; additional bicycle parking near campus building entrances; secure bicycle parking within buildings; better bicycle-related education, enforcement, and encouragement; improved bicycle access to, from, and on public transportation; and improved coordination with other agencies on bicycle projects and programs. Prohibitions against bicycle riding can be limited except where bicycle use might negatively impact pedestrian safety.

Identify Sources of Support to Implement Infrastructure Improvements

Implementing the projects and programs in this report will require significant UC Berkeley and City of Berkeley staff time. UC Berkeley and the City of Berkeley already do excellent work to improve pedestrian and bicycle conditions, while using limited resources. Therefore, many of the recommendations in this document hinge on identifying resources for both organizations to conduct traffic studies, design review, public processes, construction, and maintenance. Funding may include grants from the California Department of Transportation, Metropolitan Transportation Commission, Bay Area Air Quality Management District, or Alameda County Transportation Commission; Office of Traffic Safety, UC Police Department, or City of Berkeley Police Department; as well as other public and private funding sources. Several examples of federal pedestrian and bicycle funding sources and eligible uses are listed in Table 6.1. Internal funding from the City of Berkeley and University of California may also be used to implement some of these projects.

Table 6.1. Examples of Federal Funding Sources for Pedestrian and Bicycle Projects

	Surface Transportation Program (STP)	Highway Safety Improvement Program (HSIP)	Safe Routes to School	Transportation Enhancements	Congestion Mitigation/Air Quality (CMAQ)	Recreational Trails Program	Federal Transit Capital Improvements	State & Community Traffic Safety Programs (402 Grant Funds)	State/Metropolitan Planning Funds	Transportation & Community and System Preservation Pilot Program	Access to Jobs/Reverse Commute Program	Federal Lands Highway Program
Bicycle and pedestrian plan	*				*				*	*		
Bicycle lanes on roadway	*	*	*	*	*		*					*
Paved Shoulders	*	*	*	*	*							*
Signed bike route	*		*	*	*							*
Shared use path/trail	*		*	*	*	*						*
Single track hike/bike trail						*						
Spot improvement program	*	*	*	*	*							
Maps	*		*		*			*				
Bike racks on buses	*			*	*		*					
Bicycle parking facilities	*		*	*	*		*					
Trail/highway intersection	*	*	*	*	*	*						*
Bicycle storage/service center	*		*	*	*		*			*	*	
Sidewalks, new or retrofit	*	*	*	*	*		*					*
Crosswalks, new or retrofit	*	*	*	*	*		*					*
Signal improvements	*	*	*	*	*							
Curb cuts and ramps	*	*	*	*	*							
Traffic calming	*	*	*							*		
Coordinator positions/programs	*		*		*					*		
Safety/education position	*		*		*			*				
Police Patrol	*		*					*				
Helmet Promotion	*		*	*				*				
Safety brochure/book	*		*	*	*	*		*				

Source: Federal Highway Administration (http://www.fhwa.dot.gov/environment/bikeped/bp-guid.htm)

6.2. Recommended Education, Enforcement, and Encouragement Programs

Education, enforcement, and encouragement programs could also be established to improve pedestrian and bicycle safety near campus. These programs are important complements to infrastructure improvements because they increase awareness of walking and bicycling opportunities and promote safe interactions between all users in the roadway environment. Several of the programs described below have been recommended in previous plans, but many are new ideas that can be considered in future UC Berkeley and City of Berkeley planning and programming initiatives.

Implement the "Bear Crossing" University Focused Safety Campaign

The City of Berkeley Pedestrian Master Plan recommends instituting a "Bear Crossing" pedestrian safety program in areas around the UC Berkeley campus (Recommendation 7.1.2). This program could be coordinated between the City and University, with the UC Police Department playing a lead role and City of Berkeley Police playing a secondary role in implementing targeted education and enforcement. It should address driver, pedestrian, and bicyclist behaviors, including drivers obeying speed limits, driving with an expectation to see pedestrians crossing at all locations, and yielding to pedestrians; pedestrians obeying crossing signals and not using mobile phones when crossing streets; and bicyclists obeying traffic signals and stop signs and yielding to pedestrians. The campaign could involve police outreach, integration into new student orientation activities, bumper stickers, and outreach to news media.

Offer Pedestrian, Bicyclist, and Driver Safety Education during UC Berkeley Student Orientation

Students entering UC Berkeley could be educated about walking, bicycling, and driving safely near pedestrians and bicyclists as a part of orientation activities. This could include brochures and e-mail messages with safety facts, rules and responsibilities for all roadway users. It could also include at least five minutes of instruction on safe walking, bicycling, and driving behaviors, with specific examples from the campus periphery area. This is especially important for international students and other students who may not be familiar with roadway environments in an urban area. Safety messages should not discourage walking and bicycling; they should be combined with messages to promote these modes. It is important to emphasize the benefits of walking and bicycling and the shared responsibility of all roadway users to keep pedestrians and bicyclists safe. The UC Berkeley Campus Bicycle Master Plan indicates that UCPD and UC Parking and Traffic have provided bicycle safety educational materials during past student orientations.

Source: East Bay Bicycle Coalition

Provide Bicycle Safety Workshops for Students, Faculty, and Staff

Bicycle safety education could be offered on a regular basis to UC Berkeley students, faculty, and staff. The East Bay Bicycle Coalition offered free bicycle safety workshops on the UC

Berkeley campus in 2011. Topics covered in those classes included basic rules of the road, how to share the road with cars on busy streets, helmet use, and basic bicycle maintenance.

Reduce Automobile Traffic Speeds to Less than 25 Miles Per Hour

Using a combination of engineering treatments (e.g., eliminating excess travel lane capacity, reducing travel lane widths, installing curb extensions), speed limit changes (e.g., reducing posted speed limits to less than 25 miles per hour), and enforcement (e.g., ticketing speeding motorists) vehicle speeds should be reduced to less than 25 miles per hour in the campus periphery study area. There are many benefits of slower vehicle speeds:

- The likelihood of a traffic crash producing a serious injury decreases significantly when automobile speeds are lower.
- Pedestrians feel more comfortable and are able to judge gaps in traffic more easily when automobiles travel more slowly.
- Bicyclists feel more comfortable sharing streets with motorists when they travel at similar speeds.

The City of Berkeley Downtown Area Plan street modifications policy states: “Modifications should encourage traffic to flow at speeds under 25 miles per hour.” (Policy AC-1.1.).

Continue to Limit Internal Automobile Access to the Main Campus Area

Continue to limit internal automobile access at East Gate and West Gate to “permit only” between 8 a.m. and 5 p.m. This will reduce potential conflicts between automobiles, pedestrians, and bicyclists, and make all shared campus streets more comfortable for walking and bicycling. In addition, this action will reduce the number of vehicles using the roads on the campus periphery and entering and exiting campus from Oxford Street and Gayley Road. As this action is implemented, impacts on visitors and deliveries should be considered. There is broad support for limiting automobile access to campus in existing plans. The UC Berkeley Long Range Development Plan recommends: “The long-term goal for the campus should be to limit access to internal routes to two points, east and west gate, and by permit only from 8 am to 5 pm” (p. 46). The City of Berkeley Southside Plan, Policy T-C7, recommends addressing street crossing safety concerns where pedestrian passageways are located. The UC Berkeley College of Engineering Streetscape and Open Space Master Plan, p. 4-11, recommends limiting vehicular access to the college to times when the fewest pedestrians are present. The UC Berkeley New Century Plan, Policy 5.5, recommends admitting private service and delivery vehicles to internal routes by permit only between 8 am and 5 pm.

Increase Enforcement of Traffic Laws to Improve Pedestrian, Bicyclist, and Driver Behavior

The behavior of pedestrians, bicyclists, and drivers can contribute to pedestrian and bicyclist crashes. Targeted enforcement should be conducted to reduce the following user behaviors in the campus periphery area.

- Drivers: Speeding, drunk driving, red-light running, failing to yield to pedestrians in crosswalks, talking on cell phones or texting while driving, parking on sidewalks, parking in bicycle lanes.
- Pedestrians: Jaywalking against traffic signals.

- Bicyclists: Red-light running, running stop signs, failing to yield to pedestrians in crosswalks, bicycling on sidewalks.

The City of Berkeley Southside Plan recommends enforcing traffic laws, including laws that apply to bicyclists and pedestrians, to improve safety for pedestrians and bicyclists. The City of Berkeley Pedestrian Master Plan has a goal to "Support…enforcement programs to…reduce speeding and increase pedestrian, bicyclist and automobile safety" (p. 2-8) and an implementation measure to "Conduct targeted enforcement of pedestrian right-of-way violations (crosswalk stings) especially on multilane roadways" (p. 2-9).

The City of Berkeley Police Department has conducted Pedestrian Safety Month enforcement and education activities over the last three years. Patrol officers are trained before Pedestrian Safety Month about laws designed to protect pedestrians. During the month, purple ribbons are displayed on patrol cars to raise awareness of pedestrian safety. The Department identifies problem intersections and targets enforcement efforts at these locations on the following behaviors:

- Distracted driving, especially cell phone violations
- Speeding
- Failure to yield to pedestrians in crosswalks

When drivers are stopped for one of these violations, officers give them literature with information about pedestrian safety. Pedestrian safety education is also provided by officers who visit elementary schools to tell children how to be safe when walking along and crossing the street. Pedestrian Safety Month activities are conducted by shifting enforcement resources rather than by hiring additional officers or having officers work overtime. Therefore, the City of Berkeley Police Department does not need additional budget resources to conduct Pedestrian Safety Month.

Provide Targeted Pedestrian and Bicycle Encouragement Messages

Conduct pilot testing of an individualized pedestrian and bicycle marketing program with students, faculty, and staff in one college. This program would be intended to increase awareness of traveling by non-automobile modes among members of the college. It would involve providing information (e.g., brochures and e-mail messages) about walking, bicycling, and using public transit to travel to campus. Individuals who drive regularly could be given the opportunity to attend a group meeting where a representative of a local advocacy group can show each person how to commute by walking, bicycling, or public transit. If desired, the advocacy group member could commute to campus with them to demonstrate how this could be done. Since faculty and staff are more likely to drive to campus than students, they could receive special attention. This pilot program could distribute surveys before and after the program to document any changes in travel behavior that occur. If the pilot program is successful, it could be applied to other colleges in the University. While this specific type of encouragement program is not recommended in an existing plan, it is consistent with the intent of some of the other encouragement measures and incentives listed in the City of Berkeley Pedestrian Master Plan Section 7.3.3.

Participate in a County or Regional Pilot Bicycle Sharing Program

UC Berkeley and the City of Berkeley could participate in a future county or regional pilot bicycle sharing program. This would involve partnering with and supporting the leading organization, which may be the Alameda County Transportation Commission or Metropolitan Transportation Commission. This program could establish bicycle sharing facility locations in downtown Berkeley (e.g., at the Berkeley Bike Station and the BART station), in the Telegraph Avenue Commercial District, as well as on the UC Berkeley campus (e.g., near the Recreational Sports Facility, near Moffitt Library, near Memorial Stadium). Bicycle sharing would allow students who do not bicycle to campus to use bicycles on campus and in surrounding areas. The City of Berkeley Downtown Area Plan recommends promoting convenient "bike sharing" options for employees, residents and visitors (Policy AC-5.3).

Encourage Pedestrian and Bicycle Commuting to Campus

General information could be provided to faculty, staff, and students about the benefits of walking and bicycling to, from, and in the area around campus. This could be integrated into orientation events at the beginning of each semester and possibly combined with pedestrian, bicyclist, and driver safety messages. These efforts could also be coordinated with overall Campus Transportation Demand Management efforts and programs such as Bike to Work Day (in May), the "Everybody Walks in Berkeley" campaign (first Wednesday of every month) cited in the City of Berkeley Pedestrian Master Plan, and Campus Bike Day.

Source: Campus Bike Initiative (http://campusbikeinitiative.wordpress.com/bike-to-campus-day/)

7. EVALUATION

UC Berkeley should collect data on pedestrian and bicycle infrastructure, activity, behavior, and safety within the campus periphery area. This information should be analyzed and reported on a regular basis to determine the effectiveness of pedestrian and bicycle safety improvements implemented in future years. Specific performance measures are outlined below. These detailed data will also help show which specific actions have been the most effective at reducing pedestrian and bicyclist injuries and fatalities in the campus periphery study area. Ultimately, this evidence will lead to future recommendations for further improvements to pedestrian and bicyclist safety. The City of Berkeley should assist with this effort by sharing its pedestrian- and bicycle-related data with the University. Included at the end of the chapter is a summary of the performance measures for the base year (academic year 2011-2012). These measurements should be updated annually to allow for regular comparison and analysis of safety improvements.

7.1. Data Collection Recommendations

An extensive database of pedestrian and bicycle volumes, behaviors, and crash information can help UC Berkeley and the City of Berkeley quantify the impact of pedestrian and bicycle improvements over time. Several actions should be taken by UC Berkeley to collect long-term pedestrian and bicycle data. These include:

- *Purchase and install four continuous pedestrian counters*. These counters can be placed across entrances on all sides of campus. Provide a small amount of funding to collect, analyze, and report the data that are collected.
- *Purchase and install four continuous bicycle counters*. With permission from the City of Berkeley, these counters can be installed in the pavement on the primary bicycle routes to and from campus within one block of the campus boundary. Provide a small amount of funding to collect, analyze and report the data that are collected.
- *Fund routine pedestrian and bicycle infrastructure data updates, manual pedestrian and bicycle intersection counts, manual pedestrian and bicycle behavior observations, vehicle speed and behavioral observations, and pedestrian and bicycle crash data analysis*. The types of data that could be collected are described below. Where applicable, infrastructure and crash data should be compiled for each street corridor as well as for the campus periphery study area as a whole.

Therefore, UC Berkeley should:

- Produce an annual report to show progress on pedestrian and bicycle infrastructure and safety improvements, and track changes in activity, behavior, and safety in the campus periphery.
- Fund graduate student research to evaluate and report the effectiveness of specific actions taken in the campus periphery study area.

7.2. Pedestrian and Bicycle Performance Measures

The section below lists several performance measures within the general categories of infrastructure, activity, behavior, and safety. Each measure includes a brief description of the data and process required for the measure, with more detailed descriptions of each measure included in Appendices B through G. Table 7.1 at the end of this section reports the base measures collected for the 2011-2012 academic year. These measures should be reported at regular intervals in the future. These performance measures can be used to analyze the impacts of UC Berkeley and City of Berkeley actions on pedestrian and bicycle infrastructure, activity, behavior, and safety in the campus periphery area. This information should help document the impacts of specific infrastructure projects as well as specific education, enforcement, and encouragement programs.

Infrastructure Data

1. **Sidewalk coverage (percentage)**. Sidewalk coverage is defined as the percentage of both sides of the street corridor that have existing sidewalks. For example, if a street corridor has a sidewalk along the entire length of the corridor but only on one side of the street, its sidewalk coverage is recorded as 50%.
2. **Length of designated bicycle facilities (miles)**. Bicycle facility length is calculated by direction (e.g., a two-way bicycle facility that is one mile long represents two bicycle facility miles). The following types of bicycle facilities are included in this measure: multi-use trails, barrier-separated on-road bicycle facilities, bicycle lanes, shared-lane markings, and bicycle boulevards.
3. **Bulbouts (number)**. Bulbouts are counted separately at each end of a crosswalk and computed over the entire corridor.
4. **Raised median island at crossings (number)**. Median islands are counted at each crossing when there is a median island in the middle of the street that separates different lanes of automobile traffic.
5. **Average pedestrian crossing distance (feet)**. The average pedestrian crossing distance for a street corridor is the average of all marked and unmarked crosswalks crossing the street along the length of the corridor. Crossing distance is defined as the shortest curb-to-curb distance within the legal crossing area.

Activity Data

1. **Total count of pedestrians at annual count intersections (number)**. Pedestrians should be counted each time they cross a leg of the intersection (within 50 feet of the crosswalk). They should be counted on a typical, good weather weekday during the fall semester when school is in session for a two-hour duration. The annual count intersections include: Hearst Avenue & Euclid Avenue, Hearst Avenue & Oxford Street, Oxford Street & Center Street, Bancroft Way & Fulton Street, Bancroft Way & Dana Street, Bancroft Way & Telegraph Avenue, Durant Avenue & Bowditch Street, and Gayley Road & Stadium Rim Way. See Appendix E for more detailed information on conducting pedestrian counts.
2. **Total count of bicyclists at annual count intersections (number)**. Bicyclists should be counted each time they arrive at the intersection from any approach leg. They should be counted on a typical, good weather weekday during the fall semester when school is in session for a two-hour duration. The annual count intersections include: Hearst Avenue &

Euclid Avenue, Hearst Avenue & Oxford Street, Oxford Street & Center Street, Bancroft Way & Fulton Street, Bancroft Way & Dana Street, Bancroft Way & Telegraph Avenue, Durant Avenue & Bowditch Street, and Gayley Road & Stadium Rim Way. For more information on conducting bicyclist counts see Appendix E.

3. **Student and faculty mode shares (percentage)**. Mode share data should continue to be obtained from the periodic student and faculty transportation survey conducted by UC Berkeley to assist the campus in understanding the transportation needs of faculty, students, and staff. This survey also helps inform future programs and policies under consideration by the campus. Mode shares of interest include:
    a. *Student pedestrian mode share*: The percentage of students who walk to campus.
    b. *Student bicycle mode share*: The percentage of students who bicycle to campus.
    c. *Faculty pedestrian mode share*: The percentage of faculty who walk to campus.
    d. *Faculty bicycle mode share*: The percentage of faculty who bicycle to campus.

Behavior Data

1. **85th percentile motor vehicle travel speed (miles per hour)**. Motor vehicle speeds should be observed during similar, good weather weekday periods during off-peak hours. The 85th percentile speed should be based on approximately 100 distinct speed measurements (e.g., not taken from cars in the same platoon). The 85th percentile speed is calculated using all of the observations from the six annual locations. Observations should be made at the following locations: Bancroft Way between Dana Street & Ellsworth Street in the westbound direction, Piedmont Avenue between Optometry Lane & Stadium Rim Way in the northbound direction, Hearst Avenue between Gayley Road & Leroy Avenue in the westbound direction, Hearst Avenue between Euclid Avenue and Scenic Avenue in the westbound direction, Oxford Street between Center Street & Allston Way in the southbound direction. See Appendix G for more information on the collection of speed data.
2. **Pedestrian traffic signal compliance (percentage)**. The percentage of pedestrians who arrive at a traffic signal on red and a) comply with the signal, or b) do not comply with the signal should be recorded at several intersections. These intersections should include: Hearst Avenue & Euclid Street, Hearst Avenue & Oxford Street, Oxford Street & Center Street, and Durant Street & Telegraph Avenue. For more information on the collection of pedestrian behavior, see Appendix F.
3. **Pedestrian looks in all directions (percentage)**. The percentage of pedestrians who look in the directions of all potential conflicts with drivers (e.g., cross-traffic and the potential turning movements of vehicles that traverse the crossing) should be observed. Only pedestrians who check every potential direction for conflict are recorded. Intersections should include: Hearst Avenue & Euclid Street, Hearst Avenue & Oxford Street, Oxford Street & Center Street, and Durant Street & Telegraph Avenue. For more information on the collection of pedestrian behavior, see Appendix F.
4. **Bicyclist traffic signal compliance (percentage)**. The percentage of bicyclists who arrive at a traffic signal on red, and a) comply with the signal, or b) do not comply with the signal should be recorded at several intersections. These intersections should include: Hearst Avenue & Euclid Street, Oxford Street & Center Street, and Durant Street & Bowditch Street. See Appendix F for more information on the collection of bicyclist traffic signal compliance behavioral data collection.

5. **Driver yielding to pedestrians at midblock crosswalks (percentage)**. The percentage of drivers who a) yield to pedestrians at midblock crosswalks or b) do not yield to pedestrians at midblock crosswalks should be observed. Observation locations could include the crosswalk on Durant Street between Dana Street and Telegraph Avenue and, Hearst Avenue at Spruce Street between Oxford Street and Arch Street. Future observations should include the crosswalk on Channing Way between Dana Street and Telegraph Avenue. For more information on the collection of driver yielding behavior and additional measures to consider in the future, see Appendix F.

Crash and Injury Data

Bicycle and pedestrian crash and injury data should be obtained from the City of Berkeley Police Department's crash data. The data should be collected annually and checked against CHP Statewide Integrated Traffic Records System (SWITRS).[28]

1. **Reported pedestrian crashes per year (number)**. This count is the total number of pedestrian-involved crashes within the Campus Periphery zone and on the UC campus.
2. **Reported bicyclist crashes per year (number)**. This count is the total number of bicyclist-involved crashes within the Campus Periphery zone and on the UC campus.
3. **Reported pedestrian injuries per year (number)**. This count is the total number of pedestrian injuries (including fatal injuries) within the Campus Periphery zone and on the UC campus.
4. **Reported bicyclist injuries per year (number)**. This count is the total number of bicyclist injuries (including fatal injuries) within the Campus Periphery zone and on the UC campus.
5. **Pedestrian crash index (index)**. This index is calculated in two ways, a) using the latest available year's crash data, and b) using the average annual crash data for the latest available 5-year window. These indices area calculated by a) dividing the annually reported pedestrian crashes for the entire periphery area (including the main campus) by the total pedestrian counts at the annual count locations for the current year, and b) dividing the average annual pedestrian crashes from the 5-year window by the pedestrian counts at the annual count locations for the current year.[29] This index serves as a proxy for the relative rate of pedestrian crashes to pedestrian volume in the Campus Periphery and UC Berkeley campus area and should be calculated annually.
6. **Bicyclist crash index (index)**. This index is calculated in two ways, a) using the latest available year's crash data, and b) using the average annual crash data for the latest available 5-year window. These indices area calculated by a) dividing the annually

[28] It should be noted that official crash records, including the police report data used for crash and injury data analysis in this report, have been shown to significantly underestimate the number of pedestrians and bicyclists injured in collisions with motor vehicles. Stutts and Hunter (1998) demonstrated in a three-state study that only 56 percent of pedestrian-motor vehicle and 48 percent of bicyclist-motor vehicle injury cases could be linked to the state motor vehicle crash files, indicating the limitations of reported crash data for traffic safety analysis.

[29] These indices are proxies for the overall level of pedestrian and bicyclist crashes and injuries relative to total pedestrian and bicyclist volumes. However, these indices rely on volumes calculated from counts taken at the annual count locations to generate an assumed representative sample of the overall bicycle and pedestrian volumes on campus and in the campus periphery. Thus, this index assumes that the change in pedestrian and bicycle volumes at the sample count locations is similar to the change in the volumes across all intersections within the Campus Periphery area. These indices are intended to be used for the entire periphery area and should not be used for interpretation at individual intersections or sites. The calculated values for the indices are multiplied by 10,000.

reported bicyclist crashes for the entire periphery area (including the main campus) by the total bicyclist counts at the annual count locations for the current year, and b) dividing the average annual bicyclist crashes from the 5-year window by the bicyclist counts at the annual count locations for the current year.[30] These indices serve as proxies for the relative rate of bicyclist crashes to bicyclist volume in the Campus Periphery and UC Campus area and should be calculated annually.

7. **Pedestrian injury index (index)**. This index is calculated in two ways, a) using the latest available year's injury data, and b) using the average annual injury data for the latest available 5-year window. These indices area calculated by a) dividing the annually reported pedestrian injuries for the entire periphery area (including the main campus) by the total pedestrian counts at the annual count locations for the current year, and b) dividing the average annual pedestrian injuries from the 5-year window by the pedestrian counts at the annual count locations for the current year.[30] These indices serve as proxies for the relative rate of pedestrian injuries to pedestrian volume in the Campus Periphery and UC Campus area and should be calculated annually.
8. **Bicyclist injury index (index)**. This index is calculated in two ways, a) using the latest available year's injury data, and b) using the average annual injury data for the latest available 5-year window. These indices area calculated by a) dividing the annually reported bicyclist injuries for the entire periphery area (including the main campus) by the total bicyclist counts at the annual count locations for the current year, and b) dividing the average annual bicyclist injuries from the 5-year window by the bicyclist counts at the annual count locations for the current year.[30] These indices serve as proxies for the relative rate of bicyclist injuries to bicyclist volume in the Campus Periphery and UC Campus area and should be calculated annually.

[30] These indices are proxies for the overall level of pedestrian and bicyclist crashes and injuries relative to total pedestrian and bicyclist volumes. However, these indices rely on volumes calculated from counts taken at the annual count locations to generate an assumed representative sample of the overall bicycle and pedestrian volumes on campus and in the campus periphery. Thus, this index assumes that the change in pedestrian and bicycle volumes at the sample count locations is similar to the change in the volumes across all intersections within the Campus Periphery area. These indices are intended to be used for the entire periphery area and should not be used for interpretation at individual intersections or sites. The calculated values for the indices are multiplied by 10,000.

Table 7.1. Base-Year Pedestrian and Bicycle Performance Measures

Measure Type	Measure Name	Base Measure (AY 2011-2012)
Infrastructure		
	Sidewalk coverage (% covered, entire study area)	98.9%
	Length of designated bicycle facilities	2.03 mi
	Number of bulbouts	40
	Number of median islands at crossings	58
	Average pedestrian crossing distance	46.11 ft
	Average posted speed	25.0 mph
	Stop and signal controls at crossings	
Activity		
	Total count of pedestrians at annual count intersections	18,171
	Total count of bicyclists at annual count intersections	1,458
	Student pedestrian mode share[31]	51%
	Student bicycle mode share[31]	12%
	Faculty pedestrian mode share[31]	9%
	Faculty bicycle mode share[31]	9%
Behavior		
	85^{th} percentile motor vehicle travel speed	29.13 mph
	Pedestrian traffic signal compliance	87%
	Pedestrian looks in all directions	19.8%
	Bicyclist traffic signal compliance	52.3%
	Driver yielding to pedestrians at midblock crossings	58.9%

[31] Based on 2009 Transportation Survey Summary from UC Berkeley Parking & Transportation.

Safety		
	Reported pedestrian crashes (per year / 5-year window)[32]	22 / 111
	Reported bicyclist crashes (per year / 5-year window)[32]	30 / 158
	Reported pedestrian injuries (per year / 5-year window)[32]	19 / 99
	Reported bicyclist injuries (per year / 5-year window)[32]	24 / 132
	Pedestrian crash index (per year / 5-year window average)[33]	12.11 / 12.22
	Bicyclist crash index (per year / 5-year window average)[33]	205.76 / 216.74
	Pedestrian injury index (per year / 5-year window average)[33]	10.46 / 10.90
	Bicyclist injury index (per year / 5-year window average)[33]	164.61 / 181.07

[32] Crash and injury data based only on SWITRS reported crashes and are given on the most recent year available (2009) and a 5-year window between 2005-2009.

[33] These indices were calculated using annual count data from 2011 and crash and injury data from 2009 for the annual index and from 2005-2009 for the 5-year window index.

8. SUMMARY

In the past decade, UC Berkeley and the City of Berkeley have adopted numerous policy documents that emphasize the importance of improving pedestrian and bicycle conditions in and around the UC Berkeley campus. This Pedestrian and Bicycle Safety Implementation Strategy for the UC Berkeley Campus Periphery document recommends concrete actions that can be taken to achieve the vision established by these overarching policies. Many of the recommendations in this implementation strategy are already supported by previous UC Berkeley or City of Berkeley documents. The framework established in this document identifies which projects could be addressed first and will help build momentum for future improvements. The implementation strategy also provides additional ideas that can be considered in future public discussions of how to make even greater pedestrian and bicycle access and safety improvements in the vicinity of campus. Ultimately, this collaborative effort between UC Berkeley and the City of Berkeley will help improve the sustainability of travel and reduce pedestrian and bicycle injuries near the UC Berkeley campus.

California Walks and the UC Berkeley Safe Transportation Research & Education Canter led a Community Pedestrian Safety Training Workshop in Berkeley in September 2011. Ideas from public meetings and community workshops can help identify and prioritize future pedestrian and bicycle safety improvements on and near campus. Photo credit: Phyllis Orrick

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Appendix A. Existing Plan Policies Supporting Pedestrian and Bicycle Safety Improvements near UC Berkeley Campus

Both the City of Berkeley and UC Berkeley support efforts to improve pedestrian and bicycle safety. This is shown by many general policy recommendations in previous planning documents.

City of Berkeley General Plan (2001)

- Objective 6 of the General Plan, Transportation Element is: "Create a model bicycle- and pedestrian-friendly city where bicycling and walking are safe, attractive, easy, and convenient forms of transportation and recreation for people of all ages and abilities."
- "Policy T-4, Transit-First Policy: Give priority to alternative transportation and transit over single-occupant vehicles on Transit Routes on the Transit Network map." Primary Transit Routes include: Shattuck Avenue, University Avenue, Hearst Avenue, Oxford Street, Gayley Road, Bancroft Way, Durant Street, Telegraph Avenue, and College Avenue. Secondary Transit Routes include: Dwight Way, Piedmont Avenue, and Warring Street.
- "Policy T-12, Education and Enforcement: Support, and when possible require, education and enforcement programs to encourage carpooling and alternatives to single-occupant automobile use, reduce speeding, and increase pedestrian, bicyclist, and automobile safety."
- "Policy T-13, Major Public Institutions: Work with other agencies and institutions, such as the University of California…Lawrence Berkeley Laboratory…to promote Eco-Pass and to pursue other efforts to reduce automobile trips."
- "Policy T-18, Level of Service: When considering transportation impacts under the California Environmental Quality Act, the City shall consider how a plan or project affects all modes of transportation, including transit riders, bicyclists, pedestrians, and motorists, to determine the transportation impacts of a plan or project. Significant beneficial pedestrian, bicycle, or transit impacts, or significant beneficial impacts on air quality, noise, visual quality, or safety in residential areas, may offset or mitigate a significant adverse impact on vehicle Level of Service (LOS) to a level of insignificance. The number of transit riders, pedestrians, and bicyclists potentially affected will be considered when evaluating a degradation of LOS for motorists." This policy includes the following action: "Establish new multi-modal levels of service (LOS) City standards that consider all modes of transportation, including transit, bicycles, and pedestrians in addition to automobiles."
- "Policy T-21, Speed Limits: Pursue changes to State regulations to allow cities to enforce a 15- or 20-mile-per-hour speed limit."
- "Policy T-38, Inter-Jurisdictional Coordination: Establish partnerships with adjacent jurisdictions and agencies, such as the University of California and the Berkeley Unified School District, to reduce parking demand and encourage alternative modes of transportation." This includes the following action: "Promote bicycle and pedestrian travel through training, education, incentive programs, and physical improvements such as path improvements and signage, bicycle lockers, and shower facilities."

- "Policy T-42, Bicycle Planning: Integrate the consideration of bicycle travel into City planning activities and capital improvement projects, and coordinate with other agencies to improve bicycle facilities and access within and connecting to Berkeley."
- "Policy T-43, Bicycle Network: Develop a safe, convenient, and continuous network of bikeways that serves the needs of all types of bicyclists, and provide bicycle-parking facilities to promote cycling."
- "Policy T-44, Bicycle Safety: Improve bicycle safety for riders, pedestrians, and drivers through continuing education of motorists and bicyclists as well as rigorous enforcement of laws for both bicyclists and automobile drivers."
- "Policy T-45, Bicycle Promotions: Promote bicycle use by increasing public awareness of the benefits of bicycling and of the available bike facilities and programs."
- "Policy T-46, Bicycle Funding: Secure sufficient resources from all available sources to fund ongoing bicycle improvements and education."
- "Policy T-49, Disabled Access: Improve pedestrian access for the entire disabled community." This includes an action to: "Fund sidewalk, crosswalk, curb, signalization and signage, and talking signal improvements."
- "Policy T-50, Sidewalks: Maintain and improve sidewalks in residential and commercial pedestrian areas throughout Berkeley and in the vicinity of public transportation facilities so that they are safe, accessible, clean, attractive, and appropriately lighted."
- "Policy T-51, Pedestrian Priority: When addressing competing demands for sidewalk space, the needs of the pedestrian shall be the highest priority."
- "Policy T-52, Pedestrian Safety and Accessibility: Provide safe and convenient pedestrian crossings throughout the city." This includes the following actions:
    - "A. Seek to ensure that the distance between signal-controlled intersections, 'smart crosswalks,' or stop signs is never more than one-quarter mile on major and collector streets. At intersections with severe or high pedestrian/automobile collision rates and at heavily used pedestrian crossings, consider all-way stop signals that allow the free flow of pedestrians through the intersection, 'smart' signals to calm traffic and improve intersection safety, and pedestrian/bicycle-activated signals that allow bikes and pedestrians to cross busy streets without inviting traffic onto cross streets."
    - "B. Consider pedestrian crosswalk 'runway' lights in the pavement at intersections with severe or higher than average pedestrian collision rates."
    - "C. Encourage and educate the public on the use of painted and unpainted crosswalks; enforce jaywalking regulations on main arterials."
    - "D. Encourage the creation of accessible pedestrian medians or islands in wide streets where people have to cross more than two lanes."
    - "E. Enforce pedestrian right-of-way laws."
- "Policy T-53, Intersections with Severe or High Collision Rates: Reduce pedestrian and bicycle collisions, injuries, and fatalities." This includes an action to: "Undertake a review of intersections or street locations with a high number of collisions and/or a high percentage of fatal or permanently disabling collisions and develop programs with appropriate mix of education, enforcement, and engineering changes to improve the safety of these intersections and locations." The following recommendations should be considered:

- “1. Adding signage at intersections, warning the public that the intersection has been the site of several traffic collisions or fatalities.”
    - “2. Moving bus stops to the far side of the intersection so that buses do not block visibility at the intersection when stopping to pick up passengers.”
    - “3. Providing an all-red, pedestrian phase to especially congested intersections, giving pedestrians the ability to cross the intersection in any direction before vehicles are given a green light.”
    - “4. Lighted crosswalks.”
    - “5. Maintaining a minimum 50-foot red, no-parking zone adjacent to the intersection to increase visibility.”
    - “6. Re-timing pedestrian crossing signals to allow more time for pedestrian crossing.”
    - “7. Other actions recommended by the Bicycle and Pedestrian Safety Report.”

City of Berkeley Bicycle Master Plan (2005)

- “Mission Statement: To create a model bicycle-friendly city where bicycling is a safe, attractive, easy, and convenient form of transportation and recreation for people of all ages and bicycling abilities.”
- “Goal 1, Planning: Integrate the consideration of bicycle travel into City planning activities and capital improvement projects, and coordinate with other agencies to improve bicycle facilities and access within and connecting to Berkeley.”
- “Goal 2, Network and Facilities: Develop a safe, convenient, and continuous network of bikeways that serves the needs of all types of bicyclists, and provide bicycle parking facilities to promote cycling.”
- “Goal 3, Education/Safety: Improve the safety of bicyclists through education and enforcement.”
- “Goal 4, Promotion: Increase bicycle mode share by increasing public awareness of the benefits of bicycling and of the available bike facilities and programs.”
- “Goal 5, Implementation: Secure sufficient resources from all available sources to fund ongoing bike improvements and education.”

City of Berkeley Pedestrian Master Plan (2010)

- “Goal 1: Plan, Build and Maintain Pedestrian Supportive Infrastructure.” (p. 2-2)
- “Goal 2: Provide Universally Safe and Equal Access.” (p. 2-5)
- “Goal 3: Develop Pedestrian Supportive Encouragement and Enforcement Programs.” (p. 2-8)

City of Berkeley Southside Plan (2011)

- The three overarching goals of the Southside Plan, Transportation Element are:
    - “Increase the quality, amenity, and use of all non-automobile modes.”
    - “Reduce the number of trips to, from, and through the Southside made in single-occupant automobiles.”
    - “Improve pedestrian and bicycle safety.” (pp. 63-64)
- “Objective T-C: Improve travel and safety conditions for bicyclists and pedestrians.” (p. 89)

- "Policy T-C6: Ensure that improved pedestrian and bicycle safety is included as a significant objective in all further studies of, and changes to, the Southside circulation pattern." (p. 89)
- "Objective T-D: Calm and guide traffic throughout the Southside." (p. 90)
- "Objective T-F3: Improve pedestrian access to the [Telegraph Avenue commercial district] and pedestrian travel within the district." (p. 93)
- "Objective T-F4: Improve bicycle access to the [Telegraph Avenue commercial district] per the City of Berkeley Bicycle Plan." (p. 93)
- "Objective T-G: Develop a trip reduction strategy, including a methodology to monitor and measure performance, to achieve a quantified reduction in single-occupant vehicle trips to the Southside (including trips to Southside parking sites)." (p. 94)
- "Objective T-I: Encourage more housing in the Southside in order to reduce auto trips to the area and facilitate travel on foot and by bike." (p. 95)

City of Berkeley Downtown Area Plan (2011 Draft)

- The Strategic Statement of the Downtown Area Plan Access chapter includes the following theme: "Give priority to transit, pedestrians, and bicyclists, while reducing automobile use, especially by commuters." (p. AC-1)
- Goal AC-1 is: "Improve options that increase access to Downtown on foot, by bicycle, and via transit. Make living, working, and visiting Downtown as car-free as possible."
- Policy AC-1.1, part e) states: "Evaluate street network changes from the perspective of the needs, safety, and comfort of bicyclists and pedestrians, including changes to lanes and turning movements. Where accommodations for private automobiles and accommodations for pedestrians are in conflict, decisions should reflect the priority of the pedestrian. Accept that improvements may result in slowing down vehicular traffic."
- Goal AC-2 is: "Give pedestrians priority in downtown, and make walking downtown safe, attractive, easy, and convenient for people of all ages and abilities."
- Goal AC-3 is: "Provide parking to meet the needs of Downtown, while discouraging commuter parking and encouraging motorists to park their cars and experience Downtown as a pedestrian."
- Goal AC-5 is: "Maintain and enhance safe, attractive, and convenient bicycle circulation within Downtown, and to and from surrounding areas, for people of all ages and abilities. Promote bicycling Downtown."
- Goal OS-1 is: "Enhance public open spaces and streets to benefit pedestrians, improve Downtown's livability, and foster an exceptional sense of place. In particular, create new public gathering places that support nearby uses and downtown as a destination."
- Goal OS-4 is: "Ensure that parks, plazas, streets, walkways, and other publicly accessible open spaces are safe, comfortable, and inviting."

UC Berkeley 2020 Long Range Development Plan (2005)

- Policy: "Locate all new university housing within a mile or within 20 minutes of campus by transit." The center of campus is defined as Doe Library.
- Policy: "Reduce demand for parking through incentives for alternate travel modes. Collaborate with cities and transit providers to improve service to campus."

- Policy: “Implement a program of strategic investment in Campus Park pedestrian and bicycle routes,” and “Ensure the Campus Park provides full access to users at all levels of mobility.”
- Policy: “Minimize private vehicle traffic in the Campus Park,” and “Locate new campus parking at the edge or outside the Campus Park.”
- “The longterm goal for the campus should be to limit access to internal routes to two points, east and west gate, and by permit only from 8 am to 5 pm, to minimize vehicular movement on campus during peak times of instruction.” (p. 46)
- Policy: “Partner with the City and Lawrence Berkeley National Laboratory on an integrated program of access and landscape improvements at the Campus Park edge.” According to this policy, “The streets that define the Campus Park—Bancroft, Oxford/Fulton, Hearst, and Gayley/Piedmont—should be re-envisioned as ‘seams’ linking the Campus Park and its adjacent blocks, rather than dividers. UC Berkeley should collaborate with the City of Berkeley and Lawrence Berkeley National Laboratory to define, and jointly seek funds for, an integrated program of capital investments to improve the visual quality, pedestrian safety, functionality, amenity, bicycle access and transit service on these streets” (p. 46).

Draft Environmental Impact Report: UC Berkeley 2020 Long Range Development Plan & Chang-Lin Tien Center for East Asian Studies

- “The City of Berkeley does not maintain a traffic LOS standard, but has adopted a policy in the General Plan that requires development of a multi-modal level-of-service measurement that treats all travel modes equitably” (Section 4.12, p. 10).

UC Berkeley New Century Plan (2003)

- Strategic Goal: “Capital investment shall both optimize access to campus programs and resources and maintain the primacy of the pedestrian, by:
    - Establishing a program of strategic investments to upgrade major pedestrian routes into and within the core campus
    - Creating a network of campus access routes that serve users of all levels of mobility
    - Collaborating with the City and Lawrence Berkeley Laboratory on integrated landscape and access improvement programs at the campus perimeter
    - Restricting service and delivery vehicles to designated times and routes
    - Consolidating core campus parking in structures outside or at the edge of the core campus.” (p. 47)
- Initiative 5.2: “Collaborate with the City on an integrated program of access and landscape improvements at the campus perimeter. Hearst, Oxford and Bancroft should be envisioned as ‘seams’ linking campus and community, rather than borders dividing them. The campus should take the initiative with the city to develop, and seek funding for, a joint program of investments to improve the visual quality, pedestrian safety and amenity, and transit service on these streets. Specific elements may include:
    - Redesigned intersections to improve pedestrian safety,
    - Removal of curbside parking to create wider sidewalks, enhanced landscaping and/or bike lanes,
    - Improvements to make transit service more convenient and comfortable,

    - A coherent landscape and lighting treatment along each street, and
    - Improved landscaping, paving and lighting at major campus gateways" (p. 49-50).

UC Berkeley Campus Bicycle Plan (2006)

- "Goal, Integrate Bicycling: UCB wants to make bicycling a routine part of campus planning, design, and construction activities. The intent is to weave bicycle riding into the fabric of the campus and the adjacent community" (p. 13).

UC Berkeley Campus Sustainability Plan (2009)

- Overall transportation goal: "By 2014, reduce fuel use by commuters and campus fleet to 25% below 1990 levels."
- Transportation Strategy 2: "Reduce demand for parking through incentives for alternate travel modes."
- Transportation Strategy 3: "Locate all new University housing within a mile or within 20 minutes of campus by transit."
- Transportation Strategy 4: "Implement a program of strategic investment in campus pedestrian and bicycle routes."
- Transportation Strategy 5. "Continue strategic bicycle access planning."
- Transportation Strategy 6. "Develop a strategic pedestrian improvement plan."

UC Berkeley Climate Action Plan (2009)

- Action related to faculty/staff commuting: "Decrease drive alone rate" (p. 24).
- Action related to student commuting: "Decrease drive alone rate" (p. 24).
- Behavioral project related to commuting: "Implement High Priority Bicycle Plan Projects & Programs" (Appendix B).

UC Berkeley Landscape Master Plan (2004)

- Policy 6-1: "Plan, design and manage routes within the central campus for the primary use of pedestrians. Where space permits, access routes for various types of vehicles shall be established separating pedestrians from vehicular traffic."
- Policy 6-2: "Integrate universal access standards with the most feasible routes relative to terrain and landscape quality, in providing equal access for disabled and able-bodied persons in the design of new and renovated facilities."
- Policy 6-3: "Designate two north-south cross campus bicycle routes to convey high traffic volumes and locate consolidated free bicycle parking in secure lots along these routes."

UC Berkeley and City of Berkeley 2020 Long Range Development Plan Litigation Settlement Agreement (2006)

- "Beginning July 31, 2006, UC Berkeley agrees to make an annual allocation of $1.2 million to the City for the term of the 2020 LRDP…This annual contribution will be increased annually by 3%." This amount includes $200,000 annually for "joint UC Berkeley and City of Berkeley Transportation Demand Management and pedestrian improvement programs, studies, and projects, including, but not limited to, new or improved signage, which allocation does not require the City to provide matching funds" and $200,000 annually for "projects that benefit City neighborhoods."

Appendix B. Detailed Description of Background Data

Database Summary Table

Analysis	Code	Variable Description	Units
Walking along the roadway			
	AP	Average posted speed	mph
	L	Lanes per direction	count
	S/W	Striped shoulder or bicycle lane width	feet
	MV/V	Main street AADT in both directions	volume/day
	SP	Sidewalk presence	binary
Bicycling along the roadway			
	AP	Average posted speed	mph
	L	Lanes per direction	count
	PP	On-street parking coverage	percentage
	S/W	Striped shoulder or bicycle lane width	feet
	MV/V	Main street AADT in both directions	volume/day
Reported bicycle crashes			
	B	Reported bicycle crash density	crashes/km^2
Pedestrian roadway crossing			
	CD	Crossing distance	feet
	M	Raised median island at crossing	binary
	RR	No right turn on red allowed	percentage
	SC	Stop control at four-way crossing	weighted percentage
	SG	Signal control at crossing	weighted percentage
	XL	Cross street number of lanes	averaged count
	XV	Cross street single direction AADT	volume/day
	XS	Cross street 85^{th} percentile speed	mph
Bicycle roadway crossing			
	BL	Bicycle lane present	binary
	CV	Cross street AADT	volume/day
	HS	Main street speed limit ≥ 35 miles per hour	binary

MV/V	Main street AADT in both directions	volume/day
PC	On street parking on intersection approach, greater than 25% coverage	binary
RL	Number of right-turn lanes on intersection approach	averaged count
TV	Turning vehicles across bicycle movement	average
SI	Signalized intersection	weighted percentage
Approximate pedestrian activity		
DB	Distance to BART station	meters
DC	Distance to major campus entrance	meters
DZ	Distance to commercial zone boundary	meters
OB	Operation bus stops in a 24-hour period	count
OP	Off-street parking spaces	count
PD	Population density of adjacent blocks	population/mi^2
WC	Within a commercial zone	binary
Approximate bicycle activity		
DB	Distance to BART station	meters
DC	Distance to major campus entrance	meters
DF	Distance to existing bicycle facility	meters
DZ	Distance to commercial zone boundary	meters
OB	Operation bus stops in a 24-hour period	count
OP	Off-street parking spaces	count
PD	Population density of adjacent blocks	population/mi^2
WC	Within a commercial zone	binary
Reported pedestrian crashes		
P	Reported pedestrian crash density	crashes/km^2
Other variables		
	Bicycle parking infrastructure present	binary
	Population density of street corridor	population/mi^2
	Pedestrian collisions per street corridor	crashes/corridor

Data Collection Description

Average posted speed (mph)

Definition: Posted speed limit was used as a proxy for average speed along a street block and corridor.

Process: The speed limit was collected for each block along a street corridor. Street blocks' speed limits were weighted by the length of the block as a percentage of the street corridor's length and then averaged to calculate the average posted speed limit on the corridor.

Bicycle lane present

Definition: Determination of whether bicycle lanes, routes, or boulevards are present along a street block. Bicycle lanes and boulevards are defined as any form of street intervention that is intended for bicyclists to share a part of a street with automobiles. For example, signs of bicycles marked on the ground or specially marked lanes on the street. A bicycle route is defined as a street corridor that has no bicycle street interventions but serves the same function as a bicycle lane or boulevard.

Process: Bicycle lane, boulevard, and route data was obtained from the City of Berkeley website (http://www.ci.berkeley.ca.us/uploadedFiles/Public_Works/Level_3_-_General/Bikeway_Network.pdf), accessed March 2011.

Bicycle parking infrastructure present

Definition: Any installed structures for bicycles to allow secure bicycle parking.

Process: Bicycle parking infrastructure information was collected through field research along street corridors.

Crossing distance (ft)

Definition: Crossing distance is defined as the shortest possible length between one end of a sidewalk to another.

Process: Distances of pedestrian crossing locations were calculated using ArcGIS. In marked crosswalks the distance is the shortest crosswalk marking line visible. Where a pedestrian crossing involved any form of median, only the distance crossing travel lanes for each segment of the crossing was calculated to generate the shortest possible pedestrian trip across all lanes of travel. If a pedestrian crossing was unmarked or worn-out, the crossing length was approximated by measuring from the edge of one sidewalk to the other sidewalk edge.

Cross street annual average daily traffic in both directions (AADT)

Definition: AADT of cross street at intersection in both directions

Process: Based on AADT estimates by the City of Berkeley, collected annually.

Distance to BART station (m)
Definition: The straight-line distance from the centroid of a street block to the nearest BART station.

Process: In ArcGIS, street blocks are converted to points at their centroid and the distance from the centroid to the BART station is measured.

Distance to major campus entrance (m)
Definition: The straight-line distance from the centroid of a street block to the nearest campus entrance at UC Berkeley.

Process: In ArcGIS, street blocks are converted to points at their centroid and the distance from the campus entrance to the centroid is measured.

Distance to existing bicycle facility (m)
Definition: The straight-line distance from the centroid of a street block to the nearest bicycle facility.

Process: In ArcGIS, street blocks are converted to centroids and the distance from the campus entrance to the centroid is measured.

Distance to commercial zone boundary (m)
Definition: The straight-line distance from the centroid of a street block to the nearest edge of a commercial area, as defined by the City of Berkeley.

Process: Commercial zone data is obtained from the City of Berkeley. In ArcGIS, street blocks are converted to centroids and the distance from the centroid to the nearest edge of the commercial zone is measured. If a block has commercial areas on the same block, but it covers less than half of the entire street length, the distance from the centroid to the nearest commercial area boundary line is measured as the distance. If more than half the street length is within the commercial area, the distance is assigned as zero meters.

Main street speed limit greater than or equal to 35 miles per hour
Definition: The posted speed limit of a street corridor is greater than or equal to 35 miles per hour.

Process: Based on published speed limits from the City of Berkeley. The prevailing speed limit for the entire street corridor is used to determine the corridor speed limit.

Lanes per direction
Definition: The number of lanes on a street in each direction.

Process: The data is based on GIS data from the City of Berkeley and is at the street block level. The street corridor lanes per direction variable is calculated by weighting the number of lanes by the street block distance over the entire corridor.

Raised median island at crossing

Definition: Presence of elevated pavement in the street that either separates the different directionalities of automobile traffic or different lanes going in the same direction (as, for example, in the case of a median island separating a right turn lane).

Process: Median island locations were collected through field research in the campus periphery area.

Main street AADT in both directions

Definition: Average annual daily traffic on street corridors in both directions.

Process: AADT data is based on estimates by the City of Berkeley. However, due to inconsistencies in some of data, expert judgment was used to provide a rough estimate of traffic volumes for problematic corridors.

Operational bus stops in a 24-hour period (number)

Definition: The number of scheduled operational stops made by buses on a street block or corridor on a weekday over a 24-hour period.

Process: The data includes both AC Transit and UC Shuttle (Bear Transit) operational stops. AC Transit operates nearly 20 routes throughout the UC campus periphery area, with the high density of stops along Shattuck Avenue, Addison Street, Bancroft Way, and Durant Avenue. AC Transit data was collected using route schedules from 2011 provided by AC Transit. Terminal bus stops are calculated as one trip rather than the last stop of one run and the first stop of the next. This data was cross-checked with Google Transit information to ensure accuracy. Where a bus stopped in the middle of a three-way intersection, the stop was assigned to the segment closest to the bus stop. Bear Transit data was counted using bus schedules provided by UC Berkeley Parking and Transportation and adding the number of stops made by each shuttle on a street block. The data was then aggregated from both AC Transit and Bear Transit by summation to the street corridor level. The data was also aggregated at the block and corridor level by directional travel for future analysis.

Off-street parking spaces (number)

Definition: The total number of parking spaces in either City of Berkeley or UC Berkeley parking structures along the street corridors.

Process: The location of parking structures in Berkeley is based on accessing the Campus Parking Lot Map accessed through the UC Berkeley Parking and Transportation site (http://pt.berkeley.edu/park). The parking spaces are allocated to street blocks based on whether vehicles enter or exit the parking structure on that block. The number of parking spaces in UC Berkeley parking structures was provided from the same web map while the City of Berkeley parking structures parking information was provided by the City of Berkeley website (http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=8260). The total amount of parking spaces available along a street corridor is the sum of the parking spaces along the blocks making up the corridor.

Reported pedestrian crash density (crashes/km^2)

Definition: The highest value of pedestrian crash densities along a street block. Crash density is defined as the number of crashes per square kilometer.

Process: Crash data from the Statewide Integrated Traffic Records System (SWITRS) were brought into ArcGIS where the Kernel Density spatial analysis tool was used to calculate the magnitude of pedestrian crashes per square kilometer using a five square meter grid cell and a 150 meter search radius. Once the densities were calculated, the maximum pedestrian crash density value along a street block was assigned to the block.

Reported bicycle crash density (crashes/km^2)

Definition: The highest value of bicycle crash densities along a street block. Crash density is defined as the number of crashes per square kilometer.

Process: Crash data from the Statewide Integrated Traffic Records System (SWITRS) were brought into ArcGIS where the Kernel Density spatial analysis tool was used to calculate the magnitude of bicycle crashes per square kilometer using a five square meter grid cell and a 150 meter search radius. Once the densities were calculated, the maximum bicycle crash density value along a street block was assigned to the block.

On street parking on intersection approach, greater than 25% coverage

Definition: Presence of greater than 25% parking coverage on block approaching intersection.

Process: For each block approaching an intersection, the parking coverage percentage was estimated for each side of the block. The coverage was estimated according to the availability of parking space in relation to the number of vehicles parked in the available parking spaces. The type of parking was also noted including metered, 2-hour parking, and blue, yellow, or white curb zones. The data was collected using Google Earth and Google Streetview. The data was then limited to areas with greater than 25% parking coverage approaching an intersection.

Population density of adjacent blocks (pop/mi^2)

Definition: The population density in square miles of the adjacent land on either side of a street block or corridor weighted by the relative length between the street block or corridor and the city block perimeter.

Process: The data for population density was obtained from ESRI's Census 2000 website (http://www.esri.com/data/esri_data/census2000.html) which provides the Census 2000 data from the U.S. Bureau of the Census[34][35]. Street blocks were divided base on the street network in

[34] The Census 2000 data is used for this research and, as a result, the population density for the Channing-Bowditch apartments was not included because they were built in 2003. According to the census data, there are 14 people who lived on that block, but the Channing-Bowditch apartments currently house approximately 220 students. However, because our study spans a range of 10 years (1999-2008 currently, we continued with the Census 2000 data for that block.

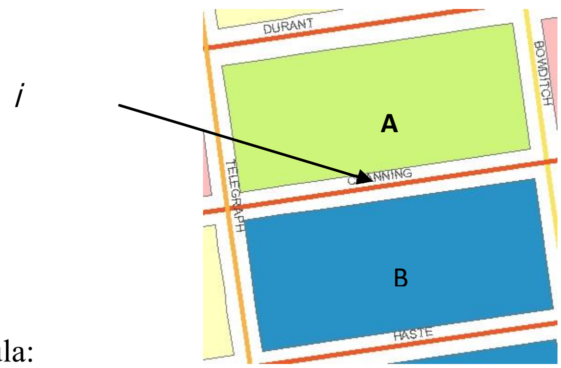
[35] The population density data regarding the two campus dormitories (Foothill and Stern) located at Gayley and/or Hearst were manually imputed because the Census 2000 did not include such information. In the case of the Foothill dormitory, the La Loma Complex is situated on the Highland/Gayley/La Loma/Hearst block. Due to lack of information, we decided to allocate 25% of the total population of Foothill to the La Loma Complex. Information regarding the Bowles Dorm was not included due to lack of information.

the SafeTREC GIS database with the exception of parts of Bancroft, Gayley, Oxford and Hearst where they intersect with minor UC Berkeley campus roads. The length of these streets blocks were added to the length of nearby street blocks which together form one street block on the other side of campus. Population density per street block was calculated using the following process:

1. For each street block length i, there are two blocks, one on each side. Each block is arbitrarily labeled A and B. For each A and B, we find the perimeter (P) and population density (D).
2. The street block length L_i is divided by the perimeter of A and B to obtain the percentage of the street block length in relation to the entire block.
3. This percentage is then multiplied by the density of each block.
4. Finally, the density from both blocks are summed to get the density of the street block D_i.

List of variables and clarifying image for calculating Population Density per Street Block:

A	Block A
B	Block B
P_A	Perimeter of A
P_B	Perimeter of B
D_A	Population Density of A
D_B	Population Density of B
i	Street-Block index
L_i	Length of Street-block i
D_i	Population density per Street-block i



Population Density per Street Block Formula:

$$D_i = {}^{L_i}/_{P_A} \times D_A + {}^{L_i}/_{P_B} \times D_B$$

Population density of street corridor (pop/mi^2)

Definition: Average street block density weighted by street block length for all blocks in a street corridor.

Process: The calculation for the population density of the street corridor requires the calculation of the population density of the street block as well as the calculation of the relative weight percentage of each street block on the corridor to the overall street corridor using the formula below where i is the street block, n is the number of street blocks in the street corridor, L_i is the length of street block i and w_i is the weighted length of street block i.

$$w_i = {}^{L_i}/_{\sum_{i=1}^{n} L_i}$$

The weighted length of the street block is then multiplied by the population density of the street corridor and summed with all blocks along a street corridor to obtain the population density per street corridor D_s as in the formula below.

$$D_S = \sum_{i=1}^{n} w_i D_i$$

On-street parking coverage (%)

Definition: Percentage of a block covered by parking.

Process: For each block the parking coverage percentage was estimated for each side of the block. The coverage was estimated according to the availability of parking space in relation to the number of vehicles parked in the available parking spaces. The type of parking was also noted including metered, 2-hour parking, and blue, yellow, or white curb zones. The data was collected using Google Earth and Google Streetview.

Number of right-turn lanes on intersection approach (average)

Definition: Average number of right-turn lanes per intersection along the street corridor.

Process: Field observations were done to count the number of right-turn lanes on approach to an intersection. These counts were then totaled for all intersections along a street corridor and then divided by the number of intersections along the corridor.

No right turn on red allowed (%)

Definition: Percentage of intersections along a street corridor that do not allow right turn on red.

Process: Field observations taken to identify intersections with no right turn on red. These counts were then totaled and then divided by the total number of intersections along the corridor to obtain the percentage of no right-turn on red allowed intersections along the street corridor.

Striped shoulder or bicycle lane width (ft)

Definition: The width of a bicycle lane or striped shoulder along a street block or corridor.

Process: Two measurements were made to determine the striped shoulder or bicycle lane widths:

1. Outside Lane Width – the width of the lane of moving traffic that is closest to the curb on either side of the road
2. Outside Lane-to-Curb Width – the Outside Lane Width plus any bike lane, parking lane, or space between a lane divider and the regular travel lane(s).

The striped shoulder or bicycle lane width is the difference between the Outside Lane-to-Curb Width and the Outside Lane Width.

Stop control at four-way crossing (%)

Definition: Percentage of intersections that had stop control at four-way crossings.

Process: Field observations were made to identify whether an intersection has an all-way stop. These counts were then totaled and divided by the total number of intersections along the corridor to obtain the percentage of intersections with stop control at four-way crossings

Note: For calculations of stop control at crossing in the prioritization analytic process, stop control at four-way crossings was used as a proxy for stop control at all types of crossings due to the minimal number of non-four-way crossings.

Signalized intersection (%)
Definition: Percentage of signalized intersections along a corridor.

Process: Field observations are made to identify whether intersections were signalized along a street corridor. These intersection counts were summed and then divided by the total number of intersections to generate the percentage of all intersections along a corridor that are signalized.

Signal control at crossing (%)
Definition: Percentage of pedestrian crossings that are signalized along a corridor.

Process: Field observations are made to identify whether there is signal control at a pedestrian crossing along a street corridor. These counts are then summed and divided by the total number of intersections/pedestrian crossings to generate the percentage of all pedestrian crossings that have signal control along a corridor.

Sidewalk presence
Definition: Presence of elevated pavement along the side of a street that separates automobile traffic and/or cycling traffic from other pedestrian usage.

Process: Field research along street blocks with presence or absence of sidewalk noted. If the sidewalk was complete on both sides of the road, a value of one was assigned to the block, if the sidewalk was complete only on half of the street or there were significant gaps in the sidewalk on one side of the block, it was assigned a value of 0.5, if there was not sidewalk present or the sidewalk contained significant gaps along both sides of the block the block was assigned a value of zero. For the street corridor level, these assignments were then summed together and divided by the number of street blocks in the corridor to generate the average percentage of blocks where sidewalks were present.

Turning vehicles across bicycle movement
Definition: Presence or absence of right-turning vehicles across the path taken by a through bicyclist at an intersection.

Process: Field observations were taken at intersections along street corridors to identify locations with vehicles crossing bicycle movement. The variable is assigned "1" if the path of the through bicyclist would be crossed or zero if there would there is a lack of turning through the bicyclist's path as in the case of a bike lane crossover. These values are then summed over the entire street corridor and divided by the total number of intersections along the street corridor.

Within a commercial zone
Definition: Commercial zones are those areas generally zoned for commercial use with commercial uses present.

Process: Commercial zones were determined using expert judgment to delineate the areas based on City of Berkeley land use maps and existing commercial uses.

Cross street number of lanes

Definition: The number of through lanes in both directions on a cross street of a street corridor.

Process: Based on GIS data obtained from the City of Berkeley.

Cross street single direction AADT

Definition: AADT of cross street at intersection in a single direction

Process: Based on AADT estimates by the City of Berkeley, collected annually. If the street is one-way the total AADT is used for the street. If the street is bidirectional, the volume is divided by two to provide the AADT for a single direction.

Bicycle collisions per street corridor

Definition: The total number of bicycle collisions occurring along a street corridor.

Process: Obtain crash data for bicycle collisions through the City of Berkeley Police Department. This data pinpoints the location of where the collision happened along the street corridor. The total number of bicycle collisions per street corridor is then calculated by adding the bicycle collisions that occurred along and within 50 feet of the street corridor.
Notes: In order to address bicycle collisions at intersections, a buffer of 50 feet was placed on each block, therefore some bicycle collisions are counted twice-at both intersections.

Other Data Collected

Total count of pedestrians at annual count intersections (number)

Definition: Count of pedestrians each time they cross a leg of an intersection.

Process: Counts should occur on a typical weekday during the fall semester when school is in session. Pedestrian should be counted each time they cross a leg of the intersection (within 50 feet of the crosswalk). The annual count intersections should include: Hearst Avenue & Euclid Avenue, Hearst Avenue & Oxford Street, Oxford Street & Center Street, Bancroft Way & Fulton Street, Bancroft Way & Dana Street, Bancroft Way & Telegraph Avenue, Durant Avenue & Bowditch Street, and Gayley Road & Stadium Rim Way. For detailed instructions on conducting pedestrian intersection counts, see Appendix E.

Total count of bicyclists at annual count intersections (number)

Definition: Count of bicyclists each time they arrive at an intersection from any approach.

Process: Counts should occur on a typical weekday during the fall semester when school is in session. Bicyclists should be counted each time they arrive at the intersection from any approach leg. Bicyclists who are riding against traffic or on the sidewalk should be included. Bicyclists include people riding bicycles. People who are walking their bicycles are not included. The annual count intersections include: Hearst Avenue & Euclid Avenue, Hearst Avenue & Oxford Street, Oxford Street & Center Street, Bancroft Way & Fulton Street, Bancroft Way & Dana Street, Bancroft Way & Telegraph Avenue, Durant Avenue & Bowditch Street, and Gayley Road & Stadium Rim Way. For more detailed instructions on conducting pedestrian and bicyclist intersection counts, see Appendix E.

Appendix C. Prioritization Sensitivity Analysis for Top Five Street Corridors

A sensitivity analysis was conducted to determine the impact of assigning different proportions to street corridor scores for the three main categories of suitability, approximated activity, and crash density. One possible combination was 33% suitability, 33% approximated activity, and 33% crash density. The following tables show the overall score that was produced using different combinations for the five street corridors that typically had the highest overall scores for crossing the roadway (e.g., had the worst suitability for crossing, greatest pedestrian activity, and most reported pedestrian crashes). For example, a combination of 5% suitability, 5% approximated activity, and 90% crash density would produce a score of 94 for Shattuck Avenue (upper left cell of first table, below). This analysis showed that many different combinations produced similar overall scores for the roadway corridors.

Pedestrian roadway crossing

	Shattuck																		
	Weight for approximate pedestrian activity																		
Weight for pedestrian crossing the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	94	94	95	95	95	96	96	96	97	97	97	98	98	98	99	99	99	100	100
10%	94	95	95	95	96	96	96	97	97	97	98	98	98	99	99	99	100	100	
15%	95	95	95	96	96	96	97	97	97	98	98	98	99	99	99	100	100		
20%	95	95	96	96	96	97	97	97	98	98	98	99	99	99	100	100			
25%	95	96	96	96	97	97	97	98	98	98	99	99	99	100	100				
30%	96	96	96	97	97	97	98	98	98	99	99	99	100	100					
35%	96	96	97	97	97	98	98	98	99	99	99	100	100						
40%	96	97	97	97	98	98	98	99	99	99	100	100							
45%	97	97	97	98	98	98	99	99	99	100	100								
50%	97	97	98	98	98	99	99	99	100	100									
55%	97	98	98	98	99	99	99	100	100										
60%	98	98	98	99	99	99	100	100											
65%	98	98	99	99	99	100	100												
70%	98	99	99	99	100	100													
75%	99	99	99	100	100														
80%	99	99	100	100															
85%	99	100	100																
90%	100	100																	
95%	100																		

	University																		
	Weight for approximate pedestrian activity																		
Weight for pedestrian crossing the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	82	83	83	83	84	84	84	85	85	85	85	86	86	86	87	87	87	87	88
10%	83	83	84	84	84	85	85	85	85	86	86	86	87	87	87	87	88	88	
15%	84	84	84	85	85	85	85	86	86	86	87	87	87	87	88	88	88		
20%	84	85	85	85	85	86	86	86	87	87	87	87	88	88	88	89			
25%	85	85	85	86	86	86	87	87	87	87	88	88	88	89	89				
30%	85	86	86	86	87	87	87	88	88	88	88	89	89	89					
35%	86	86	87	87	87	88	88	88	88	89	89	89	90						
40%	87	87	87	88	88	88	88	89	89	89	90	90							
45%	87	88	88	88	88	89	89	89	90	90	90								
50%	88	88	88	89	89	89	90	90	90	90									
55%	88	89	89	89	90	90	90	90	91										
60%	89	89	90	90	90	91	91	91											
65%	90	90	90	91	91	91	91												
70%	90	91	91	91	91	92													
75%	91	91	91	92	92														
80%	91	92	92	92															
85%	92	92	93																
90%	93	93																	
95%	93																		

	Shattuck SQ																		
	Weight for approximate pedestrian activity																		
Weight for pedestrian crossing the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	91	91	91	92	92	93	93	93	94	94	95	95	95	96	96	97	97	97	98
10%	89	90	90	90	91	91	92	92	92	93	93	94	94	94	95	95	96	96	
15%	88	88	89	89	89	90	90	91	91	91	92	92	93	93	93	94	94		
20%	87	87	87	88	88	89	89	89	90	90	91	91	91	92	92	93			
25%	85	86	86	86	87	87	88	88	88	89	89	90	90	90	91				
30%	84	84	85	85	85	86	86	87	87	87	88	88	89	89					
35%	83	83	83	84	84	85	85	85	86	86	87	87	87						
40%	81	82	82	82	83	83	84	84	84	85	85	86							
45%	80	80	81	81	81	82	82	83	83	83	84								
50%	79	79	79	80	80	81	81	81	82	82									
55%	77	78	78	78	79	79	80	80	80										
60%	76	76	77	77	77	78	78	79											
65%	75	75	75	76	76	77	77												
70%	73	74	74	74	75	75													
75%	72	72	73	73	73														
80%	71	71	71	72															
85%	69	70	70																
90%	68	68																	
95%	67																		

	Telegraph																		
	Weight for approximate pedestrian activity																		
Weight for pedestrian crossing the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	96	95	93	92	90	89	87	85	84	82	81	79	78	76	75	73	71	70	68
10%	94	93	91	90	88	87	85	83	82	80	79	77	76	74	73	71	69	68	
15%	92	91	89	88	86	85	83	81	80	78	77	75	74	72	71	69	67		
20%	90	89	87	86	84	83	81	79	78	76	75	73	72	70	69	67			
25%	88	87	85	84	82	81	79	77	76	74	73	71	70	68	67				
30%	86	85	83	82	80	79	77	75	74	72	71	69	68	66					
35%	84	83	81	80	78	77	75	73	72	70	69	67	66						
40%	82	81	79	78	76	75	73	71	70	68	67	65							
45%	80	79	77	76	74	73	71	69	68	66	65								
50%	78	77	75	74	72	71	69	67	66	64									
55%	76	75	73	72	70	69	67	65	64										
60%	74	73	71	70	68	67	65	63											
65%	72	71	69	68	66	65	63												
70%	70	69	67	66	64	62													
75%	68	67	65	64	62														
80%	66	65	63	62															
85%	64	63	61																
90%	62	61																	
95%	60																		

		Bancroft E																		
		Weight for approximate pedestrian activity																		
		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
Weight for pedestrian crossing the roadway suitability	5%	68	69	71	72	74	76	77	79	81	82	84	86	87	89	90	92	94	95	97
	10%	67	69	70	72	74	75	77	78	80	82	83	85	87	88	90	92	93	95	
	15%	67	68	70	71	73	75	76	78	80	81	83	85	86	88	89	91	93		
	20%	66	68	69	71	73	74	76	78	79	81	82	84	86	87	89	91			
	25%	66	67	69	70	72	74	75	77	79	80	82	84	85	87	88				
	30%	65	67	68	70	72	73	75	77	78	80	81	83	85	86					
	35%	65	66	68	70	71	73	74	76	78	79	81	83	84						
	40%	64	66	67	69	71	72	74	76	77	79	80	82							
	45%	64	65	67	69	70	72	73	75	77	78	80								
	50%	63	65	66	68	70	71	73	75	76	78									
	55%	63	64	66	68	69	71	72	74	76										
	60%	62	64	65	67	69	70	72	74											
	65%	62	63	65	67	68	70	71												
	70%	61	63	64	66	68	69													
	75%	61	62	64	66	67														
	80%	60	62	63	65															
	85%	60	61	63																
	90%	59	61																	
	95%	59																		

Pedestrian walking along the roadway

Weight for pedestrian walking along the roadway suitability	Telegraph																		
	Weight for approximate pedestrian activity																		
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	98	97	95	94	92	91	89	87	86	84	83	81	80	78	76	75	73	72	70
10%	98	97	95	94	92	90	89	87	86	84	83	81	79	78	76	75	73	72	
15%	98	97	95	93	92	90	89	87	86	84	82	81	79	78	76	75	73		
20%	98	96	95	93	92	90	89	87	85	84	82	81	79	78	76	75			
25%	98	96	95	93	92	90	88	87	85	84	82	81	79	78	76				
30%	98	96	95	93	92	90	88	87	85	84	82	81	79	77					
35%	98	96	95	93	91	90	88	87	85	84	82	80	79						
40%	98	96	94	93	91	90	88	87	85	83	82	80							
45%	97	96	94	93	91	90	88	86	85	83	82								
50%	97	96	94	93	91	89	88	86	85	83									
55%	97	96	94	93	91	89	88	86	85										
60%	97	96	94	92	91	89	88	86											
65%	97	95	94	92	91	89	88												
70%	97	95	94	92	91	89													
75%	97	95	94	92	90														
80%	97	95	93	92															
85%	97	95	93																
90%	96	95																	
95%	96																		

Weight for pedestrian walking along the roadway suitability	Center																		
	Weight for approximate pedestrian activity																		
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	94	94	94	94	95	95	95	95	95	96	96	96	96	96	97	97	97	97	97
10%	92	93	93	93	93	93	94	94	94	94	94	95	95	95	95	95	96	96	
15%	91	91	91	92	92	92	92	92	93	93	93	93	93	94	94	94	94		
20%	90	90	90	90	90	91	91	91	91	91	92	92	92	92	92	93			
25%	88	88	89	89	89	89	89	90	90	90	90	90	91	91	91				
30%	87	87	87	87	88	88	88	88	88	89	89	89	89	89					
35%	85	85	86	86	86	86	87	87	87	87	87	88	88						
40%	84	84	84	84	85	85	85	85	86	86	86	86							
45%	82	83	83	83	83	83	84	84	84	84	85								
50%	81	81	81	82	82	82	82	82	83	83									
55%	80	80	80	80	80	81	81	81	81										
60%	78	78	79	79	79	79	79	80											
65%	77	77	77	77	78	78	78												
70%	75	76	76	76	76	76													
75%	74	74	74	75	75														
80%	73	73	73	73															
85%	71	71	72																
90%	70	70																	
95%	68																		

Shattuck SQ

Weight for approximate pedestrian activity

Weight for pedestrian walking along the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	90	91	91	91	92	92	93	93	93	94	94	95	95	95	96	96	97	97	97
10%	89	89	89	90	90	91	91	91	92	92	93	93	93	94	94	95	95	95	
15%	87	87	88	88	89	89	89	90	90	91	91	91	92	92	93	93	93		
20%	85	86	86	87	87	87	88	88	89	89	89	90	90	91	91	91			
25%	84	84	85	85	85	86	86	86	87	87	88	88	88	89	89				
30%	82	82	83	83	84	84	84	85	85	86	86	86	87	87					
35%	80	81	81	82	82	82	83	83	84	84	84	85	85						
40%	79	79	80	80	80	81	81	82	82	82	83	83							
45%	77	78	78	78	79	79	80	80	80	81	81								
50%	76	76	76	77	77	78	78	78	79	79									
55%	74	74	75	75	75	76	76	77	77										
60%	72	73	73	73	74	74	75	75											
65%	71	71	71	72	72	73	73												
70%	69	69	70	70	71	71													
75%	67	68	68	69	69														
80%	66	66	66	67															
85%	64	64	65																
90%	62	63																	
95%	61																		

Shattuck

Weight for approximate pedestrian activity

Weight for pedestrian walking along the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	92	92	92	93	93	93	94	94	94	95	95	95	96	96	96	97	97	97	98
10%	90	90	90	91	91	91	92	92	92	93	93	93	94	94	94	95	95	95	
15%	88	88	88	89	89	89	90	90	90	91	91	92	92	92	93	93	93		
20%	86	86	87	87	87	88	88	88	89	89	89	90	90	90	91	91			
25%	84	84	85	85	85	86	86	86	87	87	87	88	88	88	89				
30%	82	82	83	83	83	84	84	84	85	85	85	86	86	86					
35%	80	80	81	81	81	82	82	82	83	83	83	84	84						
40%	78	78	79	79	80	80	80	81	81	81	82	82							
45%	76	77	77	77	78	78	78	79	79	79	80								
50%	74	75	75	75	76	76	76	77	77	77									
55%	72	73	73	73	74	74	74	75	75										
60%	70	71	71	71	72	72	72	73											
65%	69	69	69	70	70	70	71												
70%	67	67	67	68	68	68													
75%	65	65	65	66	66														
80%	63	63	63	64															
85%	61	61	62																
90%	59	59																	
95%	57																		

		University																		
		Weight for approximate pedestrian activity																		
		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
Weight for pedestrian walking along the roadway suitability	5%	80	81	81	81	82	82	82	82	83	83	83	84	84	84	84	85	85	85	86
	10%	79	79	79	80	80	80	81	81	81	82	82	82	82	83	83	83	84	84	
	15%	77	78	78	78	79	79	79	79	80	80	80	81	81	81	81	82	82		
	20%	76	76	77	77	77	77	78	78	78	79	79	79	79	80	80	80			
	25%	74	75	75	75	76	76	76	76	77	77	77	78	78	78	78				
	30%	73	73	74	74	74	74	75	75	75	76	76	76	76	77					
	35%	71	72	72	72	73	73	73	73	74	74	74	75	75						
	40%	70	70	71	71	71	71	72	72	72	73	73	73							
	45%	68	69	69	69	70	70	70	70	71	71	71								
	50%	67	67	68	68	68	68	69	69	69	70									
	55%	65	66	66	66	67	67	67	68	68										
	60%	64	64	65	65	65	65	66	66											
	65%	62	63	63	63	64	64	64												
	70%	61	61	62	62	62	62													
	75%	60	60	60	60	61														
	80%	58	58	59	59															
	85%	57	57	57																
	90%	55	55																	
	95%	54																		

Bicycle roadway crossing

	Center																		
	Weight for approximate bike activity																		
Weight for bicycle crossing the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62
10%	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	
15%	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65		
20%	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66			
25%	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67				
30%	82	81	80	79	78	77	76	75	74	73	72	71	70	69					
35%	82	81	80	79	78	77	76	75	74	73	72	71	70						
40%	82	81	80	79	78	77	76	75	74	73	72	71							
45%	83	82	81	80	79	78	77	76	75	74	73								
50%	83	82	81	80	79	78	77	76	75	74									
55%	83	82	81	80	79	78	77	76	75										
60%	84	83	82	81	80	79	78	77											
65%	84	83	82	81	80	79	78												
70%	84	83	82	81	80	79													
75%	84	83	82	81	80														
80%	85	84	83	82															
85%	85	84	83																
90%	85	84																	
95%	86																		

	Oxford S																		
	Weight for approximate bike activity																		
Weight for bicycle crossing the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	73	75	76	77	79	80	81	83	84	85	87	88	90	91	92	94	95	96	98
10%	72	74	75	76	78	79	80	82	83	85	86	87	89	90	91	93	94	95	
15%	71	73	74	75	77	78	79	81	82	84	85	86	88	89	90	92	93		
20%	70	72	73	74	76	77	79	80	81	83	84	85	87	88	89	91			
25%	69	71	72	73	75	76	78	79	80	82	83	84	86	87	88				
30%	68	70	71	73	74	75	77	78	79	81	82	83	85	86					
35%	68	69	70	72	73	74	76	77	78	80	81	82	84						
40%	67	68	69	71	72	73	75	76	77	79	80	81							
45%	66	67	68	70	71	72	74	75	76	78	79								
50%	65	66	67	69	70	71	73	74	76	77									
55%	64	65	66	68	69	70	72	73	75										
60%	63	64	65	67	68	70	71	72											
65%	62	63	64	66	67	69	70												
70%	61	62	64	65	66	68													
75%	60	61	63	64	65														
80%	59	60	62	63															
85%	58	59	61																
90%	57	58																	
95%	56																		

Weight for bicycle crossing the roadway suitability	University																		
	Weight for approximate bike activity																		
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	68	67	67	66	66	65	65	64	64	64	63	63	62	62	61	61	60	60	59
10%	69	69	68	68	67	67	66	66	65	65	64	64	63	63	62	62	61	61	
15%	71	70	70	69	69	68	68	67	67	66	66	65	65	64	64	63	63		
20%	72	71	71	70	70	69	69	68	68	68	67	67	66	66	65	65			
25%	73	73	72	72	71	71	70	70	69	69	68	68	67	67	66				
30%	75	74	74	73	73	72	72	71	71	70	70	69	69	68					
35%	76	75	75	74	74	73	73	72	72	71	71	71	70						
40%	77	77	76	76	75	75	74	74	73	73	72	72							
45%	79	78	78	77	77	76	76	75	75	74	74								
50%	80	79	79	78	78	77	77	76	76	75									
55%	81	81	80	80	79	79	78	78	77										
60%	83	82	82	81	81	80	80	79											
65%	84	83	83	82	82	81	81												
70%	85	85	84	84	83	83													
75%	86	86	86	85	85														
80%	88	87	87	86															
85%	89	89	88																
90%	90	90																	
95%	92																		

Weight for bicycle crossing the roadway suitability	Shattuck																		
	Weight for approximate bike activity																		
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	72	71	71	70	69	69	68	67	67	66	65	65	64	63	63	62	62	61	60
10%	73	72	71	71	70	69	69	68	67	67	66	66	65	64	64	63	62	62	
15%	73	73	72	71	71	70	70	69	68	68	67	66	66	65	64	64	63		
20%	74	73	73	72	72	71	70	70	69	68	68	67	66	66	65	64			
25%	75	74	74	73	72	72	71	70	70	69	68	68	67	66	66				
30%	76	75	74	74	73	72	72	71	70	70	69	68	68	67					
35%	76	76	75	74	74	73	72	72	71	70	70	69	68						
40%	77	76	76	75	74	74	73	72	72	71	70	70							
45%	78	77	76	76	75	74	74	73	73	72	71								
50%	78	78	77	77	76	75	75	74	73	73									
55%	79	79	78	77	77	76	75	75	74										
60%	80	79	79	78	77	77	76	75											
65%	81	80	79	79	78	77	77												
70%	81	81	80	79	79	78													
75%	82	81	81	80	79														
80%	83	82	81	81															
85%	83	83	82																
90%	84	84																	
95%	85																		

		Shattuck SQ																		
		Weight for approximate bike activity																		
		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
Weight for bicycle crossing the roadway suitability	5%	59	59	60	60	60	60	60	60	60	60	61	61	61	61	61	61	61	61	62
	10%	61	62	62	62	62	62	62	62	62	63	63	63	63	63	63	63	63	64	
	15%	64	64	64	64	64	64	64	64	65	65	65	65	65	65	65	65	66		
	20%	66	66	66	66	66	66	66	67	67	67	67	67	67	67	68	68			
	25%	68	68	68	68	68	69	69	69	69	69	69	69	69	70	70				
	30%	70	70	70	70	71	71	71	71	71	71	71	71	72	72					
	35%	72	72	72	73	73	73	73	73	73	73	73	74	74						
	40%	74	74	75	75	75	75	75	75	75	75	76	76							
	45%	76	77	77	77	77	77	77	77	77	78	78								
	50%	79	79	79	79	79	79	79	80	80	80									
	55%	81	81	81	81	81	81	82	82	82										
	60%	83	83	83	83	83	84	84	84											
	65%	85	85	85	85	86	86	86												
	70%	87	87	87	88	88	88													
	75%	89	90	90	90	90														
	80%	92	92	92	92															
	85%	94	94	94																
	90%	96	96																	
	95%	98																		

Bicycling along the roadway

Oxford S

Weight for bicycle riding along the roadway suitability	Weight for approximate bike activity																		
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	74	75	77	78	79	81	82	83	85	86	88	89	90	92	93	94	96	97	98
10%	74	75	76	78	79	80	82	83	85	86	87	89	90	91	93	94	95	97	
15%	73	75	76	78	79	80	82	83	84	86	87	88	90	91	92	94	95		
20%	73	75	76	77	79	80	81	83	84	85	87	88	89	91	92	94			
25%	73	74	76	77	78	80	81	82	84	85	87	88	89	91	92				
30%	73	74	75	77	78	79	81	82	84	85	86	88	89	90					
35%	72	74	75	77	78	79	81	82	83	85	86	87	89						
40%	72	74	75	76	78	79	80	82	83	84	86	87							
45%	72	73	75	76	77	79	80	81	83	84	86								
50%	72	73	74	76	77	78	80	81	83	84									
55%	71	73	74	76	77	78	80	81	82										
60%	71	73	74	75	77	78	79	81											
65%	71	72	74	75	76	78	79												
70%	71	72	73	75	76	77													
75%	70	72	73	75	76														
80%	70	72	73	74															
85%	70	71	73																
90%	70	71																	
95%	69																		

Shattuck

Weight for bicycle riding along the roadway suitability	Weight for approximate bike activity																		
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	73	72	71	71	70	69	69	68	67	67	66	65	65	64	64	63	62	62	61
10%	74	73	73	72	71	71	70	69	69	68	68	67	66	66	65	64	64	63	
15%	75	75	74	74	73	72	72	71	70	70	69	68	68	67	66	66	65		
20%	77	76	76	75	74	74	73	72	72	71	70	70	69	68	68	67			
25%	78	78	77	76	76	75	74	74	73	72	72	71	70	70	69				
30%	80	79	78	78	77	76	76	75	74	74	73	73	72	71					
35%	81	80	80	79	78	78	77	77	76	75	75	74	73						
40%	82	82	81	81	80	79	79	78	77	77	76	75							
45%	84	83	83	82	81	81	80	79	79	78	77								
50%	85	85	84	83	83	82	81	81	80	79									
55%	87	86	85	85	84	83	83	82	81										
60%	88	87	87	86	86	85	84	84											
65%	90	89	88	88	87	86	86												
70%	91	90	90	89	88	88													
75%	92	92	91	90	90														
80%	94	93	92	92															
85%	95	94	94																
90%	97	96																	
95%	98																		

	Center																		
	Weight for approximate bike activity																		
Weight for bicycle riding along the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62
10%	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	
15%	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65		
20%	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66			
25%	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68				
30%	82	81	80	79	78	77	76	75	74	73	72	71	70	69					
35%	83	82	81	80	79	78	77	76	75	74	73	72	71						
40%	83	82	81	80	79	78	77	76	75	74	73	72							
45%	84	83	82	80	79	78	77	76	75	74	73								
50%	84	83	82	81	80	79	78	77	76	75									
55%	84	83	82	81	80	79	78	77	76										
60%	85	84	83	82	81	80	79	78											
65%	85	84	83	82	81	80	79												
70%	86	85	84	83	82	81													
75%	86	85	84	83	82														
80%	86	85	84	83															
85%	87	86	85																
90%	87	86																	
95%	88																		

	University																		
	Weight for approximate bike activity																		
Weight for bicycle riding along the roadway suitability	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
5%	68	68	67	67	66	66	65	65	64	64	63	63	62	62	61	61	60	60	59
10%	69	69	68	68	68	67	67	66	66	65	65	64	64	63	63	62	62	61	
15%	71	70	70	69	69	68	68	68	67	67	66	66	65	65	64	64	63		
20%	72	72	71	71	70	70	69	69	68	68	67	67	67	66	66	65			
25%	74	73	73	72	72	71	71	70	70	69	69	68	68	67	67				
30%	75	75	74	74	73	73	72	72	71	71	70	70	69	69					
35%	77	76	76	75	75	74	74	73	73	72	72	71	71						
40%	78	78	77	77	76	76	75	75	74	74	73	73							
45%	80	79	79	78	78	77	77	76	76	75	75								
50%	81	81	80	80	79	79	78	78	77	77									
55%	82	82	82	81	81	80	80	79	79										
60%	84	83	83	82	82	81	81	81											
65%	85	85	84	84	83	83	82												
70%	87	86	86	85	85	84													
75%	88	88	87	87	86														
80%	90	89	89	88															
85%	91	91	90																
90%	93	92																	
95%	94																		

		Shattuck SQ																		
		Weight for approximate bike activity																		
		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%
Weight for bicycle riding along the roadway suitability	5%	59	59	59	59	59	60	60	60	60	60	60	60	60	61	61	61	61	61	61
	10%	61	61	61	61	61	61	62	62	62	62	62	62	62	62	63	63	63	63	
	15%	63	63	63	63	63	63	63	64	64	64	64	64	64	64	64	65	65		
	20%	64	65	65	65	65	65	65	65	65	66	66	66	66	66	66	66			
	25%	66	66	67	67	67	67	67	67	67	67	68	68	68	68	68				
	30%	68	68	68	68	69	69	69	69	69	69	69	70	70	70					
	35%	70	70	70	70	70	71	71	71	71	71	71	71	71						
	40%	72	72	72	72	72	72	73	73	73	73	73	73							
	45%	74	74	74	74	74	74	74	75	75	75	75								
	50%	75	76	76	76	76	76	76	76	76	77									
	55%	77	77	78	78	78	78	78	78	78										
	60%	79	79	79	80	80	80	80	80											
	65%	81	81	81	81	81	82	82												
	70%	83	83	83	83	83	83													
	75%	85	85	85	85	85														
	80%	86	87	87	87															
	85%	88	88	89																
	90%	90	90																	
	95%	92																		

Appendix D. Street Corridor Scores for Suitability, Approximated Activity, and Reported Crashes

	Suitability				Approximate activity		Reported crashes	
	Pedestrian		Bicycle					
Name	Crossing	Along	Crossing	Along	Pedestrian	Bicycle	Pedestrian	Bicycle
Addison	11	43	59	37	96	59	55	44
Allston	5	45	63	45	89	58	81	60
Arch	9	49	38	57	32	35	0	50
Atherton	7	32	16	11	24	36	28	20
Bancroft E	57	55	50	83	99	54	66	49
Bancroft W	21	47	76	34	74	50	77	80
Berkeley	33	65	60	76	81	56	72	65
Bowditch	10	44	0	4	47	87	63	36
Center	19	67	87	89	93	61	95	81
Channing	17	55	1	0	67	80	64	39
College	20	49	59	41	38	39	30	50
Dana	14	46	40	23	44	68	60	52
Durant E	55	51	69	88	88	54	71	48
Durant W	42	30	78	12	65	48	52	74
Dwight E	16	42	31	33	0	3	2	13
Dwight W	50	75	63	92	24	31	33	35
Ellsworth	0	0	43	1	27	35	28	27
Euclid	4	47	34	46	50	41	22	26
Fulton	52	60	65	93	33	36	38	47
Gayley	55	95	68	96	36	18	30	24
Haste	16	43	50	35	54	38	45	43
Hearst E	52	86	63	99	69	35	43	46
Hearst W	74	48	79	68	43	43	64	90
Kittredge	1	39	45	15	83	56	73	61
La Loma	20	38	36	26	32	31	21	6
Le Conte	14	44	31	43	32	35	11	16
Le Roy	0	50	23	32	33	34	28	7
Oxford N	37	61	61	76	33	34	69	100
Oxford S	66	63	54	68	95	100	49	73
Piedmont	42	93	63	90	27	33	48	30
Prospect	19	53	25	63	16	22	9	12
Ridge	1	36	19	27	43	34	19	17
Scenic	22	47	26	51	31	33	16	0
Shattuck	100	55	86	100	100	59	93	72
Shattuck SQ	65	59	100	94	99	60	92	57
Spruce	4	48	29	61	35	36	69	78
Telegraph	60	98	72	93	69	51	100	47
University	94	52	94	96	87	57	82	67
Virginia	6	33	7	7	23	65	12	11
Walnut	13	46	33	50	42	40	27	39
Warring N	16	40	29	37	24	31	27	26
Warring S	66	100	60	85	0	0	17	25

Appendix E. Pedestrian and Bicyclist Intersection Count Data Collection Instructions (2-hour counts)

This document describes the procedure that you will use to count pedestrians and bicyclists at intersections[36]. Review this document before visiting the field, and refer to it when you have questions in the field. Ideally, you will be trained on the counting methods described below before taking counts. However, it is not necessary to have formal training to follow these procedures.

SAFETY FIRST: You will be standing near roadway intersections to take counts. Use caution traveling to the count locations, including crossing roadways near the sites. Follow traffic laws at all times. Maintain a constant awareness of your surroundings, including traffic conditions and social situations, and ensure that data collection does not interfere with your attention to safety. If you feel unsafe, uncomfortable, or threatened, stop data collection and move to a safer location.

Bring Count Materials

- Data Collection Sheet
- Pencil or Pen
- Clipboard (or something to write on)
- Watch (or other timing device that can identify 15-minute periods)
- Short letter from the agency that is sponsoring the counts. This letter should have the name, e-mail, and phone number of someone at the agency so that you can tell people with questions about the counting effort who they can contact (See attached Example Agency Letter).

Fill in General Information:

(See top of both sides of attached Data Collection Sheet)

- Arrive at the count intersection at least 15 minutes before the count period is scheduled to find a location where you can see all of the intersection crossings and to fill in general information
- Record the name of the mainline roadway (roadway with more traffic) and intersecting roadway
- Add an arrow to indicate which direction is NORTH
- Label the intersection diagram with the names of each roadway
- Record your name as the observer

[36] These instructions describe how to count pedestrians and bicyclists at intersections. There are many other ways that pedestrians and bicyclists can be counted at intersections, but this method is designed to gather counts in the most accurate, efficient, and consistent manner. Gender is captured using this methodology, but age, helmet use, jaywalking, wrong-way riding, and other characteristics are not included so that data collectors can focus on counting accurately. In addition, it is also possible to count pedestrians and bicyclists at locations such as trail, sidewalk, and bicycle lane segments and building entrances. However, different methodologies are used to capture counts at these other locations.

- Record the date and time period of the count
- Estimate the current temperature (°F) and weather (sunny, cloudy, rainy, etc.)
- Describe the intersection, including surrounding buildings (e.g., restaurants, single-family houses, offices, etc.), roadway characteristics (traffic signals, median islands, fast traffic, etc.)

Follow Pedestrian Counting Procedure (See Side 1 of Data Collection Sheet):

- Tally each time a pedestrian crosses each leg of the intersection from either direction
- Pedestrians should be counted whenever they cross within the crosswalk or when they cross an intersection leg within 50 feet of the intersection
- Do NOT count pedestrians who do not cross the street (e.g., turn the corner on the sidewalk without crossing the street)
- If the pedestrian is female, mark an "O"; if male, mark an "X"; if unknown, mark a "+". If the pedestrian volume is so high that it is difficult to count by gender, use standard line tally marks.
- If the pedestrian is using a wheelchair or other assistive device, underline the "O", "X", or "+".
- Count for two hours. Enter tally marks in a new row after each 15-minute period. Record totals at the bottom of the sheet after the two hours are completed.
- If the intersection is a "T" intersection with only three legs, you should still count four sides of the intersection. Pedestrians using the "sidewalk side" of the intersection should be counted when they travel along the sidewalk for at least half of the width of the intersection. Label the "sidewalk side" on the intersection diagram.
- Pedestrians include people in wheelchairs, people using canes and other assistive devices, children being carried by their parents, children in strollers, runners, skateboarders, people walking with a bicycle, etc., but do NOT include people riding bicycles, people in cars, etc.

Follow Bicyclist Counting Procedure (See Side 2 of Data Collection Sheet):

- Tally each time a bicyclist approaches from each leg of the intersection and arrives at the intersection (this includes turning left, going straight, or turning right)
- Count bicyclists who may be riding on the wrong side of the street (against traffic)
- Count bicyclists who ride on the sidewalk (i.e., if a bicyclist on the sidewalk turns right without crossing the street, they should still be counted as turning right)
- If the bicyclist is female, mark an "O"; if male, mark an "X"; if unknown, mark a "+". If the bicycle volume is so high that it is difficult to count by gender, use standard line tally marks.
- If the bicyclist is wearing a helmet, underline the "O", "X", or "+".
- Count for two hours. Enter tally marks in a new row after each 15-minute period. Record totals at the bottom of the sheet after the two hours are completed.
- Bicyclists include people riding bicycles. They do NOT include people who are walking their bicycles across the intersection.

Understand Data Priority:

If you do not feel like you (or you and your fellow data collectors at the intersection) may not be able to keep up with all observations at a location, collect the data according to the following priority ranking:

- 1. Count of Pedestrians
- 2. Count of Bicyclists
- 3. Gender
- 4. Helmet Use
- 5. Pedestrian Crossing Direction
- 6. Bicyclist Turning Movement

Give Data Collection Sheet to the Count Manager:

- Give your data sheet to the count manager as soon as possible after finishing the counts.
- Keep the completed data collection sheet in a safe place until you turn it in.

Side 1: Intersection Pedestrian Count Sheet

Mainline Roadway: ______________________________

Intersecting Roadway: ______________________________

Observer Name(s): ______________________________

Date: ______________________________

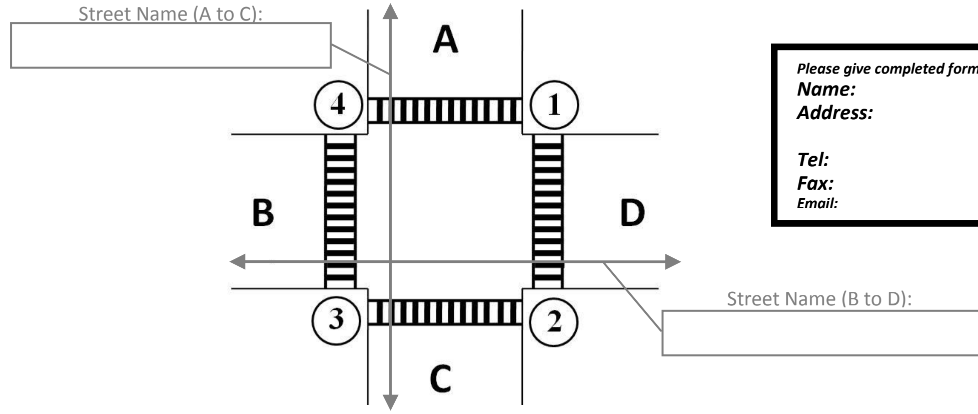
Observation Time: (Start) ______________(End)______________

Temp. (°F): __________ Sunny, cloudy, rainy, etc.: ______________

Description of Specific Observation Location: ______________

____

____



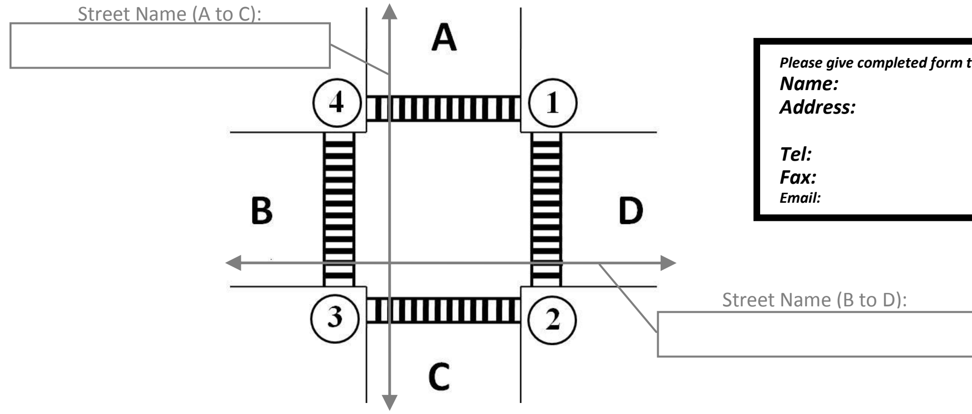
Please give completed form to:
Name:
Address:

Tel:
Fax:
Email:

Tally each time a pedestrian crosses each leg of the intersection (count all crossings within 50 ft. of the crosswalk). If the pedestrian is female, mark an "O"; if male, mark an "X"; unknown, mark a "+".

Time Period #	Pedestrian Counts							
	Crossing Leg A		Crossing Leg B		Crossing Leg C		Crossing Leg D	
	From 4 to 1 OR From 1 to 4		From 3 to 4 OR From 4 to 3		From 2 to 3 OR From 3 to 2		From 1 to 2 OR From 2 to 1	
(0-15 min)								
(15-30 min)								
(30-45 min)								
(45-60 min)								
(60-75 min)								
(75-90 min)								
(90-105 min)								
(105-120 min)								
TOTAL	Female:	Male:	Female:	Male:	Female:	Male:	Female:	Male:

Side 2: Intersection Bicycle Count Sheet



Please give completed form to:
Name:
Address:

Tel:
Fax:
Email:

Mainline Roadway: ______________________________
Intersecting Roadway: ______________________________
Observer Name(s): ______________________________
Date: ______________________________
Observation Time: (Start) ____________(End)____________
Temp. (°F): ________ Sunny, cloudy, rainy, etc.: ____________
Description of Specific Observation Location: ______________________________
____
____

Tally each time a bicyclist arrives at the intersection from each leg (include bicyclists on sidewalks). If the bicyclist is female, mark an "O"; if male, mark an "X"; unknown, mark a "+".

Time Period #	Bicycle Counts							
	Arriving from Leg A		Arriving from Leg B		Arriving from Leg C		Arriving from Leg D	
	(Turning Right) (Going Straight) (Turning Left) A to B OR A to C OR A to D		(Turning Right) (Going Straight) (Turning Left) B to C OR B to D OR B to A		(Turning Right) (Going Straight) (Turning Left) C to D OR C to A OR C to B		(Turning Right) (Going Straight) (Turning Left) D to A OR D to B OR D to A	
(0-15 min)								
(15-30 min)								
(30-45 min)								
(45-60 min)								
(60-75 min)								
(75-90 min)								
(90-105 min)								
(105-120 min)								
TOTAL	Female:	Male:	Female:	Male:	Female:	Male:	Female:	Male:

Example Project Description Letter

April 15, 2009

The UC-Berkeley Traffic Safety Center (TSC) and Alameda County Transportation Improvement Authority (ACTIA) are conducting pedestrian and bicycle counts throughout the region as a part of their efforts to track how local roadway, trail, and sidewalk systems are used by all types of transportation modes. Locations for counts have been selected by both agencies in coordination with the Alameda County Congestion Management Agency. Volunteer data collectors are being used to count pedestrians and bicyclists in the field.

If you have any questions about the count procedures or how the count data will be used by TSC or ACTIA, please feel free to contact Lindsay Arnold, the TSC pedestrian and bicycle count project manager, Lindsay Arnold. You can reach Lindsay by e-mail at larnold@berkeley.edu or by phone at (510) 643-5659.

Thank you.

Appendix F. Behavioral Observation Data Collection Instructions (2-hour observations)

The following pages describe the procedure used to observe pedestrian, bicyclist, and driver behavior. Behaviors are observed for two hours on a fair-weather weekday during the semester. The two-hour observation period will be midday between 9 a.m. and 4 p.m. Observations will be made either at an intersection or a street segment location. For observations gender and other characteristics will be recorded when appropriate. Pedestrians with disabilities include people using assistive devices and people limping. Behaviors that will be recorded at each type of location are discussed below.

Intersection Behaviors

Behavior observation sheets will be used to document specific pedestrian, bicyclist, and driver behaviors at each study intersection. Data collectors will observe the specified road user (pedestrian, bicyclist, or driver) for the user behaviors being recorded. Observers will record the behavior of the users who approach the intersection from the specified direction or cross using the specified crossing. Data collectors should randomize their selection process by choosing to observe the next user who approaches the intersection after the last observation is completed, however the next individual observed should be far enough back (approximately 20 feet for pedestrians and 50 feet for bicyclists and drivers) to fully observe their behavior approaching the intersection. Data collectors will observe each subject and mark all behaviors they observe for that person at the intersection. Note that some behaviors are dependent on certain actions being taken by the subject (e.g., whether the bicyclist or automobile driver is turning).

- Pedestrian behaviors include: crosses on green or yellow light, still crossing street when light turns red, stops and waits at red light, crosses against red light, looks both ways before entering crosswalk, enters crosswalk without looking, , uses cell phone or other communication device.
- Bicyclist behaviors include: enters on green or yellow light, stops at red light, runs red light.
- Driver behaviors include: encroaches over crosswalk line, disobeys red light, turns right with the right-of-way, stops before turning right on red, does not stop before turning right on red[37].

The following locations and time periods will be used to collect intersection behavior data:

- Pedestrian behavior observation locations and time periods:
    - Hearst Avenue & Euclid Street, crossing Hearst on the west side of Euclid heading south in the afternoon (to be collected between 12:00pm and 4:00pm).

[37]Driver intersection behaviors were not conducted for the initial Campus Periphery study, however these behaviors should be considered for future data collection efforts to more completely understand changes in behavior over time due to policy and infrastructure changes and evaluate investments' impacts.

    - Hearst Avenue & Oxford Street, crossing Oxford on the north side of Hearst heading east in the morning (to be collected between 9:30 and 12:30).
    - Oxford Street & Center Street, crossing Oxford on the south side of Center heading east in the afternoon.
    - Telegraph Avenue & Durant Street crossing Durant on the west side of Telegraph heading north around midday (between 10:30 and 2:30).
- Bicyclist behavior observation locations:
    - Hearst Avenue & Euclid Street, observing southbound cyclists on Hearst around midday.
    - Hearst Avenue &Oxford Street, observing westbound cyclists on Hearst in the afternoon.
    - Oxford Street & Center Street, observing southbound cyclists on Oxford in the morning.
    - Durant Street & Bowditch Street, observing southbound cyclists on Bowditch around midday.
- Driver behavior observation locations:
    - To be determined in the future.

Roadway Segment Behaviors

Behavior observation sheets should be used to document specific automobile behaviors at each study roadway segment. Data collectors will observe all drivers who approach the midblock study location from a safe stopping distance (calculated using the formula below) when a pedestrian is using or waiting to use the designated crossing. Data collectors will observe the designated crossing and record driver behavior when presented with the situation described below in the behavior definitions for drivers. Driver behaviors include: yields to let pedestrian cross, does not yield to pedestrian.

The following locations will be used to collect roadway segment behavior data:

- Driver behavior observation locations:
    - Durant Street between Dana Street & Telegraph Avenue, traveling eastbound in the morning.
    - Hearst Avenue & Spruce Street between Arch Street & Oxford Street, traveling westbound in the morning.
    - Channing Way between Dana Street & Telegraph Avenue, traveling westbound in the morning[38].

[38]The Channing Way between Dana Street & Telegraph Avenue was not collected in the initial performance measures due to low volumes but should be collected in the future during the semester.

Base Year Results

Included below are tables detailing the initial results from the various behavioral observations undertaken for the initial performance measure calculations:

Pedestrian Behavior Observation Initial Results

Crossing	Total Observations	Stops and Waits	Crosses Against the Light	% Complying	Looks in all Directions	% Looking
Hearst & Oxford	68	35	10	77.8%	7	10.3%
Telegraph & Durant	204	74	11	87.1%	60	29.4%
Hearst & Euclid	177	82	13	86.3%	26	14.7%
Center & Oxford	112	69	5	93.2%	18	16.1%
Total	561	260	39	87.0%	111	19.8%

Bicyclist Behavior Observation Initial Results

Crossing	Total Observations	Stops and Waits	Does Not Comply with Light	% Complying
Hearst & Oxford	25	9	5	64.3%
Hearst & Euclid	20	3	7	30.0%
Oxford & Center	46	15	13	53.6%
Bowditch & Durant	19	7	6	53.8%
Total	110	34	31	52.3%

Driver Behavior Observation Initial Results

Crossing	Total Observations	Total Yielding to Pedestrians	% Yielding, Both Directions
Hearst & Spruce b/t Oxford and Arch	47	27	57.4%
Durant b/t Dana & Telegraph	60	36	60.0%
Total	107	63	58.9%

Driver Behavior Observation Initial Results, by Crossing Direction	**Crossing Left to Right**			**Crossing Right to Left**		
	Does Not Yield	**Yields**	**% Yielding**	**Yields**	**Does Not Yield**	**% Yielding**
Hearst & Spruce b/t Oxford and Arch	5	11	69%	16	15	52%
Durant b/t Dana & Telegraph	9	22	71%	14	15	48%
Total	14	33	70%	30	30	50%

Pedestrian Behavior Definitions

Crosses on green or yellow light**:** The observed pedestrian crosses when parallel traffic has a green or yellow light and the pedestrian has the right-of-way. Pedestrian signals at the crossing should be ignored while observing this behavior, instead using the traffic signal.

Still crossing street when light turns red**:** The observed pedestrian starts crossing the street during a green or yellow light but does not finish crossing the street until after parallel automobile traffic has a red light.

Stops and waits at red light**:** The observed pedestrian does not begin crossing while cross-traffic has the right of way.[39]

Crosses against red light**:** Pedestrians are considered to be jaywalking against a red light when they begin crossing a through lane of the cross-street before the light for the parallel traffic has turned green.

Looks in all directions for cross-traffic before entering crosswalk**:** At a signalized intersection, if the observed pedestrian scans in all directions of legal cross-traffic in the interval between the cross-traffic's light turning yellow and prior to the pedestrian beginning to cross the street with a "WALK" signal or green light for parallel traffic this behavior is noted. This behavior is documented regardless of whether the pedestrian is crossing legally or against a red light.

Uses cell phone or other communication device**:** Observed pedestrians who crossed the study crossing while using a mobile device are noted on the data collection sheets. Behaviors noted include talking, texting, or other activities involving direct use of the device.

Bicyclist Behavior Definitions

Enters on green or yellow light**:** Bicyclists are noted when they enter an intersection on a green or yellow light.

Stops at red light**:** Bicyclists are recorded for this behavior when they stop at an intersection for a red light.

Runs red light**:** Bicyclists are considered to run a red light if they enter an intersection during a red light or before the light turned green. They are also recorded as disobeying a red light if they did not complete crossing the intersection before the light turned red. If the bicyclist entered the intersection on green but did not complete the crossing before the light turned red they were not considered in the evaluation of this behavior.

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[39]The observed pedestrian is to be considered waiting at a red light even if s/he steps off the curb so long as the s/he remains within two feet of the curb, unless there is a dedicated right-turn lane at the crossing, in which case the observed pedestrian is considered to be waiting at the red light only if s/he remains on the curb.

Driver Behavior Definitions

***Does not yield to pedestrian*:** If a driver does not yield to a pedestrian when legally required to do so, this behavior is recorded. A driver is marked as not yielding if he or she would have been able to stop when the pedestrian arrived at the crosswalk. In order to measure the distance beyond which a driver would be able to stop, the safe stopping distance for an automobile should be calculated using the methodology described below. Observations are undertaken from this point, and motorists who are behind the observer when a pedestrian begins to cross the street or is waiting at the crosswalk and do not yield or slow for the pedestrian to cross are recorded as not yielding. Vehicles that are closer than the marker when the pedestrian is waiting at the crosswalk or begins crossing will not be recorded regardless of whether they yield or not.

***Yields to let pedestrian cross*:** Drivers are to be recorded if they yield or slow to let pedestrians waiting at a crosswalk or in the crossing finish crossing the roadway. Drivers who are too close to yield because they did not have adequate time to stop according to the safe stopping distance below are not recorded whether they yield or not. Drivers who proceed across the crosswalk with caution after the pedestrian is further than one and a half lanes from the vehicle in the crossing are recorded as yielding.

Additional Driver Intersection Behavior Measures for Future Consideration

***Encroaches over crosswalk line*:** Drivers should be recorded as encroaching over the crosswalk line if they do not come to a complete stop before the crosswalk line and any part of their vehicle intrudes into the crosswalk when they do not have the right-of-way. If the vehicle comes to a complete stop behind the crosswalk and then proceeds forward but stops again and any part of the vehicle is in the crosswalk, this is also marked as encroaching. However, if there is a stop line prior to the crosswalk line and the vehicle stops after the marked stop line but before the crosswalk line (such that no part of the vehicle crosses over the crosswalk line) the vehicle is not recorded as encroaching. Moreover, if the vehicle has the right-of-way but cannot proceed (e.g., due to congestion) and any part of the vehicle is over the crosswalk when they lose the right of way, they are still recorded as encroaching. Further, if the vehicle stops behind the crosswalk and then proceeds forward without ever stopping in the crosswalk (as in the case of a motorist turning right on red) they are not marked as encroaching.

***Drive disobeys red light*:** A driver is recorded as running a red light if they are in the intersection at any point after the signal light has turned red. This may occur if the driver proceeds through the intersection after the light has changed or if the driver is "cheating" the light and entering the intersection prior to the light turning green. Drivers disobeying a red light are only recorded for vehicles that are turning left or going straight through an intersection, right turn movements are recorded using the methods below.

***Driver turns right with the right-of-way*:** A driver is recorded as turning right with the right-of-way if the driver completes a right-turn while the signal is still green or yellow. A driver is not recorded as turning with the right-of-way if the light turns red at any point while the driver is still in the intersection.

Driver stops before turning right on red: Motorists are considered to have stopped before turning right on red if they stop or slow nearly to a stop before turning right when the signal is red. Because few motorists come to a complete stop when turning right, it is not practical to define a stop when turning right on red as a complete stop. As a result, a stop is deemed complete when the vehicle has either stopped entirely or has slowed to less than two miles per hour (approximately walking speed). Because this behavior relies on subjective judgments by the data collectors, examples of a "complete stop" must be demonstrated during training to improve consistency. However, this observation cannot be entirely objective and will be less reliable than other behavioral observations.

***Driver does not stop before turning right on red*:** Drivers are recorded as not stopping before turning right on red if they do not stop or slow to nearly a stop (approximately walking speed) before making a right turn on red.

Calculating Safe Stopping Distances

In order to calculate the safe stopping distance for an automobile driver approaching a crosswalk, the methodology of Van Houten and Malefant (2004) was adopted. Van Houten and Malefant use the Institute for Transportation Engineers signal-timing formula which calculates the distance required by a motorist to stop for a traffic signal changing to red. This study uses a different form of the signal-timing equation from the AASHTO Green Book (2011), the sight stopping distance formula. This formula takes into account the distance covered by a driver reacting to seeing an object or signal, such as a pedestrian waiting to cross the roadway, and the distance needed to stop the vehicle. The sight stopping distance formula is given as follows:

$$SSD = 1.47vt + \frac{v^2}{30\left(\frac{a}{32.2}\right) + G}$$

where:

SSD = the sight stopping distance, in feet

v = the velocity of the vehicle, in feet per second.

t = the driver's perception/reaction time, in seconds

a = average deceleration rate of the vehicle, in feet per second squared

G = the grade of the approach, given by the rise over run of the approach, in feet

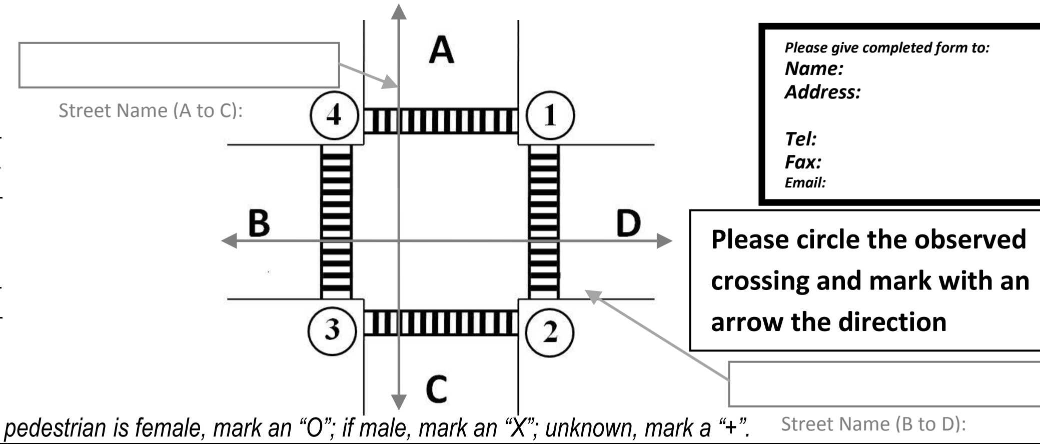
This formula is then applied to each of the study sites to determine the distance required for a vehicle to safely stop before the crosswalk. Additionally, the following assumptions are made in calculating the formula:

1. The driver's perception/reaction time is conservatively assumed to be 2.5 seconds.
2. The velocity of the vehicle is assumed to be five miles per hour above the speed limit.
3. The average deceleration rate of the vehicle is also set at a conservative value of 11.2 feet per second.

The output from the formula is then rounded up to nearest 10 foot interval and used as the safe stopping distance for the study sites. For example, the stopping distance obtained from the formula for a car approaching a crosswalk at 25 miles per hour (calculated at 30 miles per hour using the five mile per hour higher assumption above) on a 0% grade is 196.4 feet and this would then be rounded up to 200 feet for study.

Pedestrian Behavior Observation Count Sheet Page 1

Mainline Roadway: ______________________________
Intersecting Roadway: ______________________________
Observer Name(s): ______________________________
Date: ______________________________
Observation Time: (Start) ______________(End)______________
Temp. (°F): __________ Sunny, cloudy, rainy, etc.: ______________
Description of Specific Observation Location: ______________
____
____



Please give completed form to:
Name:
Address:

Tel:
Fax:
Email:

Please circle the observed crossing and mark with an arrow the direction

Mark each behavior a pedestrian exhibits upon arriving at the selected crossing. If the pedestrian is female, mark an "O"; if male, mark an "X"; unknown, mark a "+".

Time Period #	Pedestrian Behavioral Observations					
	Crosses Against Red Light	Stops and Waits at Red Light	Crosses on Green or Yellow Light	Still Crossing When on Red	Looks in All Directions	Crosses While Using Mobile Device
(0-15 min)						
(15-30 min)						
(30-45 min)						
(45-60 min)						
(60-75 min)						
(75-90 min)						
(90-105 min)						
(105-120 min)						
TOTAL	Female: Male:	Female: Male:	Female: Male:	Female: Male:	Female: Male:	Female: Male:

Pedestrian Behavior Observation Count Sheet Page 2

Behavior Definitions:

Crosses on green or yellow light**:** The observed pedestrian crosses when parallel traffic has a green or yellow light and the pedestrian has the right-of-way. Pedestrian signals at the crossing should be ignored while observing this behavior, instead using the traffic signal.

Still crossing street when light turns red**:** The observed pedestrian starts crossing the street during a green or yellow light but does not finish crossing the street until after parallel automobile traffic has a red light.

Stops and waits at red light**:** The observed pedestrian does not begin crossing while cross-traffic has the right of way.[40]

Crosses against red light**:** Pedestrians are considered to be jaywalking against a red light when they begin crossing a through lane of the cross-street before the light for the parallel traffic has turned green.

Looks in all directions for cross-traffic before entering crosswalk**:** At a signalized intersection, if the observed pedestrian scans in all directions of legal cross-traffic in the interval between the cross-traffic's light turning yellow and prior to the pedestrian beginning to cross the street with a "WALK" signal or green light for parallel traffic this behavior is noted. This behavior is documented regardless of whether the pedestrian is crossing legally or against a red light.

Uses cell phone or other communication device**:** Observed pedestrians who crossed the study crossing while using a mobile device are noted on the data collection sheets. Behaviors noted include talking, texting, or other activities involving direct use of the device.

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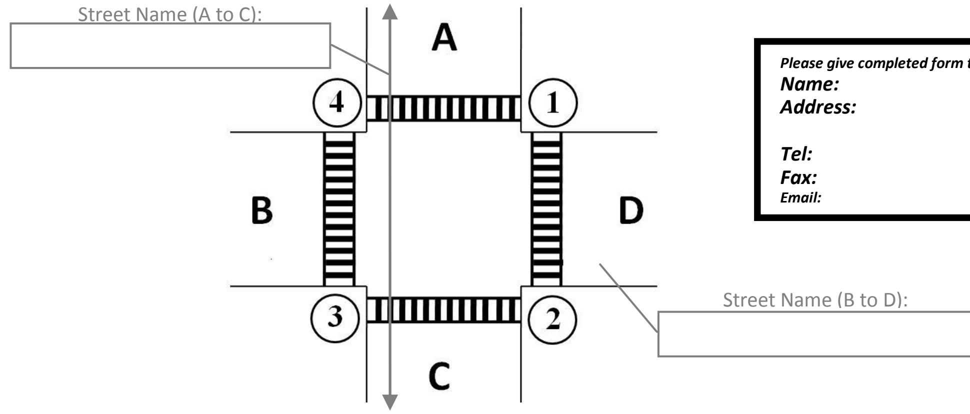
[40]The observed pedestrian is to be considered waiting at a red light even if s/he steps off the curb so long as the s/he remains within two feet of the curb, unless there is a dedicated right-turn lane at the crossing, in which case the observed pedestrian is considered to be waiting at the red light only if s/he remains on the curb.

Bicyclist Behavior Observation Count Sheet Page 1

Mainline Roadway: ______________________________
Intersecting Roadway: ______________________________
Direction Observed: ______________________________
Observer Name(s): ______________________________
Date: ______________________________
Observation Time: (Start) ______________(End)______________
Temp. (°F): __________ Sunny, cloudy, rainy, etc.: ______________
Description of Specific Observation Location: ______________
____



Please give completed form to:
Name:
Address:

Tel:
Fax:
Email:

Mark each behavior a bicyclist exhibits upon arriving at the selected crossing (include bicyclists on sidewalks). If the bicyclist is female, mark an "O"; if male, mark an "X"; unknown, mark a "+".

Time Period #	Bicyclist Behavioral Observations		
	Enters on Green or Yellow Light	Stops at Red Light	Runs Red Light
(0-15 min)	S: R: L:	S: R: L:	S: R: L:
(15-30 min)	S: R: L:	S: R: L:	S: R: L:
(30-45 min)	S: R: L:	S: R: L:	S: R: L:
(45-60 min)	S: R: L:	S: R: L:	S: R: L:
(60-75 min)	S: R: L:	S: R: L:	S: R: L:
(75-90 min)	S: R: L:	S: R: L:	S: R: L:
(90-105 min)	S: R: L:	S: R: L:	S: R: L:
(105-120 min)	S: R: L:	S: R: L:	S: R: L:
TOTAL	Female: Male:	Female: Male:	Female: Male:

Bicyclist Behavior Observation Count Sheet Page 2

Behavior Definitions:

Enters on green or yellow light**:** Bicyclists are noted when they enter an intersection on a green or yellow light.

Stops at red light**:** Bicyclists are recorded for this behavior when they stop at an intersection for a red light.

Runs red light**:** Bicyclists are considered to run a red light if they enter an intersection during a red light or before the light turned green. They are also recorded as disobeying a red light if they did not complete crossing the intersection before the light turned red. If the bicyclist entered the intersection on green but did not complete the crossing before the light turned red they were not considered in the evaluation of this behavior.

Driver Behavior Observation Count Sheet Page 1

Mainline Roadway: ______________________________

Intersecting Roadways: ______________________________

Direction Observed: ______________________________

Observer Name(s): ______________________________

Date: ______________________________

Observation Time: (Start) ______________ (End)______________

Temp. (°F): __________ Sunny, cloudy, rainy, etc.: ______________

Description of Specific Observation Location: ______________________________

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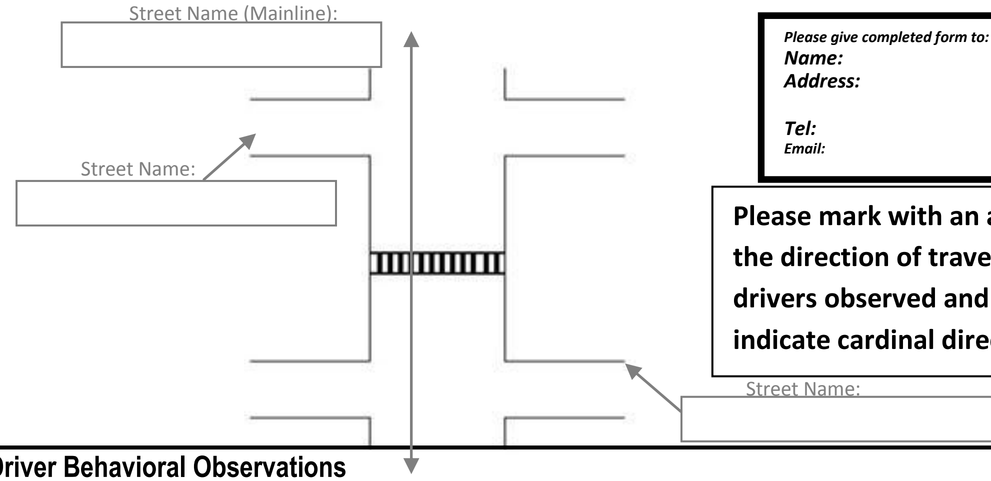

Please give completed form to:
Name:
Address:

Tel:
Email:

Please mark with an arrow the direction of travel of the drivers observed and indicate cardinal direction.

Mark each behavior a driver exhibits upon arriving at the selected crossing.

Time Period #	Driver Behavioral Observations			
	Pedestrian Crossing Left to Right		Pedestrian Crossing Right to Left	
	Does not yield to pedestrian	Yields to let pedestrian cross	Does not yield to pedestrian	Yields to let pedestrian cross
(0-15 min)				
(15-30 min)				
(30-45 min)				
(45-60 min)				
(60-75 min)				
(75-90 min)				
(90-105 min)				
(105-120 min)				
TOTAL				

Driver Behavior Observation Count Sheet Page2

Behavior Definitions:

Does not yield to pedestrian**:** If a driver does not yield to a pedestrian when legally required to do so, this behavior is recorded. A driver is marked as not yielding if he or she would have been able to stop when the pedestrian arrived at the crosswalk. In order to measure the distance beyond which a driver would be able to stop, the safe stopping distance for an automobile should be calculated using the methodology described below. Observations are undertaken from this point, and motorists who are behind the observer when a pedestrian begins to cross the street or is waiting at the crosswalk and do not yield or slow for the pedestrian to cross are recorded as not yielding. Vehicles that are closer than the marker when the pedestrian is waiting at the crosswalk or begins crossing will not be recorded regardless of whether they yield or not.

Yields to let pedestrian cross**:** Drivers are to be recorded if they yield or slow to let pedestrians waiting at a crosswalk or in the crossing finish crossing the roadway. Drivers who are too close to yield because they did not have adequate time to stop according to the safe stopping distance below are not recorded whether they yield or not. Drivers who proceed across the crosswalk with caution after the pedestrian is further than one and a half lanes from the vehicle in the crossing are recorded as yielding.

Calculated Sight Stopping Distance for 25mph: 200 feet

UNIVERSITY OF CALIFORNIA, BERKELEY

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SAFE TRANSPORTATION
RESEARCH AND EDUCATION CENTER
2614 Dwight Way, MC 7374
BERKELEY, CA 94720-7374
Phone: (510) 642-0566 Fax: (510) 643-9922

April 2012

To Whom It May Concern:

The purpose of this letter is to tell you about a research survey being conducted by the University of California, Berkeley Safe Transportation Research and Education Center (SafeTREC) for the UC Berkeley Office of Risk Management. The purpose of the study is to observe pedestrian behavior at signalized intersections around the campus area.

The trained researchers, who are conducting the observations, will stand at signalized intersections for approximately 2 hours. The researchers will not interfere with any businesses, residents, etc. in the area.

If you have any questions about the study, please call Robert Schneider at (510) 642-4049 or Offer Grembek at (510) 642-5553.

Thank you in advance for your understanding.

Sincerely,

David Ragland, Ph.D
Director
UC Berkeley SafeTREC

Appendix G. Spot Speed Study

This appendix explains the methodology used to observe motor vehicle speeds at selected corridor segments. Speeds are observed by measuring individual speeds of a sample of vehicles passing a given point. This information is used to estimate the speed distribution at that location given the prevailing conditions. These speed studies can serve a wide variety of safety purposes including helping establishing minimum and maximum speeds at the location, helping determine the proper location and priority of traffic control devices and warning signs, and improving traffic signal timing. The spot speed studies can also be used for before-and-after studies to observe changes in motor vehicle speeds after a safety improvement is made in the area. Additionally, speed studies can be used to conduct safety studies at problem locations, evaluate citizen complaints, and other research projects.

Process

Site selection: When selecting a site for a spot speed study, locations should be avoided where vehicles will be accelerating or decelerating. The study should also be as inconspicuous as possible to avoid influencing driver behavior. The radar and laser equipment should be positioned at an angle of 10 degrees or less to the path of the vehicles and placed approximately three feet above the surface level.

***Time of study*:** The study should be conducted during off-peak hours to facilitate the collection of free-flowing (versus congested) vehicle speeds. The speed study should be conducted on a Tuesday, Wednesday, or Thursday to capture weekday driving behavior.

***Selection of the sample*:** Unless deemed necessary, the sample should be restricted to free-flowing vehicles, with a 4 second headway used to define free-flowing. Additionally, care must be taken to obtain a representative sample (e.g., sample every vehicle on a rural street or every third vehicle on a city, vary depending on the feasibility of recording the necessary data between vehicles).

***Data collection*:** Data collection should be undertaken for one hour divided into four 15-minute periods to allow for segmentation within the study period. For study areas with multiple lanes, data should be collected for all lanes and the lane the vehicle was measured in should be recorded in the data sheet. Data collection should be suspended if real-time events that may temporarily alter speeds arise. A minimum sample size of 100 is recommended.

***Data analysis*:** For the current study, data analysis of speed data focused on the generation of various percentile values for the speed profile to examine how speed profiles vary around the campus area and generate overall speed statistics including the 85^{th} percentile speed of all locations. The 85^{th} percentile speed is normally assumed to be the highest safe speed for a roadway section and if this percentile is more than 5 mph over the post speed limit, the situation should be evaluated.

***Speed influences*:** Many variables affect the speed of the vehicles. These include the physical conditions of the study area, such as the curvature, grade, sight distance, pavement roughness, spacing of intersections, or roadside development. Additionally, there are many environmental factors that also effect the speed of vehicles including the roadway classification, the type of area (urban or rural), the posted speed limit, type of driver (e.g., local, out-of-state), time of day, weather, or the presence of enforcement. Finally, traffic flow may also influence speeds given the volume of traffic, classification, turning movements, as well as the presence of bicyclists or pedestrians.

Other Notes: The radar equipment must be aimed at an angle of 10 degrees or less otherwise calculations must be corrected. Only the speed of vehicles moving toward or away from the radar unit can be measured while it is possible to measure the speed of any vehicle that the observer can see in the traffic stream using the laser speed meters. The effective distance range for measurement is between 200 feet and 2 miles. Radar detectors may produce distorted results and the accuracy of the radar speed meters should be checked periodically with a tuning fork.

Spot Speed Observation Form

Location: ______________________________ Direction Observed: ________________

Distance to measurement spot: ____________

Distance to Lane 1: ____________ Distance to Lane 1: ____________ Distance to Lane 1: ____________

Temp. (°F): __________ Sunny, cloudy, rainy, etc.: ______________________ Description of Observation Location: ____

Observer Name: ___________________

Date: ______________

Start Time: _______ End Time: _______

		Time Periods											
		Lane 1	Lane 2	Lane 3	Lane 1	Lane 2	Lane 3	Lane 1	Lane 2	Lane 3	Lane 1	Lane 2	Lane 3
Recorded Speeds	10												
	11												
	12												
	13												
	14												
	15												
	16												
	17												
	18												
	19												
	20												
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