# A Bicycle Plan for the University of California Santa Cruz

UCSC Bicycle Subcommittee*

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ABSTRACT

This plan is intended to guide the development and improvement of bicycle facilities on the UC Santa Cruz Campus, with particular attention to the commuting bicyclist. Special concern is given to ensuring the safety for both bicyclists and pedestrians, primarily through careful engineering design, but also through appropriate education and enforcement programs.

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# Contents

# 1. Introduction

The UCSC campus, with its simultaneously growing population of students and employees, has the responsibility to ensure that it is accessible, that is, to ensure that transportation facilities exist which will allow people both to get to the campus and to move about on it. Such facilities include not only roads and parking for automobiles, but also a public transportation system, footpaths, and facilities designed for those who will ride bicycles.

The following plan focuses on facilities for bicyclists.

The UCSC campus also has the responsibility to mitigate its impact, both on the campus itself and on the community. To the extent that bicycles substitute for automobiles, the encouragement of bicycle use constitutes one such means of mitigation. Substantial benefits to the campus result from increasing the use of bicycles, including reducing the demand for parking, reducing air and noise pollution, and need for additional roads and parking facilities which become increasingly costly and visually obtrusive as convenient land surface available for such facilities is exhausted. Bicycle facilities are also generally much cheaper to build than the corresponding facilities for automobiles or buses, particularly where cut-and-fill work is needed to create level areas.

Benefits also accrue to the community at large, where available space for additional roads and parking is likewise geographically constrained.

Despite these important benefits, bicycles have yet to constitute a major component of the campus transportation system. Their use is inhibited by an inadequate network of overly narrow roads and a hilly campus ranging in elevation from 300 to nearly 1200 feet above sea level, whose terrain is punctuated by steep north-south canyons. Although some bicycle facilities exist, planning for bicycles has not been consistently incorporated into the development of the campus. As a consequence, there are few bike paths, with only a few connections, and many points of unsafe conflict between bicycles and pedestrians or vehicles.

The current trend, however, is clearly toward increasing bicycle use. Advances in bicycle technology, coupled with the increased cost of operating automobiles and providing roads and parking for their use, to say nothing of impending traffic jams—all serve to stimulate the use of bicycles. The popularity of bicycling for exercise has increased with the increasing interest in non-impact aerobic exercise. Moreover, the beauty of the campus, with its remarkable views and peaceful setting, serves to attract the bicyclist.

On balance, the benefits are such that the existing obstacles should be overcome. Consequently we believe that those concerned with transportation issues should give consideration to the construction of facilities to provide for those who will use bicycles to commute to campus and to move about the campus.

In planning for and constructing new facilities, it is essential that serious consideration be given to issues of safety, with attention being paid both to existing unsafe conditions and to incorporating appropriate safety measures in future planning. Lack of attention to safety issues can prove costly and demoralizing, as evidenced by an incident on the Irvine campus, recently reported in the news, in which the serious injury of a pedestrian by a bicyclist resulted in a reported multi-million dollar settlement against the University. The avoidance of conflicts between bicyclists and pedestrians or motorists has been a key principle in our preparation of this plan, primarily by separating bicyclist and pedestrians, and by designing bike routes that treat bicycles like other vehicles.

In broad terms, we recommend that existing bicycle routes on campus be made safer, and that new routes be created to reach areas currently less accessible to the bicyclist. We also recommend that appropriate parking, storage and shower facilities be provided for bicyclists. Finally, we recommend that funding be made available to accomplish the intended goals, and that methods be specified for ensuring the implementation of the plan.

In Sections 2 through 7 of this planning document, we suggest principles, state issues and concerns, and make recommendations which we believe will accomplish the goals of eliminating safety hazards and increasing bicycle use. An executive summary, consisting of a comprehensive list of recommendations grouped roughly in order of priority, may be found in Section 8.

# 2. Bicycle Policies

## 2.1 Principles

We wish to encourage bicycling to campus and on campus, with increased safety, efficiency, and enjoyment for bicyclists and pedestrians. As the campus continues to grow, the facilities provided for motor vehicles will get more obtrusive and more expensive. Bicycle facilities are so much cheaper than the corresponding ones for automobiles, that every commuter we convince to switch from automobiles to bicycles represents a substantial savings in the cost of the infrastructure.

Safe bicycling is based on three E's: Engineering, Education, and Enforcement. This plan deals mainly with engineering (except Section 6), because it has the longest-lasting effect of the three, but successful implementation of the plan requires co-ordination of all three. The Bike Subcommittee will take the lead on recommending ways to bolster all three aspects of bicycle planning.

## 2.2 Issues and Concerns

Because of perceived unsafe pedestrian-bicyclist and motorist-bicyclist conflicts, some members of the campus community have proposed that bicycles be banned from the central core of the campus. Although we understand the concern, we believe such a policy to be unwise. Substantial benefits result from the encouragement of bicycle use by the daily commuter. The commuting bicyclist must be allowed to reach his or her destination, and this implies that at least certain core routes be available to the bicyclist. Furthermore, with the inevitable increasing use of bicycles, the enforcement of such a ban would be both difficult and expensive. We agree that bicyclists and pedestrians should be kept separate, for the safety of both, but bicycles and automobiles can share the roads safely.

Currently, the best routes for bicyclists to reach their destinations are often the service roads. In some cases, no alternative route exists; in other cases, the alternative routes are significantly longer, or are on narrow roads with heavy traffic. Keeping the service roads open to bicyclists is an important part of any plan that is intended to support commuting by bicycle.

### 2.2.1 Bike Lanes or Bike Paths?

One of the first questions that comes up when designing facilities for bicyclists is whether to build separate bike paths, add bike lanes to roads, or simply widen the roads without striping special lanes.

In consonance with accepted standards [Cal83], we use the word *bikeways* to mean any paved surface for bicycle travel, and distinguish between three different three types of bikeways:

- A *Class I bikeway* (or *bike path*) provides for bicycle travel on a right of way completely separated from any street or highway.
- A *Class II bikeway* (or *bike lane*) provides a striped lane for one-way bike travel on a street or highway.
- A *Class III bikeway* (or *bike route*) provides for shared use with pedestrian or motor vehicle traffic.

Despite the numbering system, Class II bike lanes are generally the most desirable bikeways.

We will only consider Class I bike paths and Class II bike lanes for this campus. Class III bike routes are either extremely hazardous mixes of bicycles and pedestrians, or useless signs on a shared road. We have no inherent objection to shared roads, but would prefer the extra width afforded by adding bike lanes.

The accident statistics (on this campus and nationwide) show that only a small percentage of bicycle accidents are bike-car accidents (17–18% for adult riders), and that the bike-car accidents are rarely a result of motorists overtaking bicyclists [For84, 156–169]. Most bike accidents are simple falls, usually resulting from a combination of poor riding surface and inept bicycle handling.

From a safety standpoint, we are better off mixing bicycles with automobiles than we would be mixing them with pedestrians. For experienced bicyclists, accident rates on urban bike paths are about 2.6 times higher per mile traveled than their accident rates on roads [For84, 158]. (We do not have have sufficient data on miles travelled to determine whether this ratio holds for our campus.) When we further consider that bicyclists coasting downhill on campus reach 30 mph or more, it becomes even clearer why we should not mix bicyclists and pedestrians.

Putting bike lanes on roads serves several purposes:

- Bicyclists are encouraged to use the road, rather than nearby pedestrian paths.
- The road must be built to sufficient width that bicyclists do not have to irritate motorists by using the entire travel lane.
- Bicyclists are encouraged to ride far enough from the edge of the road to avoid the hazards of the road edge.
- When two roads intersect, well-understood right-of-way procedures are used to control interactions between vehicles, but when a path intersects a road, misunderstandings between motorists and bicyclists are common.
- The paving on roads is generally better maintained than the paving on paths, resulting in smoother surfaces and fewer falls for bicyclists.
- For commuters, bike lanes are more important than bike paths, as the paths are not necessarily going to go where they commute, but roads are guaranteed to.
- Newcomers to campus will usually take the clearly marked roads, rather than bike paths whose destinations are unknown.
- Adequate lighting for nighttime use is more likely to be available on roads than on separate paths.

Where roads wide enough for bike lanes to exist, no useful purpose is served by making separate bike paths that parallel the road.

Bike paths do serve a useful function when they are built where no road exists. The current bike path is an excellent example of this, as it connects Performing Arts to Coolidge Drive much more directly than the roads.

Bike paths are often proposed by recreational riders, who want a smooth paved surface without the intrusive presence of motor vehicles. Most such paths do not go anywhere useful, and need to be evaluated strictly as recreational facilities. As a committee we have not recommended building any such paths, although we would probably enjoy using them if some recreational funding were used to build them.

Some paths are proposed as commuting routes; sometimes by motorists who want to kick bicyclists off the roads, sometimes by bicyclists who fear conflicts with motorists. It is difficult to build such paths so that their intersections with roads are as safe as road-road intersections. The bottom of the current path provides illustrations of both good and bad path-road intersection design: the ascending bicyclist is obliged to make a left turn at a point where it is difficult to cross the road safely, while the descending bicyclist can enter the southbound bike lane smoothly, with sufficient space and visibility, in a manner predictable by motorists. Further discussion of the existing path can be found in Section 3.2.4.

In general, bike paths can only be justified for commuters if they go places where roads do not go. When roads exist, it is better to put the bicyclists on the roads.

A recent fad in bicycling is the off-road or mountain bike. These bicycles are designed and sold for riding on rough, unpaved paths. Unfortunately, the smaller ground contact, greater slip, and higher speed makes them much more likely to kill plants and start erosion than hikers on the same paths. Because of the fragility of the local plants and soils, we oppose off-road riding, particularly during the rainy season. But we see no problems with mountain bike riders on the streets, bike paths, and fire roads.

### 2.2.2 Designing and Maintaining Bikeways

Caltrans has published an excellent document on the design of bikeways [Cal83]. Recommendations in this manual should be used as a guide for the design of bikeways on campus. When new bikeways are planned or changes are made to existing bikeways the Caltrans guidelines will be used in so far as possible. Care should be taken to ensure that bikeways on campus meet Caltrans standards for width, stopping sight distance, lateral clearance, intersection designs, and superelevation (cross-slope).

Good engineering for bikeways makes enforcement and education easier, because the obvious way to ride is also the safest. When designing bikeways, attention should be particularly focussed on intersections with roads. According to the Caltrans Highway Design Manual, "Most auto/bicycle accident occur at intersections. For this reason, bikeway design at intersections should be accomplished in a manner that will minimize confusion by motorists and bicyclists, and will permit both to operate in accordance with the normal rules of the road." [Cal83, 7-1003.2(3)].

Intersections with traffic lights need only minor modification to be ideal intersections for bicyclists. Most modern traffic signals have sensors under the pavement that detect vehicles to determine when to change the lights. If these sensors do not detect bicycles, the bicyclists often get frustrated and disobey the signals. This dangerous behavior can be reduced by adjusting the sensors to detect a bicycle on top of the loop. Modern quadrupole-loop sensors are easily adjusted to detect bicycles above them, without incorrectly detecting vehicles in adjacent lanes. Where bicycle lanes are marked on the pavement, the bicycle lane should have its own sensor to detect any bicyclist in the lane. Where bicyclists will have to use normal traffic lanes (for example, for left-turns), the location of the sensor loop should be marked so that the bicyclist can position his or her bicycle to trip the signal. The City of San Diego has proposed a new pavement marking for indicating to bicyclists where to put their bikes to trip the signal [Moh85].

In addition to the intersection design, care should be taken to ensure that all bikeways on campus meet Caltrans standards for width, stopping sight distance, lateral clearance, and superelevation (cross-slope). New bikeways should be built to the standards, and existing ones should be upgraded.

In much of the on-campus planning, it seems that bicycle facilities are added as an afterthought, if they are added at all. Bicycle facilities would be better designed for safety and efficiency and cheaper if they were included in new projects from the beginning. It would be useful to have the Bicycle Subcommittee review plans soon enough to have some effect on what gets planned. The Bicycle Subcommittee expects to consult with the County Transportation Commission Bicycle Committee on a regular basis, particularly for projects that are on or intersect County roads. Areas that need consideration (currently or soon to be under construction) include Science Hill, the main and west entrances, the eastern access, the community access zone near the Performing Arts Center, and the OPERS area around the East Field House.

As Laurel Wilson, then Bicycle Coordinator for the Santa Cruz County Transportation Commission, points out, "the development of a safe and usable bikeway system on the UCSC campus is contingent upon the UCSC Bike Plan becoming an integral part of the UCSC planning process." [Wil88]

The Caltrans Highway Design Manual stresses the need for maintenance on bike lanes: "Measures must be taken to ensure the surface of bikeways are maintained in a smooth condition free of potholes and corrugations, and that gravel, broken glass, and other debris are not allowed to accumulate to the extent they might cause tire damage, loss of control, or inconvenience." [Cal83, 7-1003.5(2)]. Because conditions vary, the manual does not stipulate any specific frequency for sweeping. Based on what we have seen, bike lanes under the redwoods should probably be swept two or three times during each rainy season, and bike lanes in the meadow should be swept at least once a year. When there is traffic to unpaved areas (particularly construction vehicles transporting sand or gravel), more frequent sweeping would be needed. Cars leaving the unpaved vista on Coolidge Drive also deposit a lot of gravel on the road. All road edges should be swept with this frequency, not just those that have been labeled as bike routes.

All bike lane and road edge stripes should be repainted at least every two years, to ensure that they are sufficiently reflective to be visible with the relatively weak headlights available for bicycles.

The metal plates that cover utility boxes (manhole covers) are extremely slippery when wet. The metal plates should be coated with anti-skid paint (paint or epoxy with sand in it), and the anti-skid surface should be renewed when it wears off.

### 2.2.3 Data needed

Data regarding bicycle accidents are particularly useful in planning for improved safety in bicycle routes. In the past three years (August 1984–February 1988), 66 bike accidents have been documented by either the Campus Fire or Campus Police Departments; we include a summary in Appendix B. Such data should continue to be gathered, and made available to those responsible for bicycle planning.

Maps of accident locations can be used to identify trouble spots, and classification of accident causes can help us determine what remedies would be most effective in reducing accidents. The accident maps and classifications should be prepared at least every two years, and annually if possible.

To provide guidance for ordering priorities for construction projects, it is helpful to have data available concerning current and projected numbers of bicyclists using various routes. For example, one count in Fall Quarter showed 250 bicyclists a day entering campus through the main entrance. Current behavior may be easily monitored through traffic counts, if care is taken not to introduce biases from limited sampling. Bicycling traffic is subject to considerable variation because of weather, time of day, and time of year.

Reliable estimates of projected behavior are more difficult to make. A limited but a well-designed sample survey may be of use in estimating, for example, how many bicyclists might make use of a class I path serving either the east or west side of campus, or of how many bicyclists might make use of racks on shuttles and Transit District buses, but it seems likely that individual behavior will more likely be governed by the existence of such amenities than by opportunities imagined only in advance of their construction.

For some of the cheaper suggestions, it may be cheaper to build the facilities than to determine whether or not to build them, particularly if they are sited based on existing bicycling patterns.

## 2.3 Recommendations

1. All new roads should be built with bike lanes. Uphill lanes are more important than downhill lanes. (Section 2.2.1, page 4; Section 4.2.3, page 24)
2. All new bikeways (whether bike lanes or off-road bike paths) should be built to Caltrans standards [Cal83]. (Section 2.2.2, page 6)
3. Bicyclists and pedestrians should not be mixed on the same paths—particularly not on steep downslopes. Where mixed-use facilities are unavoidable, such as on the service roads, the pavement should be striped to indicate bike and pedestrian lanes. (Section 2.2.1, page 4)
4. Bicycles should be prohibited from riding in unpaved areas, except on specially marked bike paths and on the fire roads above campus. (Section 2.2.1)
5. Higher priority should be given to bikeways for commuting and utility riding than to purely recreational bikeways. (Section 2, page 4)
6. Bike paths should be constructed only where no road exists, not parallel to roads. Where roads exists, bicyclists should be encouraged to use them, preferably with bike lanes. (Section 2.2.1, page 4)
7. Bikeways should be designed so that the easiest way to use them is also the safe, legal way. That is, we should not try to make education and enforcement compensate for inadequate engineering. (Section 2.2.2, page 6)
8. The Bicycle Subcommittee should be consulted regarding any proposed construction that would affect bicyclists, at an early enough stage in the planning that changes can still be made. (Section 2.2.2, page 6; Section 4.2.3, page 24)

9. Any traffic signals installed on campus should have loop detectors in the bike lane and the left-turn lane sensitive enough to detect bicycles. (Section 2.2.2, page 6)
10. The location of loop sensors for traffic signals should be painted on the pavement. (Section 2.2.2, page 6)
11. All bike lane and road-edge striping should be repainted at least every two years, to maintain sufficient reflectivity. (Section 2.2.2, page 6)
12. Bike lanes and road edges should be swept at least twice a year—more often when there is nearby construction. (Section 2.2.2, page 6)
13. The metal plates that cover utility boxes (manhole covers) should be coated with anti-skid paint (paint or epoxy with sand in it), and the anti-skid surface should be renewed when it wears off. (Section 2.2.2, page 6)
14. Maps showing the locations of bicycle accidents on campus should be prepared at least every two years, and published widely. The leading causes of accidents should be determined to guide the selection of corrective measures.
15. A sample survey of the campus bicycling population should be conducted to determine the probable use of additional Class I bike paths serving the East and West sides of campus, and of the probable use of bike racks on shuttles and Transit District buses. The differing needs of commuters and residents should be separately determined. (Section 2.2.3, page 7)
16. The numbers of bicyclists who commute to UCSC should be estimated, distinguishing those using the bike path from those using Coolidge Drive. Care should be taken to ensure that the counts are not biased by weather, time of day, day of the week, or time of year. (Section 2.2.3, page 7)

# 3. Bicycle Traffic to and from the Campus Core

## 3.1 Principles

A central problem for the commuting bicyclist is that the campus is situated on the slopes of Ben Lomond Mountain, and to reach the core of the campus requires a climb of approximately 400 feet in elevation from the main campus entrance. Such a climb tends to discourage those who might otherwise commute on a bicycle, as evidenced by the more extensive bicycle use on other flatter campuses, such as at Davis, Stanford, and Santa Barbara. To overcome the problem of the hill, it is essential that routes designed for the bicyclist be attractive, convenient and safe. Gradients should be manageable, terminating points in the core should provide convenient access to the most heavily-used facilities, and physical hazards and conflict with vehicular traffic should be minimized.[1]

Also because of the hill, is is desirable that shower facilities be made available at campus core locations.

Furthermore, for the bicyclist not yet in condition to pump up the hill, it is necessary to arrange alternate transport, such as vehicles equipped with carrying racks. Such alternate transport may also reduce the travel time, although probably not by much, as a conditioned bicyclist can easily reach the campus core from the main entrance in 10 or 12 minutes.

Finally, when the commuting bicyclist reaches his or her destination, it is necessary to provide parking or storage facilities where a bicycle can be kept safe and protected from the elements.

## 3.2 Issues and concerns

Most commuters to campus come up Bay Drive or High Street, so this plan concentrates on routes starting on High Street (Section 3.2.1), at the main entrance (Sections 3.2.2, 3.2.3, 3.2.4, 3.2.5, and 3.2.6), or the west entrance (Sections 3.2.7 and 3.2.8). Other routes and bicycle transport without cycling are also discussed (Sections 3.2.9 and 3.2.10).

### 3.2.1 Cardiff House driveway

A bicyclist coming up High Street has three options for entering campus: the Cardiff House driveway, the main entrance on Coolidge Drive, or up Empire Grade to the west entrance on Heller Drive. The first option is currently blocked with a chain, but we believe it offers the best route to central campus for bicyclists coming up High Street.

The proposed route ascends the Cardiff House driveway from High Street, runs past the Cardiff House (the Women's Center) and the Carriage House to cross Coolidge Drive directly across from the start of the existing bike path. Although a barrier chain across the foot of the Cardiff House driveway requires bicyclists to dismount to lift their bikes over the chain, the path is now being used by an increasing number of bicyclists. It has several advantages:

- It enables bicyclists ascending High to avoid the Bay-High intersection simply by turning off High into the driveway.
- It enables bicyclists ascending Bay to bypass the Bay-High intersection by turning right at Iowa Drive and heading up Cardiff Place to cross High (with good visibility) into the Cardiff driveway.
- It enables a more convenient, safer, and better defined crossing of Coolidge, avoiding the dangerous left-turn off of Coolidge onto the bike path.

[1] We use the term vehicles in this document to mean motorized vehicles, including automobiles, buses, trucks, motorcycles and mopeds.

Bicyclists coming up Coolidge seem to have a hard time making safe, legal left turns onto the existing bike path, so one might think that crossing Coolidge would be difficult at this point for bicyclists coming up the Cardiff path, particularly during the morning commute rush when long strings of vehicles are heading up Coolidge. However, there are well-defined breaks in such strings, owing to the existence of the traffic light, during which bicyclists (and pedestrians) can cross. Furthermore, the bicyclist approaches Coolidge on a level grade and at a right angle to the road, with good visibility of the approaching vehicles. The situation encourages bicyclists to stop, wait for an appropriate gap and cross the road in a well-defined and predictable manner.

- It is shorter than continuing up High to the main entrance.

This route would **not** be suitable for the descending bicyclist, as it

- would tend to inject bicyclists travelling at high speed the wrong-way onto High Street, creating an unmanageable bicycle-vehicle conflict, and
- would require the descending bicyclist headed down Bay to cross the Coolidge-Bay corridor twice.

When Cardiff is opened to bicycle traffic, some changes may be justified on Coolidge. A stop sign could be placed on Coolidge to make it easier for bicyclists and motorists exiting the parking lot to get through traffic. If Cardiff Drive is not opened to uphill bicycle traffic, the stop sign would help bicyclists to make safe left turns onto the bike path (see Section 3.2.4 for a better suggestion for increasing the safety of the left turn).

In the event that vehicular traffic on Coolidge Drive becomes so heavy that gaps in such traffic occur only rarely, it may become increasingly difficult for (ascending) bicyclists (and pedestrians) to cross it. Future methods for dealing with this problem might include a grade separation, or a signal activated by the bicyclist or pedestrian. A grade separation should route bicyclists under rather than over the roadway, since only an 8-foot vertical clearance is required for bicyclists, while nearly twice that clearance is required for vehicles. Furthermore, there is a sink-hole just to the north of this crossing which could be used to good advantage in the construction of an underpass for bicyclists.

A grade crossing would be very pleasant for bicyclists, but would be expensive to construct. From a safety standpoint, a traffic signal would be just as effective, and much cheaper. If a traffic signal is installed, it must include sensor loops in the bike paths to detect bicyclists. Pushbuttons on poles are not an adequate substitute, as they either require bicyclists to reach way over, or put a pole perilously close to their through route.

Ken Wormhoudt has proposed closing the current driveway from the Carriage House area and adding a newer driveway further up Coolidge. [Wor87] This change would break the connection between the Cardiff Lane path and the existing bicycle path, probably causing bicyclists to cycle on the wrong side of Coolidge to get back to the path. We recommend against moving the driveway.

The Cardiff House drive way should be opened to uphill bicycle traffic by removing the chain across the gate, and installing bollards to keep motor vehicles off the path. Standard road signs saying “One-way, Do not enter” should be put at the uphill end of the path.

With the opening of Cardiff, the City should be encouraged to put directional signs on Bay Drive and Iowa Drive saying “Bike path to UCSC Campus”. They should also be encouraged to designate Iowa Drive and Cardiff Place as Class III bike routes.

### 3.2.2 Main Entrance, lower Coolidge Drive

Coolidge Drive is the main entrance for bicyclists as well as for motorists.

A few problems have been identified with the main entrance.

- Most bicyclists do not know how to trip the traffic signals at the corner of Bay and High. There is a particular problem for the descending bicyclist wishing to turn left onto High, who may find himself waiting alone in the left turn lane with no way to trip the signal. In fact, the left-turn lane loop detector is sensitive enough to detect bicycles, if they know to move to the center of the lane over the detector. The location of the loop should be painted on the pavement,

so bicyclists can locate it more easily. The City of San Diego has proposed a new pavement marking for indicating to bicyclists where to put their bikes to trip the signal [Moh85].

- Bicyclists turning left from Coolidge onto High frequently must contend with motorists ascending Bay and making wide left turns onto Empire Grade. Striping turning curves on the pavement would reduce this hazard.
- Bicyclists turning left from Coolidge onto High sometimes attempt to do it from the right-hand side of the road, violating traffic law and endangering themselves unnecessarily. Striping a narrow left-turn lane for bikes to the right of the current automobile left-turn lane would be very effective in inducing these bicyclists to turn correctly. Of course, such a left-turn lane would have to include a sensor to trip the traffic signals.
- Bicyclists continuing straight from Coolidge down Bay sometimes stay too close to the right-hand curb, confusing motorists about their planned movement. A straight-through bike lane could be striped at the intersection to show bicyclists where to ride, as was done at the corner of Bay and Escalona.

### 3.2.3 Upper Coolidge Drive

Most bicyclists turn off of Coolidge onto the bike path, but some continue on Coolidge to reach the east colleges, which are not easily accessible via the existing bike path. Although the upper part of Coolidge is used by both ascending and descending bicyclists, there are some problems with this route.

- The shoulders are not well-surfaced, leading bicyclists to ride at the edge of the roadway rather than on the shoulder. Riding in the automobile lane is the safest place for downhill riders travelling over 30 mph, but is not a good idea for uphill riders travelling less than 10 mph. Conditions could be improved in both directions by resurfacing the shoulders so as to provide Class II bike lanes.
- Coolidge Drive puts bicyclists, particularly ascending ones, in close proximity to motor vehicles emitting noxious fumes.
- It has the disadvantage that it does not serve either the East Athletic Facilities or the west side of campus well.

Coolidge Drive is currently the preferred route for mopeds. Mopeds, or motorized bicycles, are an important alternative mode of transportation that is energy efficient, economical, and realistic for a campus situated on a hill that is forbidding to commuters who would otherwise use bicycles. For safety reasons, the use of mopeds must be prohibited on bike paths and pedestrian paths. According to the California Highway Design Manual, "By State Law, motorized bicycles ('mopeds') are prohibited on bike paths unless authorized by ordinance or approval of the agency having jurisdiction over the path." [Cal83, 7-1003.1]; "Motorized bicycles ('mopeds') are permitted in bike lanes, ... ." [Cal83, 7-1003.2]

In general, mopeds should be discouraged from using the main road surface when travelling uphill on campus roads, since they cannot then maintain normal vehicular speeds, but they will not interfere with ascending bicyclists. Resurfaced shoulders of Coolidge Drive, however, could provide an excellent moped route to the campus core, since it is the least steep of the routes and the visibility is good.

### 3.2.4 The existing bike path

Currently a Class I bike path provides the main route for bicyclists to reach the campus core from the main entrance (see Figure 3.1). For the most part it provides good separation from vehicles and pedestrians, has well-designed gradients, and is attractive to bicyclists, providing peace and quiet and fine views. Furthermore it provides good access to the central core—Performing Arts, McHenry Library, Kerr Hall, and the Science Buildings.

On the other hand, it does not provide good access to either the east sides of the campus, or to many locations on the west side, and some problems relating to its safety need attention. We discuss several points in the following paragraphs.

Figure 3.1: The existing bike path. To eliminate the hazard of the sharp curve just north of the Farm Project, a proposed realignment of a section of the downhill path is shown. Also shown is a proposed new path along the old route of Allen Road (see Section 3.2.6).

A previously suggested route [Wor87], involving a re-routing of the lower part of the bike path to the west of the Barn Theater, would present serious safety problems, as it would require the bicyclist ascending Bay to get into the left turn lane prior to the Bay-High intersection and make a left turn into the right lane of Empire Grade in order to get on the path. It could also mean that the descending bicyclist would be encouraged to cross Empire Grade in a dangerous manner to the west of the intersection. Altering such a path by joining it with Coolidge Drive just north of the Bay-High intersection, near where the Farm Project currently sells vegetables and flowers, does not solve the difficulty of access by the ascending bicyclist, who would still be confronted with the problem of crossing both High and Coolidge in the vicinity of the intersection, either by using pedestrian crosswalks (which bicyclists are loathe to do) or by bicycling in an unpredictable and dangerous manner diagonally across the intersection (a more likely outcome). Also a bicyclist descending to this point is apt to conflict with motorists desiring to make the right turn from Coolidge onto Empire Grade. Furthermore, the descending bicyclist desiring to head down High Street (and there are many who do) are presented with the dilemma of how to get diagonally across the intersection.

Several problems have been identified with the current bike path:

- Conflicts may occur between bicyclists descending Coolidge and vehicles entering or exiting from the parking lots adjacent to the Cookhouse. Descending bicyclists tend to be moving at the speed limit, and motorists entering or exiting the lots are often visitors who are unaware of the existence of the bike lane.

  It is our view that this conflict is not a problem with the bike path or bike lane, but with the landscaping and signing of the driveways. The bicyclists are travelling at about the same speed as motor vehicles on Coolidge, and with about the same visibility. The chance of conflict can be lessened through the use of appropriate signs, including possible marking of the pavement to indicate (for motorists) the existence of the path, and (for bicyclists) the possible existence of motorists entering or exiting from the lots.

  We have no knowledge of any reported accidents from the perceived conflict, and believe that it is not serious enough to warrant re-routing of the descending path, particularly since alternative descending routes are likely to be much more dangerous.

- Perhaps the most serious safety problem concerns access to the lower end of the path by the ascending bicyclist, which is complicated by a confusing and unsafe crossing of Coolidge Drive near the Carriage House bus stop, leading many bicyclists to cross Coolidge in an ill-defined and unpredictable manner at a point lying anywhere from the entrance kiosk to the crest of the first rise, even, in some instances, to ascend (illegally) the designated descending path route.

  Several solutions have been proposed
  - Strict enforcement. Enforcement is moderately effective, but is fairly expensive. The best time to concentrate enforcement efforts is the first few weeks of each Fall quarter, when many new riders are starting to use the bike path. Enforcement would be most effective if combined with engineering that made the illegal left-turns difficult, and the legal ones easier.
  - Education. For some reason, college students and professors seem unwilling to be educated. Again, any education program would be most effective in the first few weeks of Fall quarter.
  - Peer pressure. This is perhaps the strongest available mechanism for changing behavior, but it requires having an overwhelming majority of safe bicyclists, who have the strength of purpose to tell off the wrong-way riders. Judging by the number of wrong-way riders we have, and how belligerent they are about gentle reminders, peer pressure cannot be counted on any time soon.
  - Cardiff Lane bike path. The Cardiff Lane bike path proposed in Section 3.2.1 would reduce the problem by encouraging bicyclists not to come up Coolidge to the bike path, but to come up Cardiff Lane instead. This solution will be extremely effective for those who take Cardiff Lane, but will not affect those who still take Coolidge.

- Stop sign on Coolidge. Putting a stop sign on Coolidge at the bike path would have several desirable effects. One, it would allow bicyclists to make a clean, safe left turn onto the bike path. Two, motorists exiting the parking lot will have an easier time getting onto Coolidge during rush hours. Three, motorist speeding on Coolidge will be reduced. This proposal is cheap and effective, but will probably be resisted by motorists who would object to the extra five second delay.
- Bike left-turn lane on Coolidge. John Forester, the country's foremost cycling transportation engineer, was consulted about several problem areas on campus. His suggestion for the intersection of the bike path and Coolidge was:

  > The left turn off of Coolidge onto the bike path can be made safer with better control of the bicyclists by widening the roadway a bit and installing a center divider with a left-turn pocket. The divider will prevent bicyclists from turning too far below, while the left-turn pocket will give them a safe place to wait for descending traffic to clear. [For88]

  This suggestion is slightly more expensive than the stop sign, but provides better protection for bicyclists without delaying motorists. The divider should extend down Coolidge past the Blacksmith Shop, to prevent bicyclists from crossing Coolidge to go the wrong way up the downhill path.

The best approach is a combination of the left-turn pocket, the Cardiff bike path, and strict enforcement. We suspect that enforcement will only be needed to retrain existing bicyclists who have developed bad habits, and that new bicyclists will automatically use the bike path or turn pocket.

- An often-mentioned problem with the existing path has to do with the sharp curve just above the Farm Project. The descending bicyclist who does not brake far enough ahead in anticipation of the curve is apt to run off the path into the gravel, lose control and fall, with consequent injury. Several accidents of this sort have already occurred, making the modification of this curve the highest priority project on our list.

  The path can be modified in one of three ways:

  **Best** This suggestion was made by the cycling transportation engineer John Forester:

  > The sharp turn just below the the merging of the upward and downward sections can be eased by moving the descending path some 200 feet to its right and easing the curve into a gradual turn that is completed at the lower end of the existing sharp curve. Keep the sharp curve as the place where the upward path diverges from the downward, and remove the existing downward path between the two junctions. [For88]

  Figure 3.1 shows the existing and proposed alignment of the bicycle path.

  **Ok** Widen and re-bank the downhill lane at the curve to handle 30 mph traffic, perhaps moving it slightly eastward to reduce the radius of the curve. The curve should be measured to to ensure that the modified path meets the Caltrans standards for cross-slope [Cal83, 7-1003.1(7–12)].

  **Inadequate** put in a standard highway warning sign for a sharp left-hand curve, with a 15mph maximum speed.

- Loose gravel from the Farm Project access road just below the dangerous curve increases the hazard. Again, the path should be upgraded to meet Caltrans standards: "Driveway aprons intersecting bikeways should be paved at least 10 feet beyond the bikeway to minimize the amount of gravel and dirt deposited on the bikeway due to crossing motor vehicle traffic." [Cal83, 7-1003.5(2)]. Because of the low traffic volume on the access road, conflicts with motor vehicles at this crossing are not expected to be a problem.
- Conflicts may exist with pedestrians who often walk along the path. Pedestrians could be encouraged to walk beside the path, instead of on it, through redesign. (Already a pedestrian path is forming naturally through use.) On the lower stretch, pedestrians could be encouraged to walk on the Farm access road, which is shorter anyway. The conflicts appear to be rare,

as most pedestrians already do both of these. It is probably not worth paving more of the meadow for the minute reduction in conflicts.

- There are several blind corners on the path alongside the Farm. They are not dangerous if riders remain in their lanes, which they generally do. Some double-yellow lines to mark no-passing zones (as is done in similar situations on roads) would help.
- The path is unlit, and thus hazardous and difficult to ride at night, particularly under clear skies with no moon. A bicyclist illegally riding without a light is apt to run off the path, or collide with other bicyclists, pedestrians, or cows. Enforcing the headlamp laws would not be enough, as bicyclists are only required to carry lights bright enough to allow them to be seen, and only the very best bike headlights would allow bicyclists to negotiate the path safely at night. Right now there is no route to the core which is suitable for nighttime bicycling. The danger is thought to be serious enough that the campus safety committee has worked to discourage nighttime use of the path by bicyclists.

  Lighting for the path could be provided, but would be quite expensive. The cycling traffic engineer John Forester contends that unobtrusive lighting from low fixtures would not provide adequate illumination, and that the current prohibition on nighttime use should be kept. [For88]

  A cheaper alternative than lighting would be to provide high-quality reflecting stripes at the path edges, so that bicyclists with decent headlights could use the path. Because so few bicyclists have headlamps bright enough to illuminate the road (and are only required to have headlamps bright enough to be seen), the reflective stripes would benefit relatively few riders.

  We regard the best alternative to be maintaining the current policy of discouraging nighttime use, while providing a different route, such as a Class II bike lane on McLaughlin and the top part of Coolidge Drive, for the use of nighttime bicyclists. In any case, there should be some planned route for bicyclists travelling to or from the core after dark.

  In addition, bicyclists riding at night, both on campus and in the community, should be required to use lights. California Vehicle Code requires the lights (Section 21200), but enforcement has been so lax that most riders are not even aware of the requirement.

### 3.2.5 Hagar Drive

While Hagar Drive provides good access to the East Athletic Facilities, the bookstore area and the east colleges, it is not used by many bicyclists, since it is too narrow for cars to pass bicyclists safely. Hagar has no shoulder, a worn-out edge stripe, and a nasty double curve about half-way down the hill. Because of the narrowness, bicyclists using the route either irritate motorists by riding correctly and legally in the middle of the lane, or endanger themselves by allowing motorists to pass when there isn't room. This problem could be alleviated by widening the road to accommodate Class II bike lanes.

If Hagar is widened for bike lanes, the nasty double curve by the entrance to the Lower Quarry should be straightened. This curve is perceived as a danger by bicyclists and motorists, even though we have no records of any accidents there.

Unfortunately, such a widened road would be visually obtrusive, and might still not be attractive for ascending bicyclists, mainly because it would place them in close proximity to automobiles and ascending Transit District buses which exude noxious fumes. From a safety standpoint, ascending bicyclists would be obliged to make a left turn onto Hagar from Coolidge Drive, much as bicyclists now do to get onto the bottom of the bike path, which as previously mentioned, is a significant hazard. The turn onto Hagar is probably somewhat safer, as motorists have more warning that an intersection exists, and visibility is better for both motorists and bicyclists.

### 3.2.6 Allen Road path paralleling Hagar Drive

An alternative route which would reach the same areas as Hagar Drive involves the construction of a Class I fork of the existing bike path, continuing northeast from just north of the Farm Project,

up the Farm Project access road and along the old Cowell ranch road known as Allen Road to the vicinity of the bookstore parking lot (see Figure 3.1).

The climb up the Farm Project access road is quite steep, but the next part of the path would be fairly level, giving bicyclists a chance to cool off. The rest of the grade has only gradual slope. The path along the edge of the quarry would be more more visible than widening Hagar, but the path soon dips into the woods. The path would be particularly attractive in warm weather for ascending bicyclists, since a long section of it is shaded by trees. Of course, at night "shaded by trees" should be read as "pitch-black and treacherous."

Parts of the path are already paved, parts have been levelled but need repaving, and parts would need construction from scratch. The path is already paved above the level of the East Field House, and would only need signs and striping to become a bike path. The roadbed through the woods has already been levelled, so would only require clearing debris and resurfacing, with perhaps one or two culverts added to improve drainage. The biggest difficulties with building the path through the woods will be in changing the height of the sewer manholes to be flush with the surface, rather than sticking up a foot above grade. Below the woods, a new path would have to be built between the edge of the quarry and Hagar. There is adequate space, and no trees or shrubs would be cut, but the Predatory Bird Project should be consulted about possible adverse impacts on their research.

The intersection of the lower end of the path with the existing path should be a couple of hundred feet below the current intersection of the Farm Project access road and the bike path, where the bike path is level with the Farm Project parking lot. The upper terminus of the path makes a reasonably clean intersection with the road to Hahn Student Services, and probably does not need any modification.

We have mixed opinions on the committee about the desirability of the Allen Road bike path. The space available for the proposed path is too narrow for a combined use by bicyclists and pedestrians. Because parts of the path are already in heavy use by pedestrians, it will be nearly impossible to make the path bikes-only. As a result, a bike lane on Hagar Drive is safer, particularly at night, but would not be as pleasant to ride as the path. The bike lane is most needed in the uphill direction, as downhill bicyclists travel at the speed limit for the road, and so can safely use the car lane.

### 3.2.7 West Entrance and Heller Drive

Commuters from the west side of campus have the option of travelling along Heller Drive and Empire Grade. This route, although short and quick, is not much used by bicyclists, since the narrowness of the roads and absence of shoulders makes them rather unpleasant to ride.

The steepness of Heller Drive means that downhill bicyclists travel at or above the speed limit, so can safely use the car lanes without annoying motorists. Uphill riders, though, generally travel very slowly, to the annoyance of overtaking motorists. Although visibility is good enough that the bicyclists can be easily seen by motorists, traffic is heavy enough that motorists sometimes try to pass too closely to the bicyclists.

With the re-routing of Heller Drive, the University has an excellent opportunity to add bike lanes at little additional cost. The lanes should be paved at the same time as the road surface, to save money and avoid dangerous grooves or ridges parallel to the direction of travel.

One alternative proposal to putting bike lanes on Heller Drive was to build a separate bike path paralleling it [Wor87]. The proposed design crossed Heller several times, making bicycle-vehicle conflicts almost inevitable, and had no way of keeping pedestrians (particularly children from Family Student Housing) off the bike path. Both the Safety Committee and the Bicycle Subcommittee have argued in favor of bike lanes on the re-routed Heller Drive, rather than providing a path shared by bicyclists and pedestrians.

One strong argument against the proposed path can be found in the Caltrans Highway Design Manual: "Bike paths immediately adjacent to streets and highways are not recommended. They should not be considered a substitute for the street, because many bicyclists will find it less convenient to ride on these types of facilities as compared with the streets, particularly for utility trips. Some problems with bike paths located immediately adjacent to roadways are as follows:

. . . " [Cal83, 7-1003.1(5)]. The manual goes on to list eight problems with bike paths that parallel roads, and concludes with "For the above reasons, bike lanes or bike routes (shared use) are generally the best way to accommodate bike travel along highway corridors, when it has been determined that bikeways are appropriate."

In all fairness, an argument against downhill bike lanes can also be found in the Caltrans Highway Design Manual: "Bike lanes are not advisable on long, steep downgrades, where bicycle speeds greater than 30 mph are expected. As grades increase, downhill bicycle speeds will increase, which increases the problem of riding near the edge of the roadway. in such situations, bicycle speeds can approach those of motor vehicles, and experienced bicyclists will generally move into the motor vehicle lanes to increase sight distance and maneuverability. If bike lanes are to be striped, additional width should be provided to accommodate higher bicycle speeds." [Cal83, 7-1003.2(1)].

We recommend that Heller Drive be built wide enough to put bike lanes on both sides, but that the lane only be striped on the uphill side. The extra lane width on the downhill side is needed to negotiate the proposed sharp curves safely.

When Heller Drive is re-routed and the West Entrance redesigned, the exit to Empire Grade should be engineered to encourage bicyclists to turn safely. The best way to do this is to have a left-turn bike lane between the automotive left- and right-turn lanes, a right-turn bike lane to the right of the automotive lanes. These lanes should be striped for the length of the automotive left-turn pocket. Without such striping, bicyclists often mistakenly turn left from the right-hand edge of the road, violating traffic law and endangering themselves unnecessarily. Figure 3.2 shows the proposed design for the lane [Cal83, Figure 7-1003.2C].

### 3.2.8 Empire Grade

Empire Grade above the city limits is particularly unpleasant for bicycling commuters, because motorists travel at high speed and seem to think that the road-edge stripe is a bike-lane stripe, forcing bicyclists off the road onto the non-existent shoulder. Inside the city limits, Empire Grade is a wide, smooth street with excellent bike lanes. The County should be urged to widen Empire Grade and add bike lanes, to connect the city's bike lanes to the campus's.

An alternative to widening Empire Grade involves the construction of a Class I fork of the existing bike path, veering to the west just north of the Farm Project to follow an old Cowell roadbed across an earthen dam and climbing toward the West Remote Parking lot or Oakes College. The terminus of the path will need careful design, as riding through parking lots is more hazardous than riding along even the busiest streets. The path would be pleasant to bicycle on during the day, but would be more dangerous at night than taking Empire Grade. If either the intersection with the existing bike path or the upper terminus is not properly designed, the path would be much more hazardous than Empire Grade is now. Although recreational riders would benefit from a new path in a quiet part of campus, commuters would be better served by bike lanes on Empire Grade.

### 3.2.9 Other possible routes

A route leading from High Street up Spring Street to Coolidge Drive and thence to the campus core has been suggested from time to time as an access route for bicyclists. Aside from the problem of access through the Cowell Foundation property, this route is quite steep, and would serve only a limited number of commuters, those heading up High and desiring to reach the east side of campus.

A route through the Pogonip, following the old Rincon Road alignment from Highway 9 near the rail crossing at Rincon to Coolidge Drive near Stevenson College, would provide good access for bicyclists coming from the San Lorenzo Valley, and indeed has been so used occasionally. Its gradients are reasonable, and although currently unpaved, it is attractive. Such a route would not be apt to serve many commuters, however, and would require negotiations with the Cowell Foundation. It would provide an excellent recreational route, providing convenient access to Henry Cowell Redwoods State Park, but would serve so few commuters that we cannot justify the expense of paving it.

Figure 3.2: Bicycle left-turn lane designs for (a) the main campus entrance, (b) the west entrance. See also [Cal83, Figure 7-1003.2C].

A possible route also exists coming from Highway 9 just south of Felton, up through Forest Lakes to the Marshall Road at the extreme north end of campus, and thence down Chinquapin Road and other fire roads, but this route is very steep, and involves a considerable climb to get up from Highway 9. Easements of an unknown nature may also need to be acquired.

Finally, a route from Empire Grade near Cave Gulch enters the campus via Seven Springs Road and the Seven Springs trail to Chinquapin Road which might be useful for a few individuals.

The consensus on our committee regarding each of the routes described in this section is that none of them would be currently preferred by many bicyclists, and hence are not recommended for consideration at this time.

### 3.2.10 Racks on shuttles and Transit District Buses

Even the best path routing does not eliminate the hill. Because students and staff live at varying distances from campus and have varying degrees of bicycling skill, mixed-mode commuting is desirable to complete the transportation system. Some commuters will choose to commute entirely by bicycle, others will prefer to bicycle as far as the base of campus and take a bus up the hill.

Bicycling to the base of campus can be made more attractive by providing means to the bicyclists to get to the top of campus without pedalling.

In the past, an experimental trailer-towing van operated at 20-minute intervals to transport bicyclists and their bikes to the bookstore parking lot. The scheme was discontinued in the late 70's, however, because of the time required to load the bikes and the lengthy headways. With the correction of these drawbacks, however, it would be a workable scheme. Steps need to be taken to develop a system whereby commuters can get from the base of the campus to the core and then have access to their bicycles.

The existing campus shuttle vehicles could be equipped with racks for bicycles, similar to those currently used by Transit District buses on the Boulder Creek, Davenport and Bonny Doon routes. To minimize impact on the driver's schedule, pick-up and drop-off spots could be limited to two: one near the main entrance and one in the campus core, probably in front of Applied Sciences. The design of the racks should permit rapid loading and unloading of bicycles, in such a way as to ensure that bicycles will be held securely, and in such a way that the driver can monitor the loading without leaving his seat, perhaps through the use of an appropriate mirror. The Transit District is currently studying possible modifications to their existing racks.

In addition, the Transit District could be urged to provide bike racks on buses destined for the campus, again with a single drop-off point central to the core of the campus. The loading and unloading locations should be the Transit Center, Mission and Bay, and in front of Applied Sciences. If the shuttles do not also have racks, then the main entrance stop should also be a loading and unloading stop.

It is still possible, even in the absence of bicycle racks on vehicles, for a bicyclist unwilling to ride up the hill to park his bike at the campus entrance and take a shuttle or a Transit District bus. However in that event, the commuter will not have his or her bicycle available to travel within the campus core. Such a cyclist may be better served by providing more bicycle parking at a bus stop lower down the hill, particularly at Bay and Mission, on Highland, and at the Transit Center.

If a fixed-guideway transportation system is planned, either on campus or connecting to campus, it should be designed to transport bicycles as well as people.

## 3.3 Recommendations

Here are a list of recommendations for correcting hazards and filling gaps in the system of bike routes for commuting bicyclists to reach the campus core.

1. Straighten the sharp curve in the downhill bike path at the corner of the Farm Project. This is our highest priority recommendation, requiring immediate action. (Section 3.2.4, page 11; Figure 3.1)

2. Pave the Farm Project access road for at least ten feet on either side of the bike path, to reduce the build up of gravel on the path. (Section 3.2.4, page 11)
3. The route up the Cardiff House driveway and continuing past the Carriage House to the start of the existing bike path should be made accessible to ascending bicyclists as a one-way Class I bike path. It could pass to the east of the Carriage House to avoid conflict with vehicles entering the corporation yard and adjacent parking lot (No. 115). The chain across the bottom of the Cardiff House driveway should be replaced by bollards to allow bicyclists to ride through without dismounting. (Section 3.2.1, page 9)
4. Put a divider and bicycle left-turn pocket on Coolidge where the existing bike path begins. (Section 3.2.4, page 11;Section 3.2.1, page 9)
5. Appropriate signs, including marking of the bike lane pavement, should be installed to inform motorists entering or leaving parking lots in front of the Cookhouse and the Barn Theater (Lots 117 and 122) of the existence of the (descending) bike path, and to inform bicyclists of the existence of motorists entering or exiting from the parking lots. Shrubbery should be trimmed or removed to eliminate blind corners. If possible, the number of driveway exits should be reduced. (Section 3.2.4, page 11).
6. Sensitive loop detectors should be installed in the bike lanes on Coolidge, High, and Bay, at the Bay-High intersection, to allow bicyclists to trip the signals in the absence of motor vehicles. The new loops, and the existing one in the left-turn lane should be clearly marked, preferably with the markings proposed for San Diego [Moh85]. (Section 3.2.3, page 11)
7. At the exits from campus, special bicycle left-turn lanes should be striped to the right of the automobile left-turn lanes (See Figure 3.2). For signalized intersections, the bike left-turn lane should include a sensor to trip the traffic signal. (Section 3.2.2, page 10; Section 3.2.7, page 16)
8. A straight-ahead bike lane should be striped on Coolidge at the intersection with High, to keep bicyclists from passing to the right of right-turning traffic. (Section 3.2.2, page 10)
9. Turning curves for left-turning vehicles should be marked on the pavement for left turns off of Coolidge and Bay at the main entrance, to reduce the conflict between left-turning bicyclists and oncoming left-turning cars. (Section 3.2.2, page 10)
10. Pedestrians wishing to walk along the general route of the bike path should be encouraged to walk beside the path in its upper portion by putting decomposed granite on the dirt footpath paralleling the bike path. Pedestrians should be encouraged to use the graded farm access road near the lower end of the bike path, by creating a modest pedestrian trail crossing to the graded road just below the water storage tanks. (Section 3.2.4, page 11)
11. The shuttles that run to the foot of the campus should be equipped with racks for bicycles. (Section 3.2.10, page 19)
12. The Transit District should be urged to provide bike racks on buses destined for the campus, with a single drop-off point central to the core of the campus. (Section 3.2.10, page 19)
13. The Transit District should be urged to provide additional bicycle parking at bus stops lower down the hill, particularly at Bay and Mission, on Highland, and at the Transit Center. (Section 3.2.10, page 19)
14. The lock-up stands currently situated near the Barn Theater should be moved across Coolidge Drive, and provided with protection from the elements. (Section 3.2.10, page 19; Section 5.2.1, page 27)
15. The County should be urged to improve the surface of the shoulders of Coolidge Drive so that it can serve as a viable Class II bike lane, and as the preferred route for mopeds. (Section 3.2.3, page 11)
16. The re-routed Heller Drive should be built wide enough to include Class II bike lanes on both sides from Empire Grade up to Meyer Drive, but the bike lane should be striped only on the uphill side. The paving should be done when the road is initially constructed, to avoid dangerous grooves or ridges parallel to the direction of travel. (Section 3.2.7, page 16; Section 4.2.5, page 24)

17. The County should be urged to widen Empire Grade from the City limits up to the west entrance on Heller Drive, putting Class II bike lanes on both sides to connect the City's bike lanes to the bike lanes on Heller Drive. These bike lanes would be particularly attractive as an alternative route for mopeds. (Section 3.2.8, page 17)
18. A new fork of the existing Class I bike path should be constructed from the vicinity of the lower division (just past the Farm Project) to veer toward the west and thence to the vicinity of the West Remote Parking Lot or Oakes College. (Section 3.2.8, page 17)
19. Hagar Drive should be widened enough to provide Class II bike lanes on both sides, but the lane should only be striped on the uphill side. (Section 3.2.5, page 15)
20. A new fork of the existing Class I bike path should be constructed from the vicinity of the water storage tanks just north of the farm to the vicinity of the bookstore parking lot, along the Allen Road alignment, and with an exit connecting with the East Athletic Facilities. (Section 3.2.6, page 15)
21. Attention should be given to the provision of a route to the campus core suitable for nighttime travel by the bicyclist. Bike lanes on Hagar and Coolidge would be a big step in this direction. (Section 3.2.4, page 11)

# 4. Bicycle Traffic within the Campus Core

## 4.1 Principles

Once commuters get to campus, it is essential that they be able to reach their final destinations. Bicyclists must have as least as much access as motorists to the buildings they work in. Currently, the service roads provide the main access routes for bicyclists going to the core buildings.

Bicycles are also useful for getting from one place to another within the campus core, providing transit times on the order of five minutes or less without having to worry about parking or waiting for intra-campus shuttles. Appropriate routes must be useful not only to commuting bicyclists, but also to bicyclists who reside on campus, and so must provide good connections linking residence halls with core buildings. Furthermore, for bicycles to be useful on campus, certain facilities must be provided, such as appropriate bicycle storage and lock-up stands. In this section we discuss possible improvements which will enable intra-campus use of the bicycle in a safe manner.

## 4.2 Issues and Concerns

Even in the absence of hard data, it is clear that the use of bicycles by both on-campus residents and commuters has increased in recent years as the campus has grown. With this increase, a number of problems have become apparent, problems which will become increasingly serious with continued growth. Among them are problems of safety, involving pedestrian-bicyclist and vehicle-bicyclist conflicts, problems involving the lack of appropriate travel routes for the bicyclist, and problems involving the lack of appropriate facilities for parking and storing bicycles.

Accurate and detailed information about the current flow of bicycle traffic within the campus core would help to identify particular needs and problems. Such information does not now exist. Nevertheless, we have identified a number of specific problem areas that need to be addressed. We discuss them in the following sections.

### 4.2.1 McLaughlin Drive

McLaughlin Drive is a heavily-used cross-campus route connecting the East Colleges with the science buildings and the West Colleges. It provides the best east-west route not only for bicyclists, but also for pedestrians and vehicles, and conflicts exist involving all three. Conflicts are exacerbated because the road has neither sufficient shoulder space for bicycle lanes nor appropriate paths for pedestrians.

The conflicts could be eliminated by widening the road to allow the creation of Class II bike lanes, and by providing appropriate pedestrian walkways. The bridge presents a problem, but it too could be widened, perhaps by adding pedestrian walkways on the outside of the current railings, allowing bicyclists to use the area currently occupied by the sidewalks. The bikeways should be lanes at road grade, not raised like sidewalks, to avoid bicycle-pedestrian conflicts.

### 4.2.2 Steinhart Way

Steinhart Way is heavily used by both pedestrians and bicyclists to travel across central campus. It links the lower east colleges (Stevenson and Cowell) and the bookstore-Whole Earth area with the Classroom Building, McHenry Library, Kerr Hall, the lower science buildings, Performing Arts and the top of the bike path, and to some extent, the West Colleges. The primary problem associated with Steinhart Way involves pedestrian-bicyclist conflicts, but modifications may be difficult, as Steinhart is also a major route for service vehicles.

Although conflicts with pedestrians exist throughout the length of the road, a particular problem relates to the curve in front of McHenry Library, where east-bound bicyclists come down the hill and around the bend at high speed, often weaving their way through occasionally dense groups of pedestrians.

Figure 4.1: Proposed modification of Steinhart Way, adding a sidewalk, making it one-way for motorists, and two-way for bicyclists.

Enforcing the current speed limit would help somewhat, but would be expensive and probably not be sufficient. Separating the pedestrians from vehicular traffic (including bicycles) is a preferable solution.

Of some concern also is the intersection of the Classroom Building access road with Steinhart Way, where bicyclists descend to the intersection too fast, and with little visibility. Again, enforcing a speed limit would be difficult and expensive, so engineering solutions should be sought. There is also a potential vehicle-bicyclist conflict at this intersection.

Although this is a difficult area to correct, we believe the best solution would be to make Steinhart Way a one-way road for motorized traffic from the Classroom Unit access road to McHenry Library, with traffic moving from west to east.

Figure 4.1 shows how we think Steinhart Way should be modified. On the north side of the road, a Class II bike lane should be installed. As bicycles in this section would be the only non-motorized traffic moving east to west, the bike lane should be clearly demarcated on its left side by the standard double yellow line used for separating traffic flowing in opposite directions. On the south side of the road, bicyclists will share the travel lane with service vehicles.

A regulation sidewalk should be installed on the south side to encourage pedestrians to walk there and not in the road. In keeping with redesign of the McHenry Library plaza, the sidewalk would continue across the entrance to that plaza. A curb cut in the sidewalk would indicate to pedestrians, cyclists and motorists that all three kinds of traffic would intersect at that point, and would encourage the appropriate level of caution.

Above McHenry Library, we believe that Steinhart Way could again become a two-lane road—continuing the Class II bicycle lanes in both directions, as there are fewer pedestrians on the road and there are good pedestrian paths parallel to the road.

### 4.2.3 Meyer Drive and Meyer Drive Extension

Conflicts between motorists and bicyclists can be expected at the corner of Meyer Drive and the road to McHenry Library. Bicyclists turning left from the library access road onto the bike path conflict with motorists turning left from Meyer Drive onto the access road. Trimming the shrubbery at the corner to less than two feet high would increase visibility sufficiently to remove this hazard.

Proposals have been made for extending Meyer Drive to Hagar. If such an extension is made, bicycle lanes should be included on both sides of Meyer Drive for its entire length.

If Meyer Drive is extended, the current upper terminus of the bike path will be changed. Whether by accident or planning, the current alignment of the bike path with the end of Meyer Drive is well designed. Bicyclists exiting the path are automatically routed to the proper (north) side of Meyer Drive, and there is no conflict with bicyclists come down Meyer on the south side.

If Meyer is extended, it is quite likely that the bike path will end in a T-intersection with Meyer Drive. If there is any motor traffic, many bicyclists will choose to ride on the wrong side of the street rather than wait for a break in traffic. This is very dangerous, both for the wrong-way rider and for bicyclists coming down Meyer on the correct side.

Possible solutions include stop signs on Meyer Drive at the bike path, or a grade separation so that riders can pass under Meyer to get to the correct side of the street.

Any plans for extending Meyer Drive should be worked out in consultation with the Bicycle Subcommittee right from the start of the planning process. There is potential here for a dangerous intersection if it is not carefully thought through by those who have a clear understanding of bicyclists' behavior.

### 4.2.4 Kerr Hall Access Road

The route is used primarily by bicyclists travelling to or from the top of the bike path or Oakes College. One problem involves conflicts with both pedestrians and vehicles by bicyclists descending past Kerr Hall. Although a stop sign was installed there following a serious accident in which a bicyclist collided with a pedestrian, bicyclists routinely do not obey the stop sign, although it does provide a warning. There is also potential conflict with vehicles backing out of parking spaces just below the stop sign. Warning signs, consisting perhaps of marks on the pavement behind the parked cars, might alleviate this conflict.

A more serious problem involves vehicle conflicts at the intersection with Meyer Drive, where the descending bicyclist turning left onto Meyer Drive has his view of westbound vehicles partially blocked by shrubs near the intersection. At least one accident involving injury has been reported here. Care should be taken to see that these shrubs are pruned—a height of 20 to 24 inches should be sufficient.

Bicyclists ascending from the top of the bike path routinely bypass this intersection by ascending the pedestrian path from the Performing Arts lot, which is a satisfactory route. This short section of path could be marked for joint use by (ascending) bicyclists and pedestrians, as it seldom has more than one or two pedestrians on it and the ascending bicyclist moves slowly. A ramp has been proposed for the top of the path, to give ascending bicyclists a convenient way to get off the sidewalk onto the Kerr Hall access road. One danger with adding a ramp at the top is that descending bicyclists may then be tempted to take the path. The path is too narrow to mix pedestrians with descending bicyclists, so we do not advise adding such a ramp.

### 4.2.5 Path to Oakes College

A particularly thorny problem in the core involves bicycle access to the West Colleges. The most direct route from the campus core to Oakes is via a narrow pedestrian path through the ravine from Meyer Drive. The route attracts bicyclists not only because it is direct, but also because it is fairly level and unencumbered by stairs. Without such discouraging encumbrances it will continue to be used by bicyclists, much to the irritation of pedestrians on the path. Any barrier that blocks a

bicycle will also block wheelchairs, so Disabled Student Services should be consulted before barriers are planned.

The path possibly could be widened sufficiently, and striped with Class III lanes so as to allow combined use by pedestrians and bicyclists, but we are unable to determine whether this could be accomplished while still retaining the remarkable beauty of the route. Making the path more accessible could also serve to mitigate the perceived isolation of Oakes College. Unfortunately, the steep slopes and closely spaced trees make it almost impossible to widen the path.

The only alternative would be to force bicyclists headed for Oakes to use the vehicular route via Heller Drive by, say, constructing bike barriers on the path. Such a route would be longer by at least a factor of two, and would involve much greater changes in grade than exist for the path route. In this case, Class II bike lanes would need to be added to Heller Drive, which is currently too narrow to accommodate such lanes. The re-routing of Heller Drive provides an excellent opportunity to add the needed bike lanes at minimal cost.

Unfortunately, in the section of Heller lying between McLaughlin and Meyer Drives, it would be both costly and disruptive to widen the road. The problem is exacerbated by the existence of the new Kresge housing, which is little enough screened from the road as it is. Bicyclists avoiding the narrow section of Heller will continue to come down Steinhart Way and the Kerr Hall access road, coming onto Meyer Drive immediately opposite the beginning of the bike path.

Of the two possible solutions, widening the path to provide room for both bicyclists and pedestrians, or blocking the path and forcing bicyclists onto Heller, we prefer widening the path, if widening is feasible.

### 4.2.6 Kresge, Porter, and College Eight

The most direct route to Kresge College from the campus core is via the foot bridge continuing across Heller from the end of McLaughlin Drive, and the most direct route to Porter College is via the similar foot bridge farther to the south. Both of these routes are unsuitable for bicyclists, owing both to serious pedestrian-bicyclist conflicts on the narrow bridges and to the existence of stairs near the ends of the bridges. We are disinclined to recommend that Class III routes be created on these foot bridges.

Another possible solution might be to widen the southerly bridge (no additional strengthening would be needed) so as to accommodate both pedestrians and cyclists. The adjoining pedestrian bridge on the east side of Heller Drive, leading to Kerr Hall, could be similarly widened. Both of these bridges are below the grade of Heller Drive, and an opportunity exists here for an intelligent grade separation allowing both pedestrians and cyclists to get across (under) Heller Drive without worrying about vehicular traffic.

Another long-term solution would be to provide a mixed pedestrian-bicyclist bridge from Porter to the Performing Arts Center. The bridge would have to be wider than existing pedestrian-only bridges, and more smoothly surfaced. The paths to the bridge would have to be carefully designed to have safe intersections with roads or bike paths at each end.

Perhaps the best immediate solution would be to mark the bridges with a sign admonishing bicyclists to walk their bikes, with barriers beside the steps to prevent bicyclists from bicycling through the shrubbery. (Such a sign currently exists on the bridge near Hahn Student Services).

For the immediate future, it seems likely that good access to Kresge and Porter will remain a problem, with only the inconveniently longer vehicular routes being available for those disinclined to walk across the bridges. Parts of such vehicular routes lie along Heller Drive, which is narrow and without space for appropriate Class II bike lanes, as mentioned above.

Traffic counts and surveys of Kresge and Porter students could help to provide useful information leading to the design of appropriate routes to serve the West Colleges. In our view, it makes sense to carry out such data-gathering and planning now, coincident with the planning for College Eight.

As of this writing, little attention has been given to the design of appropriate bicycle access in the planning for College Eight. Both the Safety Committee and the Bicycle Subcommittee have argued in favor of bike lanes on the re-routed Heller Drive, but we have not seen detailed drawings

showing the bike lanes. We have not seen any bicycle planning for access to College Eight itself. It would clearly be less costly to incorporate such design now, as plans are being formulated, than it would be to introduce new routes and paths after construction is begun.

## 4.3 Recommendations

1. A detailed study should be carried out of both current and projected bicycle traffic within the campus core, with the aim of determining appropriate routes for bicyclists. Special attention should be given to the design of bicycle access routes to the West Colleges, including possible joint use of the Oakes ravine path by pedestrians and bicyclists. (Section 4.2.1, page 22; Section 4.2.2, page 22; Section 4.2.5, page 24; Section 4.2.6, page 25)
2. Signs should be installed on the pedestrian bridges to Kresge and Oakes Colleges instructing bicyclists to walk their bikes. (Section 4.2.6, page 25)
3. The southern pedestrian bridge to Kresge and the connecting bridge to Kerr Hall should be widened to accommodate bicycle paths. The possibility of a grade separation for pedestrians and bicyclists to pass under Heller Drive between the two bridges should be studied.
4. Bicycle access to College Eight should be incorporated into the planning for that college. (Section 4.2.6, page 25)
5. Class II bike lanes should be constructed on McLaughlin Drive, with the design such that this route can be safely used by pedestrians as well. (Section 4.2.1, page 22).
6. Bike lanes should be designed and constructed on Steinhart Way, with particular attention to the dangerous corner by McHenry Library. (Section 4.2.2, page 22)
7. The shrubbery at the corner of Meyer Drive and the access road to McHenry Library should be kept trimmed to less than 24 inches high, to eliminate the blind corner. (Section 4.2.3, page 24)
8. At the intersection of Meyer Drive and the Kerr Hall access road the shrubs on the northeast corner, and continuing back along the curve of the road, should be pruned to 20 to 24 inches to allow visibility. (Section 4.2.4, page 24)

# 5. Parking and Storage Facilities

## 5.1 Principles

Bicycles are portable, valuable, and easily stolen. Because of the hilly location, commuters to UCSC will generally have fairly expensive, lightweight bicycles, so will be concerned about the security of leaving their bikes while the work or attend classes. If inadequate bicycle parking is provided, bicyclists will find other ways to ensure sufficient security, possibly blocking sidewalks and fire exits.

## 5.2 Issues and Concerns

### 5.2.1 Types of bicycle parking

The main purposes of bicycle parking facilities are

- to prevent bicycles from being stolen, and
- to keep parked bicycles from becoming a hazard by blocking pedestrian, bicyclist, or motorist routes.

To be effective, bicycle parking must have several characteristics:

- Bicyclists must be able to lock the frame and at least one wheel to an object that cannot be cut by a casual thief.
- Bicyclists must have the option of locking both wheels and the frame with a high-security U-lock, as well as the cheaper cable-and-padlock sets.
- The parking stall must not cause damage to the bicycle. The most common damage from poorly designed racks is that bicycles can fall over while in the rack, twisting the wheels out of shape. This problem is most prevalent with racks that hold only the bottom of the wheel, but also occurs with racks that hold just the front of the wheel.
- When possible, protection from weather should be provided.

Several types of bicycle lock-up facilities presently exist on campus. The most common lock-up stands are single steel posts set in concrete, with welded brackets attached, each accommodating two bicycles. These posts cost about $50 when installed ($25 per bicycle). Those with four brackets, two above and two below, provide for somewhat greater security than those with only two upper brackets, since a bicycle with quick-release hubs can have the front wheel removed and secured with a "U-lock" using the lower brackets. The posts should be mounted with the locking loops sticking out to the sides, rather than front and back. This orientation is used on the posts downtown, and is significantly easier to use than the orientation currently used on campus. An inexpensive improvement to the posts would be to coat them with a thick layer of plastic or rubber, to keep them from scratching the bicycles.

Some of us prefer the "Lock Bar Model U-Lok Class 2" stands, which are currently installed near Merrill College. These stands provide slightly higher security, at a much higher cost than the bike posts ($150 per bike). We believe that the posts provide and excellent compromise between security and cost, and are less visually obtrusive than most other bike parking devices. We recommend using bike posts for new bike parking on campus, except where special circumstances require higher density or allow covered parking.

Whatever bike locking devices are preferred, it is clear that the campus does not have enough of them. Most noticeably, there is conspicuous absence of lock-up stands which are close enough to building entrances in the vicinity of several campus buildings, such as near the entrances of McHenry Library, Thimann Labs and the Thimann Lecture Halls, the Classroom Building, the East Field House, and several of the Colleges. A result is that bicyclists tend to lock their bicycles to other structures such as railings or trees or lamp-posts. In addition, students now frequently bring their bicycles into classrooms and lecture halls when no stands are convenient. Locking to railings and light posts is fine if fire exits and pathways are not blocked, but locking to trees damages them, and bringing bicycles into classrooms or leaving them in hallways blocks essential fire exits.

In some cases, bicycle posts have been installed in visually unobtrusive ways—so unobtrusive that bicyclists are not aware of their existence and do not use them. When new posts are installed, they should be placed in plain view as close as possible to the spot where bicyclists would otherwise be leaving their bikes.

The existing stands do not protect the bicycle from the elements, however, and for long-term or overnight storage, covered storage lockers provide more protection and more security. Some such storage facilities are being installed near Cowell College. The cost is fairly high, approaching $750 per bicycle. There are currently a small number of such storage lockers available. With a substantial increase in bicycle use, however, there will clearly be an increased need for such storage. Rental charges could help to defray the cost.

Commuters parking outdoors have to leave their bicycles unattended for many hours. Even with high-security locks, only the frame and wheels can be secured with bike posts and racks. Theft of expensive bicycle components (saddles, handlebars, bicycle computers, and so forth) has become a concern for many bicyclists. Unless the bicycle is kept under observation continuously (as it would be if the bicycle were brought into an office), only bicycle lockers provide security for components.

On-campus bike parking will be useful to both commuters and on-campus bicyclists, but some commuting staff and faculty could benefit from an additional amenity—the opportunity to store their bicycles in their offices. Indoor storage provides good protection for expensive components, easy unloading of books and clothes, protection from weather, and the option of leaving the bicycle in the office overnight and taking a bus home. Many bicyclists currently store their bikes in their offices, and it has not been found, to our knowledge, to present a serious problem.

Maurice Hollman, Senior Superintendent of the Physical Plant, objects to bicycles indoors, primarily because of "damage to the interior finish, scratches on walls and doors and oil and tire marks on floors" [Hol88]. These complaints are reasonable, but seem to us to be minor problems. After all, we don't require people to remove their shoes indoors, despite the problems with heel marks and mud.

A more serious objection to bicycles in buildings is that bicycles left in hallways and classrooms block fire exits, creating significant hazards if the building needs to be evacuated quickly. Bicycles should not be permitted in classrooms, nor should they be parked in hallways or blocking doorways. Bicycles parked in individual offices do not present these hazards, so such parking should be permitted.

For bicyclists who choose to ride to the base of campus, and take the bus or shuttle up the hill, the locking posts provided in front of the Barn Theater are inconveniently located. The ascending bicyclist must cross Coolidge to lock up his bike, and then re-cross Coolidge on foot to the bus stop, frequently jay-walking in a dangerous manner, particularly if a bus has just pulled in and he is anxious to catch it. It would be much more convenient, and less dangerous, if the lock-up stands were moved to the east side of Coolidge Drive, near the bus stop.

A roof to cover the bike stands and protect them from rain would make them more attractive to commuting bicyclists. To avoid having to build a large roof, locking devices that allow higher densities of bicycles could be used. For example, bicycles could be hung from their rear wheels next to posts with locking loops, or run up ramps like those on the backs of some SCMTD buses. High density bicycle parking has a long history in Europe, and schemes that have worked well there could be copied. Covered outdoor parking will cost more and be less attractive to commuters than in-office parking, but may be needed in areas where in-office parking is not feasible.

Appendix A gives an inventory of known bicycle parking facilities on campus. In some cases, the existing posts are poorly located (not on a common bicycling route or hidden from bicyclists) and are not used heavily, while other areas suffer from a severe shortage of bicycle parking. For example, the six posts at the north end of Applied Sciences are not visible from a bicycling route, and are almost never used, while the 15 at the south end are frequently filled.

### 5.2.2 Showers for commuters

Many potential bicyclists avoid riding to campus, because they fear they will be too sweaty at the end of the climb. Providing easily accessible shower facilities may induce some of these people to bicycle on a regular basis.

For the commuting bicyclist, shower facilities exist at the East Field House, together with a substantial number of locker facilities. Although this shower facility is close to the 700-foot contour, so that in principle, a "no-sweat" bicycle traverse is possible from it to any building in the campus core, the East Field House is not conveniently reached from either the top of the existing bicycle path or Coolidge Drive, nor are there any convenient routes up to McLaughlin Drive. Hence few commuters make use of these showers.[1]

Shower facilities also exist at the individual colleges, but they are primarily for the use of college residents. Showers also exist in at least two of the core buildings—Natural Sciences II and Applied Sciences. In general, shower facilities in the campus core are inadequate to serve the needs of the commuter.

## 5.3 Recommendations

1. Bicycle parking and storage facilities for the commuter, including simple brackets on interior office walls, should be installed where appropriate. (Section 5.2.1, page 27)
2. Showers should be installed in buildings whenever building modifications are undertaken, and should be incorporated into newly-constructed buildings as part of their planning. (Section 5.2.2, page 29)
3. New lock-up stands and storage lockers should be installed at locations determined by noting areas where current parking is filled, or where bikes are unsafely parked, and adding capacity nearby. (Section 5.2.1, page 27)
4. New bicycle parking should be provided using steel posts with four locking loops, consisting of a high and a low loop on opposite sides of the post. The posts should be mounted with the locking loops sticking out to the sides, rather than front and back. If possible, the posts should be coated with a thick layer of plastic or rubber, to keep them from scratching the bicycles. (Section 5.2.1, page 27)
5. A survey should be conducted to determine the economic feasibility of installing rental lockers, for students and staff who have no indoor storage available, but desire greater security and weather protection than is now available. (Section 5.2.1, page 27; Section 7.2.1, page 33)

[1] The proposed bike lanes on Hagar or the addition of an east fork of the Class I bike path would provide such access, as described in Sections 3.2.5 and 3.2.6 above.

# 6. Education and Enforcement Programs

## 6.1 Principles

An educational component, consisting of both skills training and informational aids such as written materials, maps, visual presentations, and signs, constitutes an essential element in the encouragement of bicycle use by the campus population.

Enforcement is essential to make sure that the existing laws are obeyed.

## 6.2 Issues and Concerns

### 6.2.1 Education

The only textbook on traffic engineering for bicycles contains an analysis of accident statistics that shows that 50% of bicyclist injuries and deaths are caused by bicyclist errors [For83, page 84]. The book recommends that the most cost-effective way to increase the safety of bicyclists is to teach them how to ride properly.

The League of American Wheelmen's *Effective Cycling* course is based on these careful studies of accident statistics and on years of experience in riding safely. It teaches advanced bike handling skills, bike maintenance, bicycling science, bike transportation engineering, and methods for riding safely in traffic. Even fairly advanced bicyclists often have a lot to learn from the course. Unlike most "bike-safety" programs (which are designed by motorists), it does not teach bicyclists to fear cars blindly and to give up riding as impossibly dangerous.

The Office of Physical Education, Recreation, and Sports should be encouraged to teach the *Effective Cycling* course, which was developed by John Forester specifically for training adult bicyclists. The low-level of traffic riding skill in this community can be most easily observed downtown, where bicyclists are more likely than not to be on the wrong side of the street, running a stop sign, without lights at night.

John Forester points out that it is relatively easy to get sporting cyclists to attend *Effective Cycling* courses, but that "Reaching the more casual cyclists is more difficult. These simply desire to get around short distances with the least effort and don't want to get involved in cycling. The only appeal that is likely to attract them is ease of use and avoidance of trouble." [For88]

Bicycle use is inhibited through lack of information regarding the existence of amenities for bicyclists. It is also discouraged by lack of knowledge about proper equipment. Unsafe and discourteous behavior by bicyclists also tends to generate antagonism and lack of support for those who would travel by bicycle. While much useful knowledge is transmitted naturally by word-of-mouth, a broader audience can be reached through the distribution of written material, including maps, and through the thoughtful installation of signs or other indicators to guide behavior. Such materials might include the following:

- A map indicating preferred bicycling routes on campus, locations of parking, storage facilities and showers, and routes of bike-carrying shuttles and buses (such a map should be prominently posted at the base of campus, perhaps in the information booth pullout);
- Descriptive material, such as essays or articles, dwelling on the advantages (and disadvantages) of travelling via bicycle;
- A limited number of signs or other indicators to show preferred bicycle routes (especially, letting bicyclists know where they will end up if they choose a particular path), routes where bicycling is discouraged, and locations of storage and lock-up facilities;
- Hints and suggestions for effective bicyclist behavior, such as how to announce one's presence to unaware pedestrians, bicyclists and motorists, how to negotiate turns, how to avoid collisions, and how to deal with rainy weather and bicycling after dark;
- Announcements of classes and workshops on bicycle repair and safety, and bibliographies of useful literature available for bicyclists;

- Discussions of proper equipment, including comparisons of various bicycle design styles and safety equipment such as helmets, reflectors and lights;
- Advertisements and posters displayed on buses;
- A slide or video presentation, to be made available to groups. Iowa State University's film *Bicycling Safely on the Road* [For] should be shown annually.
- Someone (perhaps the Bicycle Subcommittee) should write an occasional newsletter or a regular column in *City on a Hill*. The newsletter could cover bicycling tips, reports on bike planning, and much of the other information proposed above. A small, informal start has been made with Peter Scott's *The Wobblies' Newsletter*.

A limited amount of such descriptive material might be included in the general catalog or with registration material, or with the parking applications distributed each year to the prospective or existing campus employees and students. In addition, such material could be distributed at orientation sessions for new students and staff.

We should also inform all the bicycle shops in Santa Cruz of campus policies that affect their customers. For example, we could ask them to remind their mountain bike customers that UCSC does not allow off-road riding, and that riding at night without lights is illegal. Perhaps we could have them help distribute our safety literature, when and if we develop it.

### 6.2.2 Enforcement

The main bicycle traffic violations (from a safety standpoint) are

- riding at night without lights,
- riding on the wrong side of the street (particularly along Coolidge below the existing bike path, see Section 3.2.4),
- riding on sidewalks, pedestrian bridges, and other pedestrian-only areas,
- not stopping at stop signs, and
- speeding.

This list is approximately in order of decreasing danger, and also in order of increasing difficulty of enforcement. We urge the University Police to step up enforcement for these violations, particularly the first two.

Riding at night without lights is perhaps the most dangerous of the common bicycling traffic violations. California Vehicle Code requires headlamps (Section 21200), but enforcement has been so lax that most riders are not even aware of the requirement. Enforcing the bicycle headlamp law should be the first priority for bicycle enforcement on campus. Compliance with the law would probably be increased somewhat if bicycle lights were offered for sale at the Bay Tree Bookstore. [1]

Perhaps we should also lobby for a new law that requires that all bicycles be sold with adequate headlights. Many bicyclists plan to ride only during the day when they buy their bikes, so see no need for the extra weight and expense of headlamps. These bicyclists do occasionally ride at night, despite their plans, and should have the proper equipment available.

Some people have proposed requiring that bicycles carry bells, horns, or other audible signals. Almost every bicyclist carrys such a system—lungs and vocal cords. Because bicyclists do not have a large sound-reducing box around them (the way motorists do), they can easily shout loud enough to be heard in an emergency. Adding bells and whistles to bicycles is superfluous. Bells have been suggested as a way of alerting pedestrians to the existence of bicyclists, but in normal use, bicycles will be on the road and pedestrians on the sidewalk, so such alerting is only needed in emergencies.

There have been some complaints from pedestrians about bicyclists speeding on the service roads, particularly Steinhart Way. Enforcement of speed limits in selected high-risk areas is probably worth doing. For example, a police car could be parked on Steinhart Way in front of the library, below the hill where bicyclists are most likely to speed. Modern radar devises should have no trouble in determining the speeds of bicycles. Unfortunately, bicyclists have a difficult time obeying speed limits for two reasons:

[1] They could offer other safety equipment as well, such as helmets, locks, leg bands, and bicycling gloves. There may even be a market for UCSC slug-monogrammed bicycling clothes—yellow Lycra would even have the right shine!

- Bicycles lack speedometers, so bike riders are often unaware that they are speeding.
- Posted speed limits for most roads are greater than the fastest speed attained by bicyclists using them. As a result, bicyclists have never had to form the habit of checking their speed.

We believe that increased enforcement of the speed limits would have little effect on bicycle speeds, and thus little effect on bicycle-pedestrian accidents. A better solution for Steinhart Way is to physically separate the bicyclists from the pedestrians by installing a sidewalk (see Section 4.2.2, page 22).

Bicyclists rarely exceed the speed limit on the main roads on campus, but sometimes ride too close to the edge of the road for the speeds they are traveling. At least until bike lanes are installed on all campus roads, bicyclists traveling over 20 mph should be encouraged to move into the automobile lanes.

Enforcement efforts might be greatly improved with the addition of police on bicycles. If none of the officers feels up to bicycle patrolling, student cadets in uniform could be used. We probably do not need full-time bicycle officers, but occasional spot enforcement, concentrated in the first few weeks of Fall and Spring Quarters, could go a long way to establishing better bicyclist behavior patterns.

## 6.3 Recommendations

1. A brochure should be prepared for general distribution to the campus population, containing a map indicating bicycling routes on campus showing links to city bike lanes in the vicinity of the campus, and indicating locations of parking and shower facilities and routes of bike-carrying shuttles and buses. It should also include descriptive material regarding advantages and disadvantages of travelling via bicycle, along with suggestions for effective bicyclist behavior and descriptions of proper bicycling and safety equipment. (Section 6.2.1, page 30)
2. A section of the General Catalog should include information useful to prospective and existing bicyclists. This information should also be included in the registration packet and in the parking application packet, and should be made available for use at orientation sessions for new students and staff. (Section 6.2.1, page 30)
3. Signs and other visual indicators should be installed to show preferred bicycle routes, routes where bicycling is discouraged, and locations of storage and lock-up facilities. To be effective, such signs should be limited in number. (Section 6.2.1, page 30)
4. The workshops on bicycle repair and safety should continue to be offered by the Office of Physical Education, Recreation and Sports. (Section 6.2.1, page 30)
5. The League of American Wheelmen's *Effective Cycling* course should be offered by the Office of Physical Education, Recreation and Sports. (Section 6.2.1, page 30)
6. Bicyclists riding at night anywhere on the campus should be required to use lights. The police should be urged to increase enforcement of the existing laws. (Section 3.2.4, page 11; Section 6.2.2, page 31)
7. The University Police should increase enforcement of laws requiring bicycles to ride on the right side of the road, particularly along Coolidge below the entrance to the bike path. (Section 3.2.4, page 11; Section 6.2.2, page 31)
8. Safety equipment, such as lights, helmets, and locks should be available for sale on campus. (Section 6.2.2, page 31)
9. Someone (perhaps the Bicycle Subcommittee) should write an occasional newsletter or a regular column in *City on a Hill*. (Section 6.2.1, page 30)
10. Campus bicyclists should be encouraged to form an organization for the purpose of sharing information useful to bicyclists and for the purpose of lobbying for improved amenities. (Section 6.2.1, page 30)
11. An informational slide or video presentation should be prepared to be made available to both the campus population and the community. John Forester's film *Bicycling Safely on the Road* [For] should be shown annually. (Section 6.2.1, page 30)

# 7. Funding and Implementation

## 7.1 Principles

To achieve the goal of increasing bicycle use by the campus population, it is essential to identify and procure appropriate funds. It is also essential to outline procedures, including the ordering of actions to be taken, for the implementation of the plan.

## 7.2 Issues and Concerns

Planning for safe bicycling is based on engineering, education, and enforcement. Engineering is capital-intensive; the others are labor-intensive. Planners often like to trim bicycle engineering out of their capital budgets, but the budgets never exist for the extra labor that would be needed to compensate for the inadequate engineering. It is essential that bicycle planning is supported by sufficient funds to implement plans completely.

### 7.2.1 Funding

Arguments leading to the identification of the appropriate sources of funds needed to carry out a plan such as that described in Sections 2–6 must be based on "common-sense economic logic, untainted by planning dogma giving rise to suspicions of social engineering" [Bra86].

Land available for surface parking within the campus core is becoming increasingly scarce, and new parking on campus will probably take the form of multi-story parking structures. The cost of such structures is estimated at $10,000 to $15,000 per space, and would lead to parking fees much higher than now exist. Thus, it is in the economic self-interest of those who desire core parking for vehicles to consider various cost-avoidance strategies whose costs could be less than the marginal cost of providing new automobile parking in the core. One such strategy consists of subsidizing amenities for bicyclists, since bicyclists do not simultaneously drive automobiles.

On the basis of this logic, we conclude that parking fees (and perhaps parking fines) should be considered as a source of funding for the construction of bicycle paths and other amenities for bicyclists.

Some people have suggested a bicycle registration fee to provide funds for more and better racks. Given that each automobile driver pays about 7% of the cost of a new automobile parking space each year (based on $180 a year for a $2500 space), the fair price for bicyclists is under $2 a year ($25 per space). This amount is so small that the expense of collecting would probably exceed the amount collected. If a better service were being provided (such as reserved bicycle lockers), larger amounts could be requested. At Stanford and in Palo Alto, reserved bicycle lockers rent for about $4–5 a month, recovering about 11–16% of their cost each year.

Other appropriate sources of funding include student registration fees,[1] Chancellor's discretionary funds, Regents' funds, and for experimental or otherwise special projects, grants from foundations or governmental agencies.

### 7.2.2 Implementation

The phasing or timing of the execution of the recommendations of this plan must be logical, both physically and economically. Some of our recommendations, such as signing or lane-striping or data gathering, are inexpensive and could be carried out immediately. Others, requiring that substantial funding be obtained, may need more time. Thus to determine precise time-lines for the carrying out of this plan requires professional planning expertise.

[1] The existing bike path was funded in part from student registration fees.

In any case, however, it is necessary that the implementation of the plan be monitored by an interested body or agency. Plans such as this one have a notorious reputation for ending up in a file drawer, or worse, in a trash bin. Hence one of our recommendations relates to the designation of an appropriate body to oversee the implementation of the plan.

## 7.3 Recommendations

1. A schedule for the precise implementation of this Bicycle Plan shall be drawn up, incorporating costs and time-lines, from which a work program can be developed. Cooperation with both the City and County is encouraged. This schedule shall be reviewed by an appropriate oversight body, such as this Bicycle Subcommittee or the Campus Transportation Committee. (Section 7.2.2, page 33)
2. Funding sources shall be identified for each project recommended in the plan, with particular attention to parking fees and fines, student registration fees, Regents' contributions, Chancellor's discretionary funds, and extra-mural agency support. (Section 7.2.1, page 33)

# 8. Collected list of Recommendations

What follows is a comprehensive list of our recommendations. First we list recommendations for fixing hazards and for preparatory work needed for future planning—these recommendations should be implemented as quickly as possible, Next we list policies that should be adopted by the University to guide future planning and implementation of bikeways. Third, we list longer-term projects that fill gaps in the existing system. Finally, we include recommendations on improvements and data-gathering judged to be less urgent.

Although we have numbered the recommendations for convenience in identifying them, these numbers are not intended to indicate any order of priority. Indeed, many individual recommendations should be carried out in simultaneously.

Appended to each recommendation is a reference to the page of the plan where it is discussed.

## 8.1 Short-term projects—to be done immediately

1. Straighten the sharp curve in the downhill bike path at the corner of the Farm Project. This is our highest priority recommendation, requiring immediate action. (Section 3.2.4, page 11; Figure 3.1)
2. Pave the Farm Project access road for at least ten feet on either side of the bike path, to reduce the build up of gravel on the path. (Section 3.2.4, page 11)
3. The route up the Cardiff House driveway and continuing past the Carriage House to the start of the existing bike path should be made accessible to ascending bicyclists as a one-way Class I bike path. It could pass to the east of the Carriage House to avoid conflict with vehicles entering the corporation yard and adjacent parking lot (No. 115). The chain across the bottom of the Cardiff House driveway should be replaced by bollards to allow bicyclists to ride through without dismounting. (Section 3.2.1, page 9)
4. Put a divider and bicycle left-turn pocket on Coolidge where the existing bike path begins. (Section 3.2.4, page 11;Section 3.2.1, page 9)
5. The re-routed Heller Drive should be built wide enough to include Class II bike lanes on both sides from Empire Grade up to Meyer Drive, but the bike lane should be striped only on the uphill side. The paving should be done when the road is initially constructed, to avoid dangerous grooves or ridges parallel to the direction of travel. (Section 3.2.7, page 16; Section 4.2.5, page 24)
6. A schedule for the precise implementation of this Bicycle Plan shall be drawn up, incorporating costs and time-lines, from which a work program can be developed. Cooperation with both the City and County is encouraged. This schedule shall be reviewed by an appropriate oversight body, such as this Bicycle Subcommittee or the Campus Transportation Committee. (Section 7.2.2, page 33)
7. Funding sources shall be identified for each project recommended in the plan, with particular attention to parking fees and fines, student registration fees, Regents' contributions, Chancellor's discretionary funds, and extra-mural agency support. (Section 7.2.1, page 33)
8. The numbers of bicyclists who commute to UCSC should be estimated, distinguishing those using the bike path from those using Coolidge Drive. Care should be taken to ensure that the counts are not biased by weather, time of day, day of the week, or time of year. (Section 2.2.3, page 7)
9. A sample survey of the campus bicycling population should be conducted to determine the probable use of additional Class I bike paths serving the East and West sides of campus, and of the probable use of bike racks on shuttles and Transit District buses. The differing needs of commuters and residents should be separately determined. (Section 2.2.3, page 7)

10. A detailed study should be carried out of both current and projected bicycle traffic within the campus core, with the aim of determining appropriate routes for bicyclists. Special attention should be given to the design of bicycle access routes to the West Colleges, including possible joint use of the Oakes ravine path by pedestrians and bicyclists. (Section 4.2.1, page 22; Section 4.2.2, page 22; Section 4.2.5, page 24; Section 4.2.6, page 25)
11. Appropriate signs, including marking of the bike lane pavement, should be installed to inform motorists entering or leaving parking lots in front of the Cookhouse and the Barn Theater (Lots 117 and 122) of the existence of the (descending) bike path, and to inform bicyclists of the existence of motorists entering or exiting from the parking lots. Shrubbery should be trimmed or removed to eliminate blind corners. If possible, the number of driveway exits should be reduced. (Section 3.2.4, page 11).
12. Sensitive loop detectors should be installed in the bike lanes on Coolidge, High, and Bay, at the Bay-High intersection, to allow bicyclists to trip the signals in the absence of motor vehicles. The new loops, and the existing one in the left-turn lane should be clearly marked, preferably with the markings proposed for San Diego [Moh85]. (Section 3.2.3, page 11)
13. At the exits from campus, special bicycle left-turn lanes should be striped to the right of the automobile left-turn lanes (See Figure 3.2). For signalized intersections, the bike left-turn lane should include a sensor to trip the traffic signal. (Section 3.2.2, page 10; Section 3.2.7, page 16)
14. Turning curves for left-turning vehicles should be marked on the pavement for left turns off of Coolidge and Bay at the main entrance, to reduce the conflict between left-turning bicyclists and oncoming left-turning cars. (Section 3.2.2, page 10)
15. A straight-ahead bike lane should be striped on Coolidge at the intersection with High, to keep bicyclists from passing to the right of right-turning traffic. (Section 3.2.2, page 10)
16. Pedestrians wishing to walk along the general route of the bike path should be encouraged to walk beside the path in its upper portion by putting decomposed granite on the dirt footpath paralleling the bike path. Pedestrians should be encouraged to use the graded farm access road near the lower end of the bike path, by creating a modest pedestrian trail crossing to the graded road just below the water storage tanks. (Section 3.2.4, page 11)
17. The lock-up stands currently situated near the Barn Theater should be moved across Coolidge Drive, and provided with protection from the elements. (Section 3.2.10, page 19; Section 5.2.1, page 27)
18. The County should be urged to improve the surface of the shoulders of Coolidge Drive so that it can serve as a viable Class II bike lane, and as the preferred route for mopeds. (Section 3.2.3, page 11)
19. Bicyclists riding at night anywhere on the campus should be required to use lights. The police should be urged to increase enforcement of the existing laws. (Section 3.2.4, page 11; Section 6.2.2, page 31)
20. The University Police should increase enforcement of laws requiring bicycles to ride on the right side of the road, particularly along Coolidge below the entrance to the bike path. (Section 3.2.4, page 11; Section 6.2.2, page 31)
21. Signs should be installed on the pedestrian bridges to Kresge and Oakes Colleges instructing bicyclists to walk their bikes. (Section 4.2.6, page 25)
22. The southern pedestrian bridge to Kresge and the connecting bridge to Kerr Hall should be widened to accommodate bicycle paths. The possibility of a grade separation for pedestrians and bicyclists to pass under Heller Drive between the two bridges should be studied.
23. Bicycle access to College Eight should be incorporated into the planning for that college. (Section 4.2.6, page 25)
24. Bike lanes should be designed and constructed on Steinhart Way, with particular attention to the dangerous corner by McHenry Library. (Section 4.2.2, page 22)
25. The shrubbery at the corner of Meyer Drive and the access road to McHenry Library should be kept trimmed to less than 24 inches high, to eliminate the blind corner. (Section 4.2.3, page 24)

26. At the intersection of Meyer Drive and the Kerr Hall access road the shrubs on the northeast corner, and continuing back along the curve of the road, should be pruned to 20 to 24 inches to allow visibility. (Section 4.2.4, page 24)

## 8.2 Policies recommended for immediate adoption

27. All new roads should be built with bike lanes. Uphill lanes are more important than downhill lanes. (Section 2.2.1, page 4; Section 4.2.3, page 24)
28. All new bikeways (whether bike lanes or off-road bike paths) should be built to Caltrans standards [Cal83]. (Section 2.2.2, page 6)
29. Bicyclists and pedestrians should not be mixed on the same paths—particularly not on steep downslopes. Where mixed-use facilities are unavoidable, such as on the service roads, the pavement should be striped to indicate bike and pedestrian lanes. (Section 2.2.1, page 4)
30. Bicycles should be prohibited from riding in unpaved areas, except on specially marked bike paths and on the fire roads above campus. (Section 2.2.1)
31. Higher priority should be given to bikeways for commuting and utility riding than to purely recreational bikeways. (Section 2, page 4)
32. Bike paths should be constructed only where no road exists, not parallel to roads. Where roads exists, bicyclists should be encouraged to use them, preferably with bike lanes. (Section 2.2.1, page 4)
33. Bikeways should be designed so that the easiest way to use them is also the safe, legal way. That is, we should not try to make education and enforcement compensate for inadequate engineering. (Section 2.2.2, page 6)
34. Maps showing the locations of bicycle accidents on campus should be prepared at least every two years, and published widely. The leading causes of accidents should be determined to guide the selection of corrective measures.
35. The Bicycle Subcommittee should be consulted regarding any proposed construction that would affect bicyclists, at an early enough stage in the planning that changes can still be made. (Section 2.2.2, page 6; Section 4.2.3, page 24)
36. Any traffic signals installed on campus should have loop detectors in the bike lane and the left-turn lane sensitive enough to detect bicycles. (Section 2.2.2, page 6)
37. The location of loop sensors for traffic signals should be painted on the pavement. (Section 2.2.2, page 6)
38. All bike lane and road-edge striping should be repainted at least every two years, to maintain sufficient reflectivity. (Section 2.2.2, page 6)
39. Bike lanes and road edges should be swept at least twice a year—more often when there is nearby construction. (Section 2.2.2, page 6)
40. The metal plates that cover utility boxes (manhole covers) should be coated with anti-skid paint (paint or epoxy with sand in it), and the anti-skid surface should be renewed when it wears off. (Section 2.2.2, page 6)
41. Showers should be installed in buildings whenever building modifications are undertaken, and should be incorporated into newly-constructed buildings as part of their planning. (Section 5.2.2, page 29)
42. Safety equipment, such as lights, helmets, and locks should be available for sale on campus. (Section 6.2.2, page 31)

## 8.3 Medium-term projects—new services and facilities

43. The League of American Wheelmen's *Effective Cycling* course should be offered by the Office of Physical Education, Recreation and Sports. (Section 6.2.1, page 30)
44. The shuttles that run to the foot of the campus should be equipped with racks for bicycles. (Section 3.2.10, page 19)
45. The Transit District should be urged to provide bike racks on buses destined for the campus, with a single drop-off point central to the core of the campus. (Section 3.2.10, page 19)
46. The Transit District should be urged to provide additional bicycle parking at bus stops lower down the hill, particularly at Bay and Mission, on Highland, and at the Transit Center. (Section 3.2.10, page 19)
47. A new fork of the existing Class I bike path should be constructed from the vicinity of the lower division (just past the Farm Project) to veer toward the west and thence to the vicinity of the West Remote Parking Lot or Oakes College. (Section 3.2.8, page 17)
48. Hagar Drive should be widened enough to provide Class II bike lanes on both sides, but the lane should only be striped on the uphill side. (Section 3.2.5, page 15)
49. A new fork of the existing Class I bike path should be constructed from the vicinity of the water storage tanks just north of the farm to the vicinity of the bookstore parking lot, along the Allen Road alignment, and with an exit connecting with the East Athletic Facilities. (Section 3.2.6, page 15)
50. Attention should be given to the provision of a route to the campus core suitable for nighttime travel by the bicyclist. Bike lanes on Hagar and Coolidge would be a big step in this direction. (Section 3.2.4, page 11)
51. Class II bike lanes should be constructed on McLaughlin Drive, with the design such that this route can be safely used by pedestrians as well. (Section 4.2.1, page 22).
52. The County should be urged to widen Empire Grade from the City limits up to the west entrance on Heller Drive, putting Class II bike lanes on both sides to connect the City's bike lanes to the bike lanes on Heller Drive. These bike lanes would be particularly attractive as an alternative route for mopeds. (Section 3.2.8, page 17)
53. Bicycle parking and storage facilities for the commuter, including simple brackets on interior office walls, should be installed where appropriate. (Section 5.2.1, page 27)
54. New lock-up stands and storage lockers should be installed at locations determined by noting areas where current parking is filled, or where bikes are unsafely parked, and adding capacity nearby. (Section 5.2.1, page 27)
55. New bicycle parking should be provided using steel posts with four locking loops, consisting of a high and a low loop on opposite sides of the post. The posts should be mounted with the locking loops sticking out to the sides, rather than front and back. If possible, the posts should be coated with a thick layer of plastic or rubber, to keep them from scratching the bicycles. (Section 5.2.1, page 27)
56. A survey should be conducted to determine the economic feasibility of installing rental lockers, for students and staff who have no indoor storage available, but desire greater security and weather protection than is now available. (Section 5.2.1, page 27; Section 7.2.1, page 33)
57. A brochure should be prepared for general distribution to the campus population, containing a map indicating bicycling routes on campus showing links to city bike lanes in the vicinity of the campus, and indicating locations of parking and shower facilities and routes of bike-carrying shuttles and buses. It should also include descriptive material regarding advantages and disadvantages of travelling via bicycle, along with suggestions for effective bicyclist behavior and descriptions of proper bicycling and safety equipment. (Section 6.2.1, page 30)
58. A section of the General Catalog should include information useful to prospective and existing bicyclists. This information should also be included in the registration packet and in the parking application packet, and should be made available for use at orientation sessions for new students and staff. (Section 6.2.1, page 30)

## 8.4 Lower priority projects—less urgent recommendations

59. Signs and other visual indicators should be installed to show preferred bicycle routes, routes where bicycling is discouraged, and locations of storage and lock-up facilities. To be effective, such signs should be limited in number. (Section 6.2.1, page 30)
60. The workshops on bicycle repair and safety should continue to be offered by the Office of Physical Education, Recreation and Sports. (Section 6.2.1, page 30)
61. Campus bicyclists should be encouraged to form an organization for the purpose of sharing information useful to bicyclists and for the purpose of lobbying for improved amenities. (Section 6.2.1, page 30)
62. Someone (perhaps the Bicycle Subcommittee) should write an occasional newsletter or a regular column in *City on a Hill*. (Section 6.2.1, page 30)
63. An informational slide or video presentation should be prepared to be made available to both the campus population and the community. John Forester's film *Bicycling Safely on the Road* [For] should be shown annually. (Section 6.2.1, page 30)

# References

[Bra86] Vice Chancellor Brase. Discussion paper, April 1986.

[Cal83] Caltrans. Bikeway planning and design. In *California Highway Design Manual*, chapter Section 7-1000, Caltrans, July 1983.

[For] John Forester. *Bicycling Safely on the Road*. Iowa State University, Film Production Unit, Iowa State University, Ames, Iowa 50011. 20-minute film.

[For83] John Forester. *Bicycle Transportation*. MIT Press, Cambridge, MA, 1983.

[For84] John Forester. *Effective Cycling*. MIT Press, Cambridge, MA, 1984.

[For88] John Forester. letter to Bicycle Subcommittee, 24 April 1988.

[Hol88] Maurice Hollman. letter to Bicycle Subcommittee, 21 January 1988.

[Moh85] Mohle, Grover, and Associates. *Traffic Signal Bicycle Detection Study—Final Report*. La Habra, CA, November 1985. Prepared for the City of San Diego.

[Wil88] Laurel Wilson. letter to UCSC Transportation Committee, 16 February 1988.

[Wor87] Ken Wormhoudt. Recommendations for the improvement of the main entrance and the west entrance to the university of california santa cruz campus. 2 November 1987.

# Appendix A. Known Bicycle Parking Facilities on Campus

This listing of bicycle parking facilities was provided by Maurice Hollman, Senior Superintendent of the Physical Plant [Hol88]. We assumed that the list he provided listed bicycle parking posts—his numbers have been doubled to indicate number of bicycles that can be locked up.

This list is not exhaustive. Some known parking that is missing from the list:

- the unused hooks under the Kerr Hall patio, and
- the racks along the railing at the end of the driveway up to Merrill.

Many of the posts are "unobtrusively" located, so unobtrusively that no one knows they are there, and they remain unused. New parking posts should be installed where bicyclists will see them and use them, preferably where bicyclists are currently parking without the benefit of posts.

| Location | bicycles that can be parked |
|---|---|
| Barn Theater | 80 |
| Cookhouse | 6 |
| East Field House | (removed for construction) |
| Hahn Student Services (north side) | 12 |
| Whole Earth | 20 |
| McHenry Library (north side) | 26 |
| McHenry Library (south side) | 14 |
| Visual Arts | 46 |
| Performing Arts | 14 |
| Kerr Hall (north side) | 42 |
| Kerr Hall (south side) | 32 |
| Thimann Lecture Hall | 20 |
| Thimann Labs (south side) | 12 |
| Thimann Labs (north side) | (removed for construction) |
| Applied Sciences (south side) | 30 |
| Applied Sciences (north side) | 12 |
| Communications | 12 |
| Natural Sciences II (north side) | 34 |
| Natural Sciences II (south side) | 6 |
| West Field House | 22 |
| Kresge | 74 |
| Oakes | 32 |
| Stevenson | 16 |
| Cardiff House | 6 |
| total | 568 |

# Appendix B. Summary of Reported Accidents

The recording and compilation of accidents involving bicycles can serve as an excellent guide to needed improvements. We have begun such a compilation, and include in this appendix a summary of the sixty-six accidents that were reported during the three-year period between 2 August 1984 and 8 February 1988, as prepared by Chief Fuentes of the Campus Fire Department and Lieutenant Tepper of the Campus Police Department.

In addition, we include more detailed descriptions of fourteen of those accidents, as gleaned from the police reports. They are selected because they relate to particular problems areas, namely the bike path, Steinhart Way, the Kerr Hall access road and Meyer Drive, and Coolidge Drive. The locations of these accidents are shown on the accompanying map (Figure B.1). The occurrence of four reported accidents associated with the sharp downhill turn on the bike path was directly responsible for our highest priority recommendation, namely that this section of the bike path be realigned.

## B.1 Bike Path

1. A descending bicyclist did not negotiate the turn. (13 August 85, 3:55 p.m.)
2. Although it is not clear from the report, it would seem that a descending bicyclist could not negotiate the turn and came off her bike. It was her first time on the path. (11 May 87, 10:18 a.m.)
3. A descending bicyclist did not negotiate the turn. (11 May 87, 10:18 a.m.)
4. A couple on an old rusty and not well-maintained bicycle did not negotiate the turn. (23 July 87, 10:25 a.m.)
5. A bicyclist came off his bicycle near the powder house by the lower cattle guard. It is not clear what the cause was. (13 October 87, 10:38 a.m.)
6. A bicyclist's front wheel came off (not being securely attached) after running over a slight bump caused by a manhole cover on the lower section of the path.

## B.2 Steinhart Way

7. A bicyclist headed downhill into a turn on the McHenry Library access road had his head down and ran into a (stopped) car coming up the road. (15 September 84, 5:33 p.m.)
8. A bicyclist headed down the McHenry Library access road ran into a pedestrian who ran from a dirt path onto the road. The pedestrian was inattentive, bent on returning books to the library. (11 March 85, 11:28 a.m.)
9. A bicyclist inexplicably ran into the berm on Steinhart opposite the access road leading to the Classroom Unit. (17 May 86, 9:02 a.m.)
10. A bicyclist descending on Steinhart attempted to turn into the McHenry Library access road, but could not negotiate the turn and ran into the rock wall in front of the library. (6 March 87, 11:30 a.m.)

## B.3 Kerr Hall access road and Meyer Drive

11. A bicyclist descending the Kerr access road to its intersection with Meyer Drive was struck by a car moving west on Meyer at the intersection. The bicyclist did not stop at the stop sign, owing, reportedly, to faulty brakes. (11 September 85, 12:10 p.m.)

12. A bicyclist tried to thread his way at high speed through a gap
    in a group of pedestrians who were walking on the access road at the straight level stretch near the large Douglas fir, and knocked down a pedestrian. We understand this to be the most serious accident involving a bicycle that we have experienced. The pedestrian's vision reportedly became impaired as a result. (15 May 86, 7:45 p.m.)
13. A bicyclist travelling south on the McHenry Library access road just south of the southern blinking light collided with a truck that was (unexpectedly for the bicyclist) turning right into the Baskin Arts access road. (31 October 86, 8:35 a.m.)

## B.4 Coolidge Drive

14. A bicyclist descending on Coolidge was struck by a car turning left onto Hagar at the Hagar/Coolidge intersection. The motorist said she did not see the bicyclist. (8 January 88, 11:10 a.m.)

Figure B.1: Map of selected bicycle accidents on campus. The numbers correspond to the listing in Appendix B.