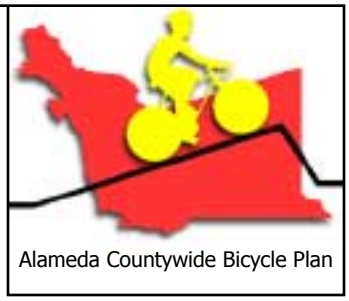
# Chapter 6: Design Guidelines and Best Practices




## PURPOSE OF COUNTYWIDE DESIGN GUIDELINES AND BEST PRACTICES

This chapter presents design guidelines and best practices for bicycle and pedestrian facilities, bicycle parking and education programs. These are based on standards and guidelines published by others, existing practices used by local agencies and on the consultant's knowledge of bicycle operations, traffic engineering and pedestrian safety.

The purpose of these guidelines is to ensure consistency in the design of the countywide bicycle network including but not limited to signing, striping and intersection treatments. Since travel by bicycle, whether on designated bikeways or on roadways, does not stop at city limits, there is a need for a set of guidelines for countywide bicycle projects. The information in this chapter will also serve as a reference for local agencies on best practices used within the County to accommodate bicycle and pedestrian transportation. A summary of existing bicycle education and outreach programs is also presented to assist local agencies in the implementation of their own programs.

## DESIGN DIFFERENCES BETWEEN BICYCLE AND PEDESTRIAN FACILITIES

Before the bicycle design guidelines are presented, it is necessary to acknowledge that pedestrians and bicyclists have different operational characteristics that affect the design of their respective facilities. Bicyclists and pedestrians travel at different speeds and therefore require different stopping sight distances. For safety reasons, it is better to separate the two modes except in special circumstances. Other design features are optimized in one way for bicyclists and in another way for pedestrians and the design guidelines for one mode are not necessarily appropriate for the other mode. The major operational characteristics and design issues are summarized below in Table 6-1.

## EXISTING BICYCLE DESIGN PRACTICES

Each of the jurisdictions of Alameda County was contacted to determine whether it has local bicycle design guidelines or if it uses specific traffic engineering practices that are bicycle-friendly. Most jurisdictions stated that they adhere to Caltrans bicycle design standards as set forth in Chap-

ter 1000 of the *Highway Design Manual*. The design practices used by agencies in the County that are over and above Caltrans standards are summarized in Appendix F-1. Some of these are recommended for countywide use and are described under the appropriate topic below.

**Table 6-1**
**OPERATIONAL DIFFERENCES**
**BETWEEN WALKING AND BICYCLING**

| Design | Pedestrian | Bicycling |
|---|---|---|
| Location of pedestrian or bicyclist within roadway right-of-way | Sidewalk when adequate ROW; otherwise shoulder or edge of roadway. | Shoulder or bike lane if adequate ROW; otherwise vehicle travel lane (sidewalk only if under age 13). |
| Design Speed | 2 to 4 mph | 20 mph level;<br>30 mph w/grade. |
| Stopping Distance | 5 - 10 ft. | 15 mph - 75 ft. (level)<br>30 mph 260 ft. (5% grade) |
| Surface | ADA requires "stable, firm and slip resistant" surface. | Asphalt or concrete. |
| Grades | Stairs and escalators OK. Ramps or elevators for ADA compliance. Maximum slope for a ramp with handrails is 8.33% and for an accessible pathway is 5%. | No stairs or escalators, acceptable grade varies widely - typical commuters prefer 5% maximum running slope, 10% maximum for short distances such as ramps. |
| Parking | NA | Required at trip end. |

## RECOMMENDED BICYCLE DESIGN PRACTICES

This section presents guidelines for common design issues that affect bicycling. The guidelines are identified as either a **Caltrans Standard** or a **Recommended Best Practice**. The **Caltrans Standard** as presented on the following pages is the description from the Caltrans publications *Traffic Manual*, *Highway Design Manual* and/or *Standard Plans* regarding signs, markings and other design details. All Alameda County bikeways should conform to these standards. In addition, a **Recommended Best Practice** is provided for design details that are either labelled optional by Caltrans or to encourage the use of other practices that are not covered in the Caltrans manuals. The **Recommended Best Practices** do not conflict with any Caltrans standard; they supplement the standards and are recommended for the Alameda Countywide Cross County Bicycle Corridors. (If a recommended practice is based on a section of the California Vehicle Code, then this is so indicated.)

The section first presents a brief overview of Class 1 Bike Paths, Class 2 Bike Lanes and Class 3 Bike Routes followed by Guidelines for Bike Paths, Bike Lanes and Bike Routes. Guidelines are also presented for:

- Accommodating Bicyclists at Signalized Intersections
- Maintenance of Bicycle Facilities
- Bicyclists Counts and Surveys
- Bicycle Parking

### Class 1 Bike Paths

The HDM specifies a minimum trail width of eight feet, however AASHTO specifies a minimum trail width of ten feet. It is recommended that the width of the trail increase with the volume of trail users. As shown in Figure 6-1, the more pedestrians or non-bicycle users projected, the wider path should be used. For paths with low pedestrian volumes (approximately 50-100 per peak hour), the paved width is recommended to be ten feet. For moderate pedestrian volumes (100-400 per peak hour), the recommended cross section is a paved width of between twelve and fourteen feet. For heavy pedestrian volumes, greater than approximately 400 per peak hour, two parallel facilities are recommended: one for faster traffic, such as bicycles and roller blades, and one for slower modes such as pedestrians, children on bicycles with training wheels, etc. Bollards, if used, should not obstruct the path of bicyclists. Design guidelines for bollards are presented in Figure 6-2.

### Class 2 Bike Lanes

Bike lanes are recommended on all arterials and collectors carrying 4000 or more vehicles per day. (Separate bike paths paralleling the roadway do not substitute for bike lanes on the arterial.) Optimally, the width of bike lanes should increase as travel speed increases as shown below in Table 6-2. The standards and recommended best practices for the signing, striping and pavement markings for bike lanes are presented on the next pages. A typical arterial street with bike lanes is illustrated in Figure 6-3 depicting the recommended placement of signs and markings. A discussion of bike lanes on bus routes is presented on page 6-11.

**Table 6-2**
**OPTIMUM BIKE LANE WIDTHS (feet)**

| Posted Speed (mph) | Without parking (feet) | With parking (feet) |
|---|---|---|
| 0 – 35 | 5 | 13 |
| 36 – 50 | 6 | 14 |
| 50+ | 8 | 16 |

### Class 3 Bike Routes

Class 3 Bike Routes as described in the *Highway Design Manual* require no special markings or treatments other than signing. Thus the designation of a roadway as a Bike Route does not convey to the user or to the motorist what roadway conditions to expect. The type of roadway where a Class 3 Bike Route can be designated ranges from a quiet residential street to a highway with shoulders to a busy arterial where width is not available for bike lanes. This document presents design guidance for three specific types of bike routes: local streets, bicycle friendly arterial roadways and narrow-lane arterial roadways.

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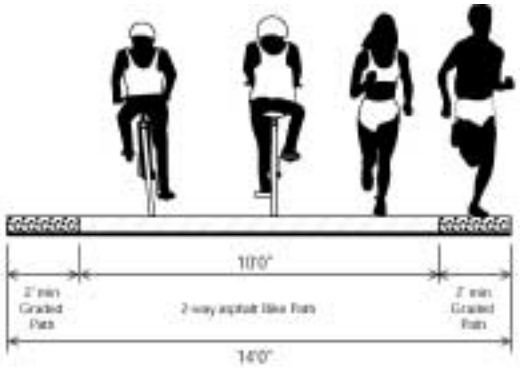
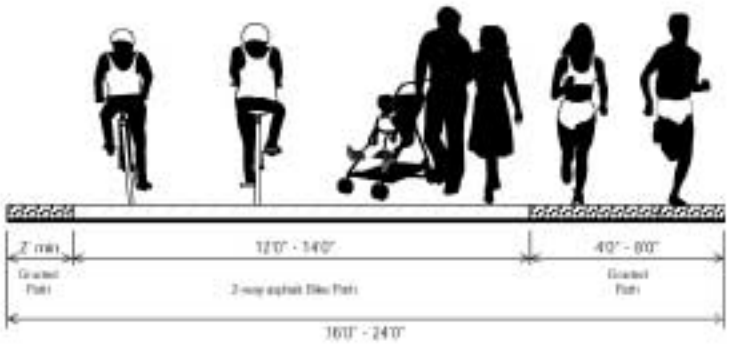
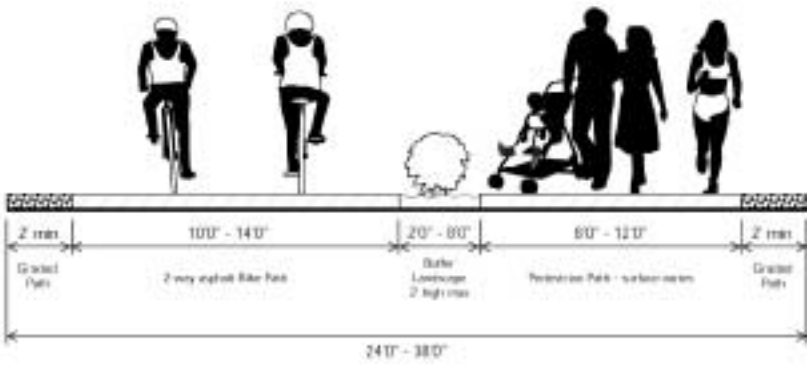
**Figure 6-1**
**TRAIL SECTIONS VERSUS PEDESTRIAN VOLUMES**




1a. BIKE PATH WITH PEDESTRIAN TRAFFIC OF LESS THAN 50 PER PEAK HOUR

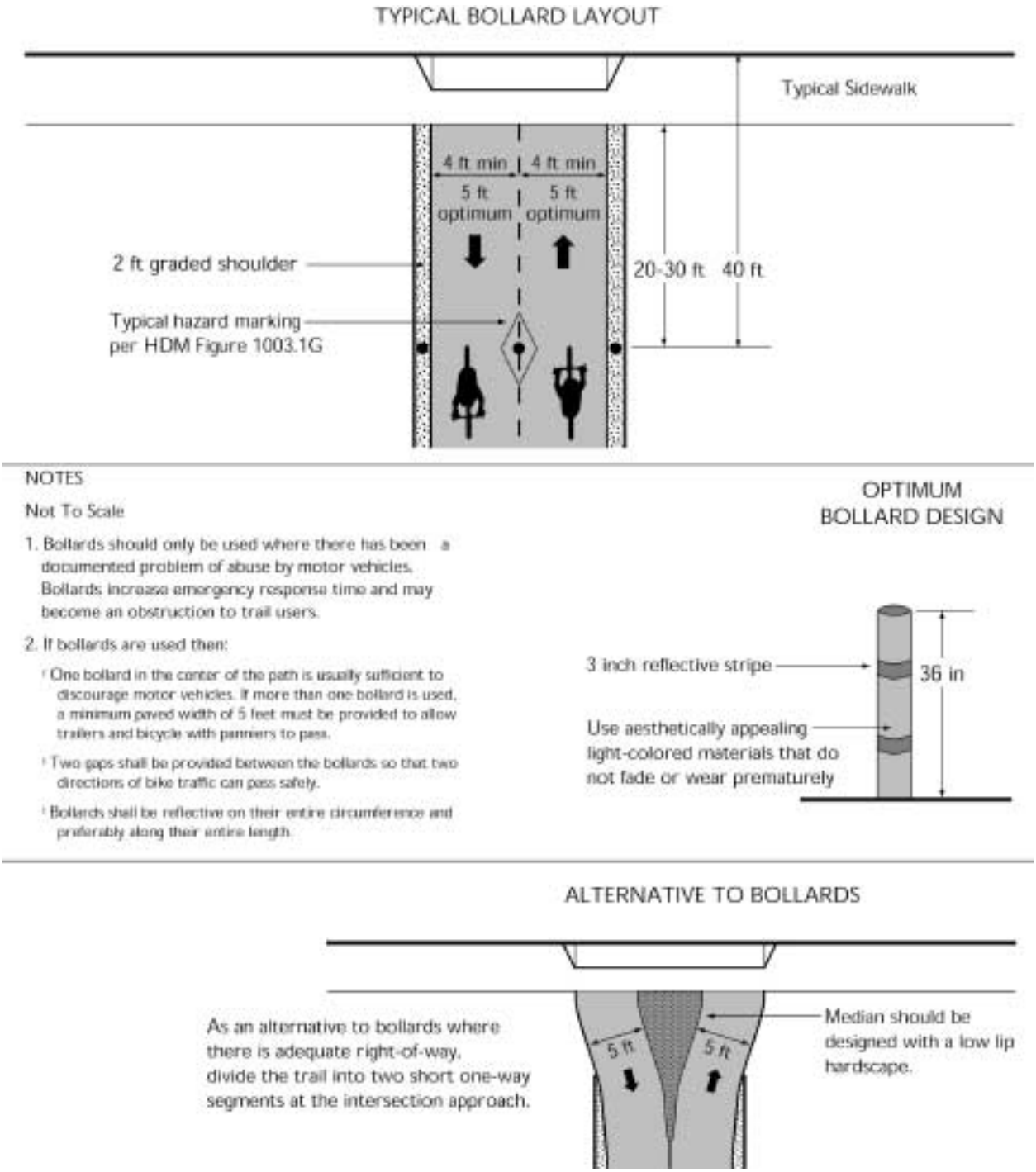



1b. MULTI-USE TRAIL - 50 TO 400 PEDESTRIANS PER PEAK HOUR




1c. SEPARATE PATHS FOR BIKES AND PEDESTRIANS MORE THAN 400 PEDESTRIANS PER PEAK HOUR

**Figure 6-2**
**TYPICAL TRAIL BOLLARDS**



**R81 Sign**


**Front**


**Back of R81**

**R81/R26 Sign**


**Front**

**R95 Sign with BIKES WRONG WAY MESSAGE**


**Back**

**R81A Sign**


**R81B Sign**


## Guidelines for Bike Lane Signing

The following describes the signs required and recommended for use on bike lanes.

***Bike Lanes with Parking Permitted***

**Caltrans Standard:** The BIKE LANE sign (R81) shall be placed at the beginning of each designated Bike Lane and …at every arterial street… and at maximum one-half mile intervals.

**Recommended Best Practice:** The rear of the BIKE LANE sign (R81) should display the BIKES WRONG WAY message to discourage wrong-way riding. The BIKE LANE sign (R81) with the BIKES WRONG WAY message on the back should be installed as indicated above, and also at the beginning of the section of roadway that is a Suggested Route to School, in front of schools and other blocks with high activity by children or seniors to reinforce correct riding practices.

***Bike Lanes with Parking Prohibited***

**State Regulation:** If parking is prohibited alongside a bike lane, it must be so posted in accordance with California Vehicle Code (CVC) Section 21461(a).

**Recommended Best Practice:** To reduce sign clutter, the BIKE LANE sign (R81) may be integrated with the NO PARKING sign (R26). (Traffic Manual Section 4-03.4 and 4-03.5).

**Recommended Best Practice:** The back of combination BIKE LANE/NO PARKING sign should display the NO BICYCLES symbol sign (R95) along with the BIKES WRONG WAY message.

***Begin and End Bike Lane Signs***

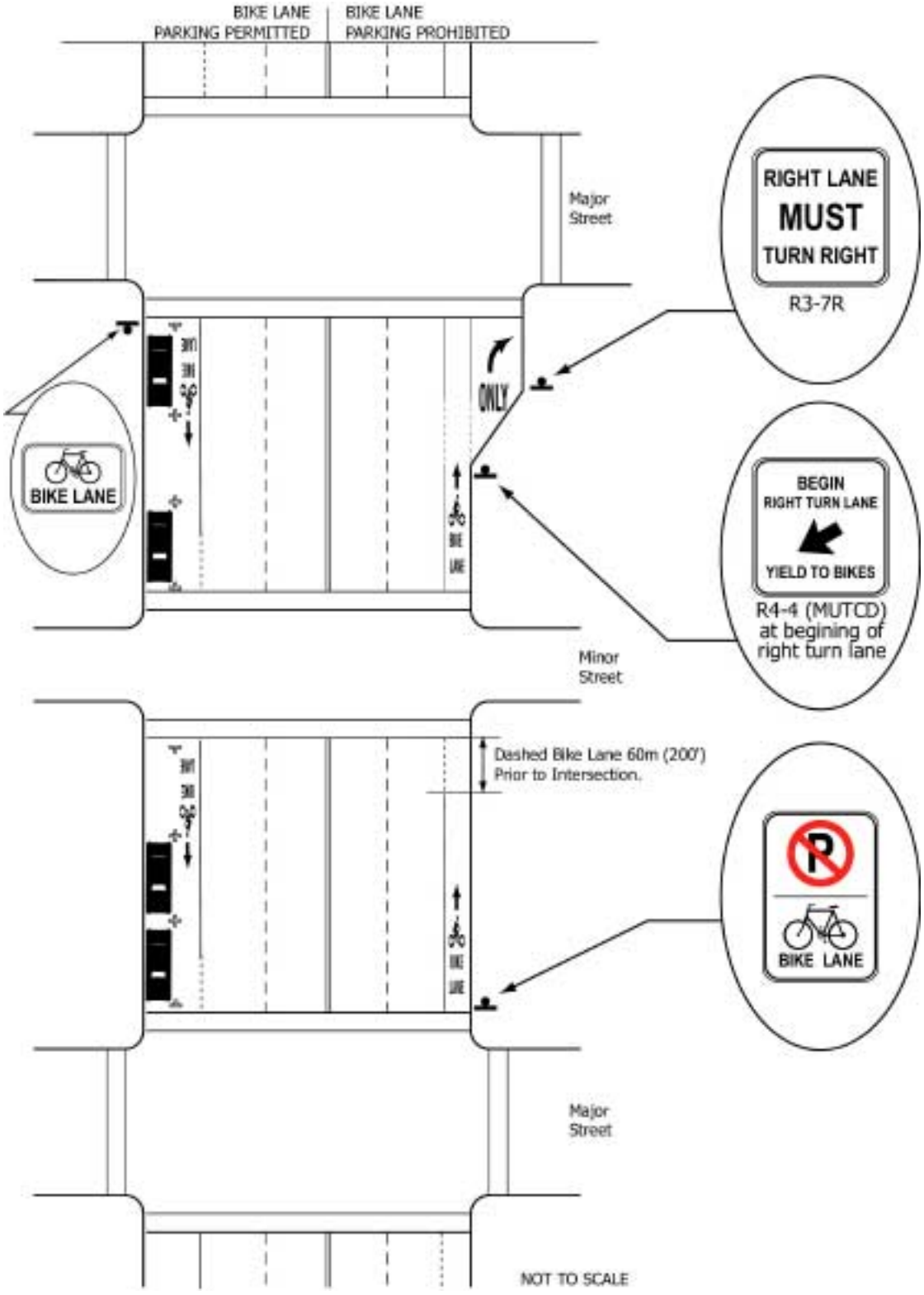
**Caltrans Standard:** The BEGIN BIKE LANE sign (R81A) may be used below the BIKE LANE sign (R81) to mark the beginning of the bike lane

**Recommended Best Practice:** To reduce sign clutter, this sign is recommended only when the bike lane begins midway in a community such as between major arterials.

**Caltrans Standard:** The END BIKE LANE sign (R81B) may be used below the BIKE LANE sign (R81) to mark the end of the bike lane.

**Recommended Best Practice:** To reduce sign clutter, this sign is recommended only when the bike lane ends abruptly between major arterials.

**Figure 6-3**
**BIKE LANES ON ARTERIALS**



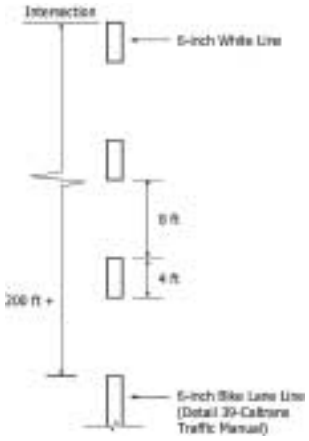
**Arrow (symbol)**

**Bicycle (symbol)**

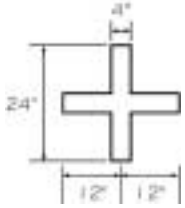

**Bike Lane (text)**

**Detail 39**


**Detail 39A**




**"+" Symbol for Delineating Parking Stalls**




## Guidelines for Bike Lane Striping and Pavement Markings

***Bike Lane (text) Caltrans Standard Plans A24D***

**Caltrans Standard:** The BIKE LANE (text) pavement marking shall be placed on the far side of each intersection, and may be placed at other locations as desired.

***Arrow (symbol) Caltrans Standard Plans A24A***

**Caltrans Standard:** The ARROW (symbol) pavement marking to supplement the word message is optional.

**Recommended Best Practice:** The ARROW (symbol) pavement marking should be used with BIKE LANE (text) pavement marking to reinforce the correct direction of bicycle travel. Together with the BIKE LANE (text), the ARROW (symbol) pavement marking should also be used on sections of roadway that are Suggested Routes to School, in front of schools and on other blocks with high activity by children or seniors.

***Bicycle (symbol) Caltrans Standard Plans A24C***

**Caltrans Standard:** The BICYCLE (symbol) pavement marking to supplement the word message is optional.

**Recommended Best Practice:** The BICYCLE (symbol) should be used in conjunction with the standard BIKE LANE (text) pavement marking. This is consistent with the guidelines of the Federal Highway Administration's Manual of Uniform Traffic Control Devices (MUTCD) and the national trend toward using international symbols.

***Bike Lane Line - Detail 39 - Caltrans Traffic Manual***

**Caltrans Standard:** The bike lane is delineated by a six inch solid white stripe.

***Dashed Bike Lane Line - Detail 39A - Caltrans Traffic Manual***

**Caltrans Standard:** Where motorist right turns are permitted, the solid bike lane line shall either be dropped entirely or dashed beginning at a point between 100 ft (30 m) and 200 ft (60 m) in advance of the intersection.

**Recommended Best Practice:** It is recommended that the bike lane be dashed 200 ft (60m) in advance of the intersection on streets with speeds greater than 30 mph and 100 ft (30m) on streets of 30 mph or less. Where right-turns are light, the local agency may choose to drop the bike lane stripe in advance of the intersection.

***Bike Lane Adjacent to Parking Stalls***

**Caltrans Standard:** In areas where parking stalls are not necessary (because parking is light), it is permissible to paint a 4 inch (100mm) solid white stripe to fully delineate the bike lane. This may be advisable where there is concern that motorists may misconstrue the bike lane to be a traffic lane.

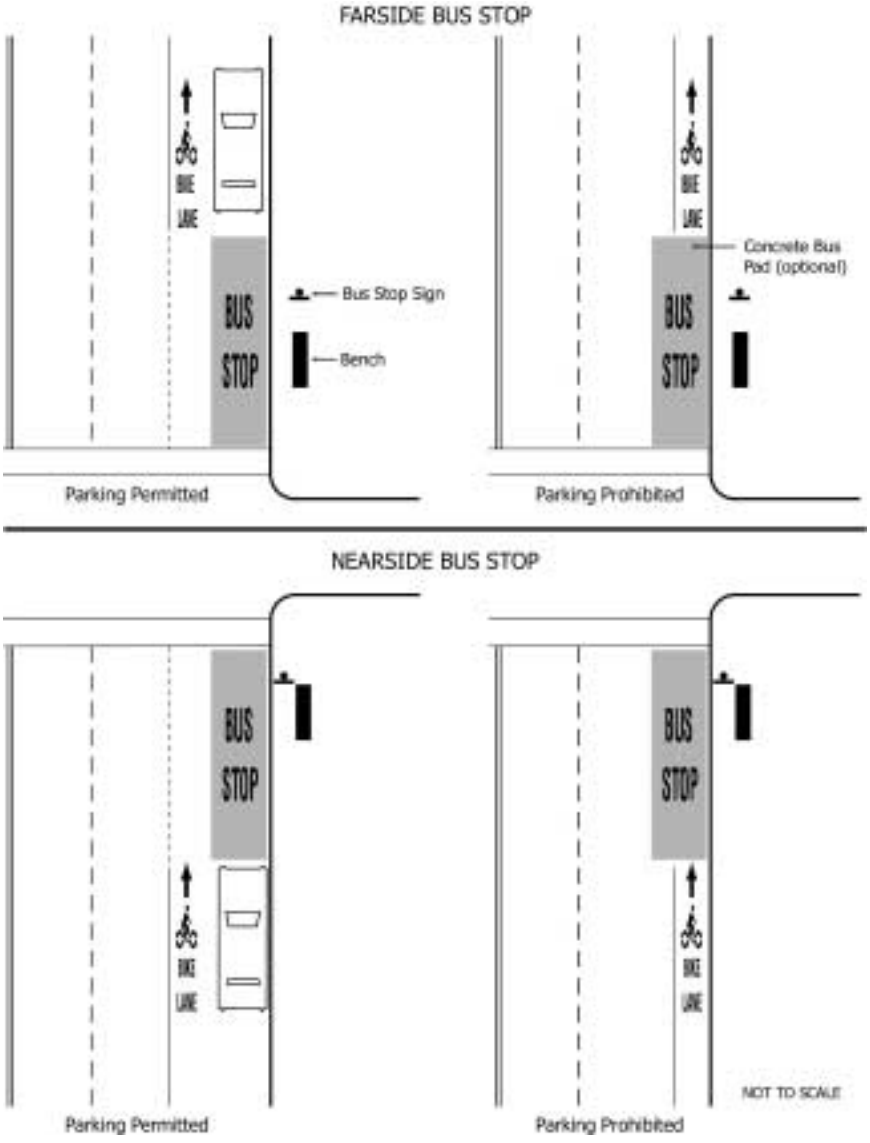
**Recommended Best Practice:** Where stalls are delineated, use a "+" symbol to discourage bicyclists from riding in the door zone.

## Guidelines for Bike Lanes on Bus Routes

When bike lanes are provided on streets that are bus routes, there are options in designing the bus stop location and the bike lane stripe. The recommended design is illustrated in Figure 6-4 for near side and far side bus stops. In general, the bike lane stripe should be dashed throughout the bus stop. In addition, it is recommended that the bus stop itself be designated by a pavement marking, or a different material such as concrete.

When streets have a designated transit lane (bus HOV lane) it is recommended that bicycles be expressly permitted to use the lane.

**Figure 6-4**
**BIKE LANES ON BUS ROUTES**



## Guidelines for Class 3 Bike Routes

The following describes the Caltrans standards for bike routes as well as recommended practices for designating three types of streets as bike routes:

- Local/Residential street - Figure 6-5
- Arterial street - Figure 6-6
- Narrow laned arterial - Figure 6-7


**Caltrans Standard:** Class 3 Bike Routes are marked with the G93 sign. The Highway Design Manual states that a street designated as a Class 3 bike route should provide continuity in the overall bikeway network or it should identify a route which is somehow preferable to immediately adjacent streets.

**Local streets can make excellent bike routes especially when they have low traffic volumes. Bike Lanes are not necessary when volumes are below 4000 vpd.**

**Recommended Best Practice:** If local streets are designated bike routes, they should meet as many of the conditions below as possible (illustrated in Figure 6-5):

- ADT < 2,000
- STOP signs positioned to give right-of-way to travel on the bike route
- Median refuges or traffic signals to cross arterials
- Traffic calming if used should be compatible with bicycles
- Not a truck route
- Directional signing
- Standard street lighting

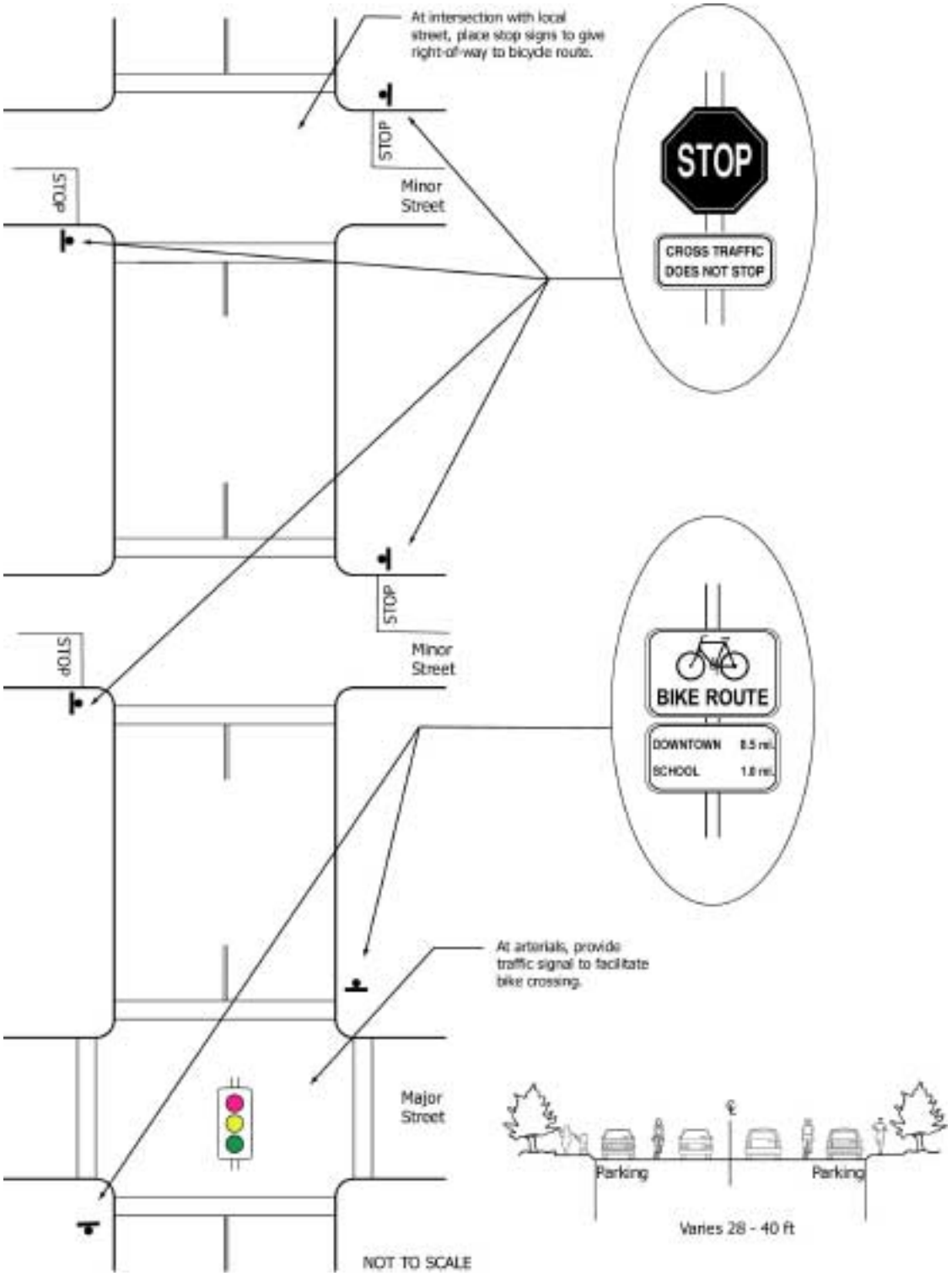
**Local streets can be designated Bicycle Boulevards if they meet the following conditions to provide a greater benefit to bicyclists:**

- **Non-local motor vehicle traffic is discouraged;**
- **Travel on the streets has the right-of-way at intersections wherever possible;**
- **Traffic control are placed to help bicycles cross arterials.**

**Recommended Best Practice:** Local streets that are bicycle boulevards should meet the following conditions:

- Not a transit or truck route
- Very little commercial frontage
- Within ¼ mile of a major street or a high-traffic collector street
- Spaced between ¾ and 1½ miles from another Bicycle Boulevard
- Reasonably continuous; (i.e. it extends for over one mile)
- Few jogs with main segments at least 0.5 mile long
- Access to major destinations

**Figure 6-5**
**BIKE ROUTE ON LOCAL STREET**

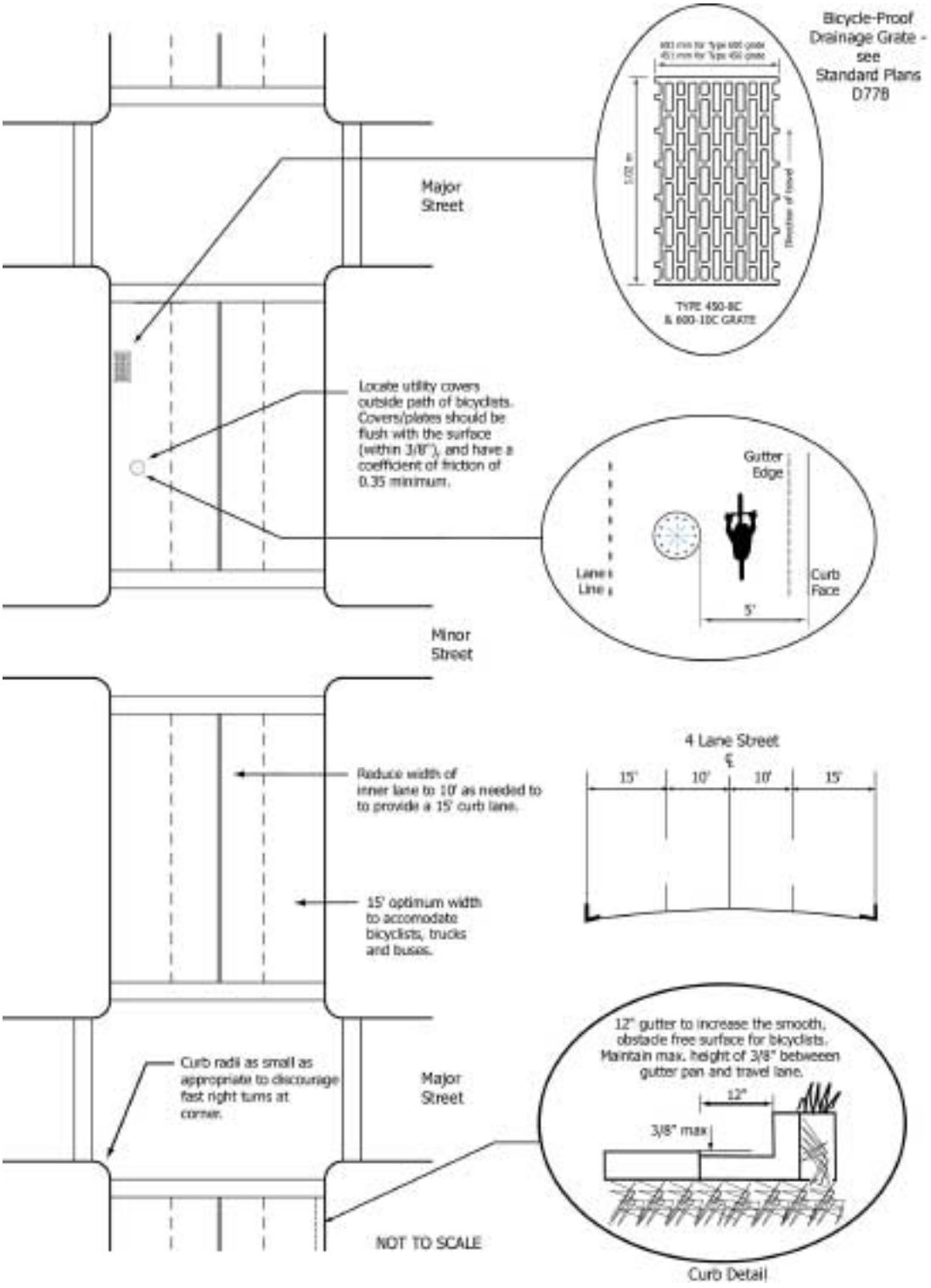


## Guidelines for Class 3 Bike Routes on Arterial Roadways

The following design practices would ideally be applied to all arterials whether or not they are designated Class 3 Bike Routes. However, as described in the Caltrans Highway Design Manual Section 1002.4, if roadways are designated bike routes, local agencies should ensure that there are particular advantages to using these routes as compared to alternative streets. The following Recommended Best Practices will meet this directive by improving a street's safety and comfort for bicyclists. The description of the design feature that can adversely affect bicycling is listed below, followed by the **Recommended Best Practice**. Some of theses practices are illustrated in Figure 6-6. Traffic signals are discussed on page 6-18.

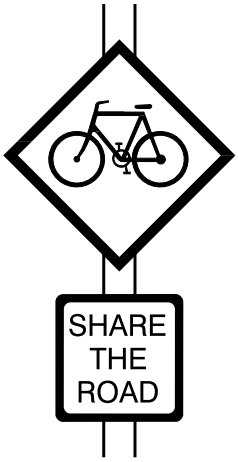
1. Width of Outer Lane/Shoulder: Inadequate width for motor vehicle to pass without crossing over the lane line or center line. **Ideally provide bike lanes or four foot shoulder; at a minimum provide 15-foot wide curb lane.**
2. Edge and Roadway Obstacles:
   a) Driveway/curb ramp lips - height differential with the roadway causes bicyclists to fall. **Install driveways and curb ramps with maximum lip height 0.5 inch.**
   b) Design and location of drainage grates. **Use bicycle-proof grates, such as those specified in Standard Plans D 77B.**
   c) In rural areas, gravel shoulders/gravel driveways often result in gravel in the roadway causing bicyclists to fall. **Pave gravel driveways for 15 feet from edge of roadway, pave four foot minimum shoulders.**
3. Roadway Surface Quality:
   a) Utility covers/Construction Plates can be slippery especially when wet. **Surface of cover or plate should have minimum co-efficient of friction = 0.35.**
   b) Chip Sealing -loose gravel. **Chip Sealing should be avoided.**
   c) **See also maintenance discussion on page 6-20.**
4. Intersections - Right-turn Treatment:
   a) Extremely long right turn lanes make it difficult for bicyclists to be positioned correctly at the intersection. **Avoid right-turn lanes over 200 feet long.**
   b) Large radius right turns, oblique right-turns, and channelized right turns enable motor vehicles to turn at high speeds. **Design right-turn lanes such that motor vehicles must slow to safe appropriate speed prior to making the turn.**
   c) Double right-turn lanes make it more difficult for through bicyclists to continue straight through the intersection, thus discouraging all but the most experienced cyclists from bicycling. **Avoid double right-turn lanes whenever possible.**

**Figure 6-6**
**BICYCLE-FRIENDLY ARTERIAL ROADWAYS**



## Guidelines for Class 3 Bike Routes on Narrow Laned Arterials

**Share the Road Sign**




Sometimes it is impossible to maintain wide outside lanes. On such streets, it is important to alert motorists of the presence of bicyclists and of the need to pass safely with due care. This is true particularly in-built up areas and for both two lane and multi-lane roads. On those streets that are nevertheless significant for bicycles, the following are **Recommended Best Practices.**

***Share the Road Sign***

Install share the road signs to officially acknowledge the presence of bicyclists on the roadway. Share the Road signs should be installed after every arterial and at minimum one-half mile intervals.

***Bicycle Stencil***

Bicycle pavement stencils are used to inform both motorists and bicycles of the safe positioning of the bicycle on narrow lane roadways.

They are recommended where the roadway is/has:

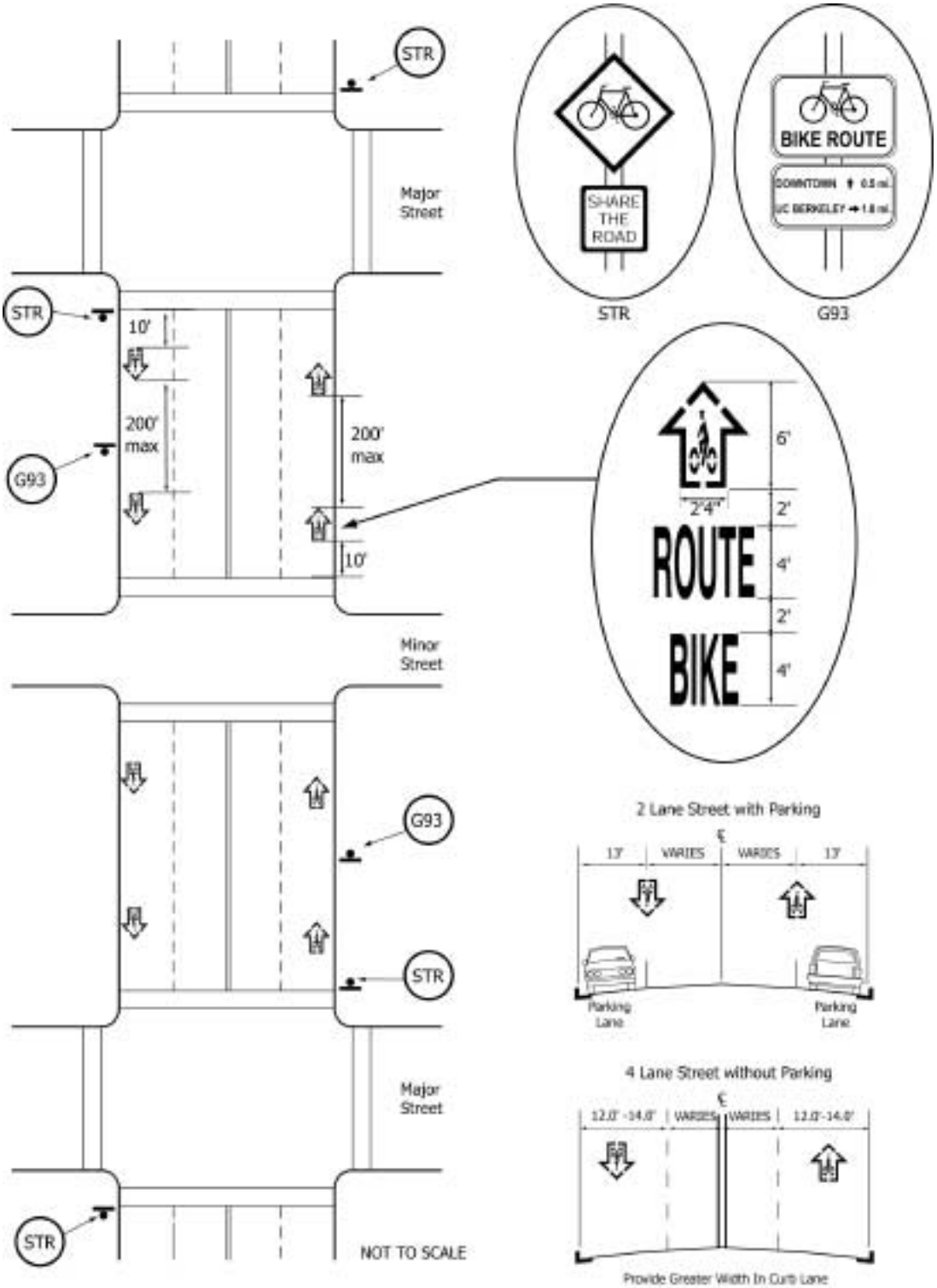
- Designated bike route
- ADT> 5,000 - two lane road
- ADT > 12,000 four lane road
- Outer lane < 14 feet (no parking) and < 22 feet with parking

**Bicycle Stencil (White)**


Placement

- Lateral placement: centerline of symbol should be five feet from edge of curb (or 13 feet with parking).
- Longitudinal placement: twice per block or every 200 feet.

**Figure 6-7**
**BIKE ROUTE ON ARTERIAL WITH NARROW LANES**



## Guidelines for Signalized Intersections

Signalized intersections can pose many challenges for bicyclists. The following **Recommended Best Practices** can ameliorate some of the problems that bicyclists encounter.

**Loop Detector Pavment Marking**

### *Traffic Signal Detection - Loop Detectors*

Actuated traffic signals depend on detectors to change the signal phase. Pedestrians push a button; motor vehicles trigger a detector located in the street pavement. Some inductive loop detectors are not sensitive enough to detect bicyclists to change the signal phase. The following types of loop detectors can be set to detect bicyclists; the recommended type of detector for a particular lane type is presented below:

a) Through lanes shared with bikes: Type D - modified quadropole loops (Caltrans Standard Plan ES5D)

b) Left-turn lanes/minor side streets: State Type 5DA loop

c) Bike lanes: Type Q - quadropole loops

d) Advance detectors that are not expected to be shared by bicycles can be Type A

### *Traffic Signal Detection - Other*

Consider other detection technologies such as microwave or video detection that do not depend on the detection of metal so that all bicycles can be detected.

### *Loop Detector Pavment Marking*

The loop detection logo shown on Caltrans Standard Plan A24C may be used to show a bicyclist where to stop in a bike lane or travel lane to be detected. The logo should be applied to the pavement in center of the Type 'D' loop.

**Minimum Green Time for Bicyclists to Clear an Intersection**

$g + y + r > t_{cross} + t_{lost}$
where $t_{cross} = (w + l)v$ and
w = intersection width
l = length of bicycle
v = speed of bicyclist
g = green time
y = yellow time
r = red time
$t_{cross}$ = time needed for bicyclist to cross the intersection
$t_{lost}$ = reaction time of the bicyclist

### *Traffic Signal Timing - See Traffic Manual Chapter 9 for more detail*

Minimum green times should account for the time needed for bicyclists to safely clear the intersection. The minimum green times depend on the width of the road, slope and type of bicyclist. Generally eight seconds is sufficient. The minimum green time can be found by using the formula to the left.

Clearance Interval: The clearance interval (yellow plus red time) must be sufficient such that a bicyclists who has entered on a green light can clear the intersection. Generally, one to two seconds of all red clearance combined with the given yellow time provides a sufficient clearance interval for bicyclists.

### *Bicycle Signal Heads*

Bicycle Signal Heads can eliminate confusion at intersections with certain geometries where it is desirable to facilitate a bicycle movement that is not permitted for a motor vehicle. The State Warrants for Bicycle Signals are presented in Table 6-3.

**Table 6-3**

**Bicycle Signal Standards**

Adopted by CTCDC* 11/19/99

A bicycle signal is an electrically powered traffic control device. It may be used only in combination with a traffic signal. It directs a bicyclist to take specific actions and may be used to improve an identified safety or operational problem involving bicycles.

Since a separate signal phase for bicycle movement will reduce the green time available for other phases, alternate means of handling conflicts between bicycles and motor vehicles should be considered first. The most likely alternatives are:

1. Striping to direct a bicyclist to a lane adjacent to a traffic lane such as a bike lane to the left of a right-turn only lane.

2. Redesigning the intersection to direct a bicyclist from an off-street path to a bicycle lane at a point removed from the signalized intersection.

A bicycle signal phase should be considered only after these and other less restrictive remedies have an adequate trial with enforcement and with the result that the collision frequency has not been reduced.

WARRANTS - A bicycle signal may be considered for use only when the volume and collision or volume and geometric warrants have been met:

1. VOLUME - When $W = B * V$ and $W > 50{,}000$ and $B > 50$

Where:

W is the volume warrant

B is the number of bicycles at the peak hour entering the intersection

V is the number of vehicles at the peak hour entering the intersection

B and V shall use the same peak hour

2. COLLISION - When two or more bicycle/vehicle collisions have occurred in a 12-month period and the responsible public works official determines that a bicycle signal will reduce the number of collisions

3. GEOMETRIC - (a) Where a separate bicycle/multi-use path intersects a roadway (b) At other locations to facilitate a bicycle movement that is not permitted for a motor vehicle.

*CTCDC = California Traffic Control Devices Committee

## Guidelines for Maintenance of Bicycle Facilities

The following **Recommended Best Practices** will ensure that roadways are maintained to an optimum level for bicycling.

- Asphalt overlay procedures: Grind asphalt at edge of roadway and/or wedge cut prior to applying the overlay to ensure smooth longitudinal gutter joint.
- Trench and pothole patching procedures: Compaction standards from Caltrans Standard Specification 39+6.03 should be met to ensure that the pavement surface remains intact and smooth.
- Ensure that any other vertical interruptions in the roadway surface adhere to the maximum tolerances set forth in the Caltrans Highway Design Manual reprinted below in Table 6-4. These are for both grooves (indentations) or steps (ridges). These tolerances should be maintained on all roadways at such locations as utility covers, driveway lips, where two pavements intersect, and other such joints in the area where bicyclists can be expected to ride.

**Table 6-4**
**Bikeway Surface Tolerances**

| Direction of travel | Grooves | Steps |
|---|---|---|
| Parallel to travel | 0.5 inch (12 mm) wide maximum | 0.375 inch (10 mm) high maximum |
| Perpendicular to travel | ---- | 0.75 high (20 mm) maximum |
| Source: Table 1003.6, Highway Design Manual | | |

## Guidelines for Bicyclist Counts and Surveys

**Recommended Best Practices:** Use surveys to supplement census journey to work data on bicycle mode share regarding:

- Number of middle and high school students who bike to school
- Number of transit riders who arrive at the station by bicycle
- Number of transit riders who bring their bikes on board
- Number of residents who use the bicycle for non-commute transportation trips

**Recommended Best Practices:** Prior to making a bicycle improvement or constructing a new on-road facility, bicycle counts should be conducted so that a "before and after" comparison in the level of bicycling can be made.

**Recommended Best Practices:** Annual counts of bicycle traffic should be conducted at key locations in the County. These locations should include major arterials, routes to schools, and bicycle bridges. These counts should be conducted during the same time of year during a non-rainy month when school is still in session such as May or early October.

In July 2000, ACTAC identified 6 locations where bicycle counts could be measured in future LOS Monitoring studies depending on available funding. The locations listed below along with the 4 optional locations will be included in future LOS Monitoring Study scopes of work. The counts will be collected in the spring.

The locations are:

1. Shattuck at Hearst, Berkeley (or Milvia and Hearst because this is a major bicycle route)
2. Telegraph and 27th Street, Oakland
3. Mission Boulevard at Jefferson, Hayward
4. Mission Boulevard at Bachman, San Lorenzo
5. Fremont Boulevard between Alder and Gibraltar, Fremont
6. East Avenue at Vasco Road, Livermore

## Guidelines for Bicycle Parking

### *Definition of Types of Bicycle Parking*

**Class I** - This is defined as protecting the entire bicycle and its components from theft, vandalism or inclement weather. It is appropriate for long-term bicycle parking such as at employment centers or transit stations. A simple solution in some workplaces, is to permit employees to keep their bikes in the their offices. Other examples are bike lockers (see Figure 6-8), rooms with key access for regular bike commuters, guarded parking areas, and valet or check-in parking. A common variation of the latter example is at schools where racks are placed within a fenced compound to provide more security to discourage thieves. The compound is either locked during the day or unofficially guarded by the activity within the school. A new concept is the Bike Station such as the Berkeley Bike Station at the Downtown Berkeley BART Station, which provides attended bike parking in an enclosed interior space.

**Class II** - This is defined as a rack to which the frame and at least one wheel can be secured with a user-provided U-lock or padlock and cable. This type of parking is appropriate for short-term parking such as at shopping areas, libraries, and other places where the typical parking duration is less than two hours. Examples of racks popular with bicyclists are the wave or ribbon racks and the inverted U-rack, or horse rail rack. Increasingly popular are higher security Class II racks such as the Crank Case racks.

**Class III** - These racks secure only one wheel and are not designed to secure the frame. They are never recommended.

### *Typical Bike Rack Designs*

Bike racks that meet the above definition of Class II are illustrated in Figures 6-9 to 6-11. These should not be construed as the only acceptable bike rack designs.

### *Bike Rack Placement*

The placement of bike racks is very important for several reasons:

1. To ensure that they are safe from vandalism
2. To ensure that they are easily accessible to bicyclists
3. To avoid adversely impacting pedestrian circulation
4. To ensure that they can be used to their maximum design capacity

Recommended placement dimension and clear space requirements for lockers and three types of racks are illustrated in Figures 6-8 through 6-11.

### *Parking Supply*

Recommendations for the supply of bicycle parking by land use is shown in Table 6-5. The parking rates in this table could be the basis for a parking ordinance.

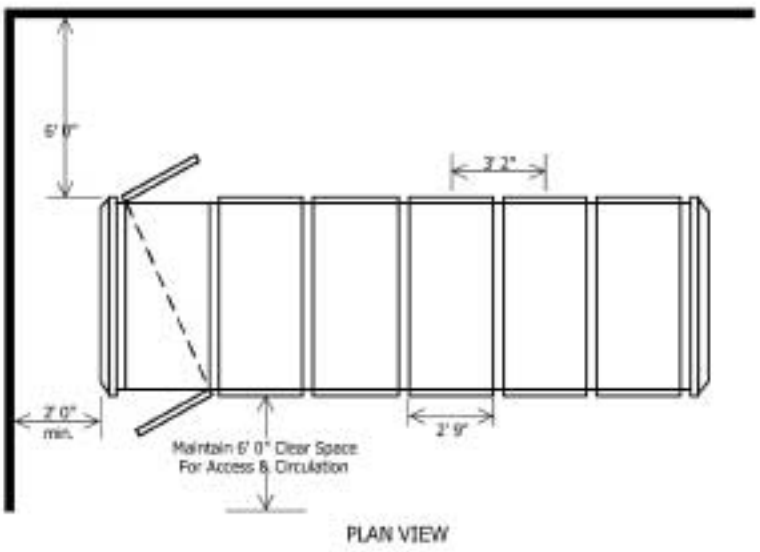
**Table 6-5**
**BICYCLE PARKING REQUIREMENT RECOMMENDATIONS**

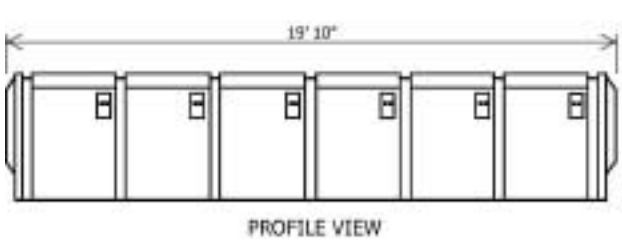
| Use | Required Number of Bicycle Spaces[1][2] |
|---|---|
| **Residential (such as apartments & townhouses)** | |
| General, multi-dwelling | 1 Class I/3 units + 1 Class II/15 units. |
| Primarily for students & low-income families, multi-dwelling | 1 Class I/2 units + 1 Class II/15 units |
| Primarily for residents 62 and older, multi-dwelling | 1 Class I/30 units + 1 Class II/30 units |
| **Schools** | |
| Elementary, middle & high schools | 1 Class I/30 employees[3] + 1 spot/12 students (50% Class I and 50% Class II) |
| Colleges - Student residences | 1 Class I/4.5 beds + 1 Class I/30 employees |
| Academic buildings and other university facilities | 1 Class I/30 employees + 1 spot/9 student seats (25% Class I and 75% Class II) |
| **Park-and-Ride Lots/Parking Garages** | 7% of auto parking (75% Class I & 25% Class II) |
| **Transit Centers** | 5% of daily boardings (75% Class I and 25% Class II) |
| **Cultural/Recreational** (includes libraries, theaters, museums, & religious institutions) | 1 Class I/30 employees + (1 Class II 1500 sq. ft. or 1 Class II/60 seats (whichever is greater) |
| **Parks/Recreational Fields** | 1 Class I/30 employees + 1 Class II/9 users during peak daylight times of peak season |
| **Retail Sales/Shopping Center/ Financial Institutions/ Supermarkets** | 1 Class I/30 employees + 1 Class II/6000 sq. ft. |
| **Office Buildings/Offices** | 1/6000 sq. ft. (75% Class I & 25% Class II) |
| **Hotels/Motels/Bed-&-Breakfasts** | 1 Class I/30 rooms + 1 Class I/30 employees |
| **Hospitals** | 1 Class I/30 employees + 1 Class II/45 beds |
| **Restaurants** | 1 Class I/30 employees + 1 Class II/3000 sq. ft. |
| **Industrial** | 1 Class I/30 employees or 1 Class I/15,000 sq. ft. (whichever is greater) + 1 Class II/15,000 sq. ft. |
| **Day Care Facilities** | 1 Class I/30 employees + 1 Class II/75 children |
| **Auto-Oriented Services** | 1 Class I/30 employees |
| **Other Uses** | Same as most similar use listed |

**Notes**
(1) For cities with less than 2% bicycle commuter rate. Pro-rate for cities with higher commute rates.
(2) The minimum number of required Class II Bicycle parking spaces is 4, except when the code would require 1 or less in which case 2 bicycle spaces must be provided.
(3) Employees = maximum number of employees on duty at any one time.

Source: League of American Bicyclists, 1994.

**Figure 6-8**
**GUIDELINES FOR PLACEMENT OF BICYCLE LOCKERS**



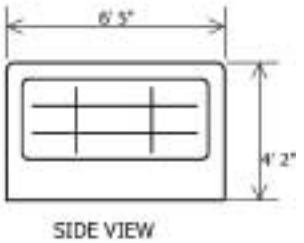
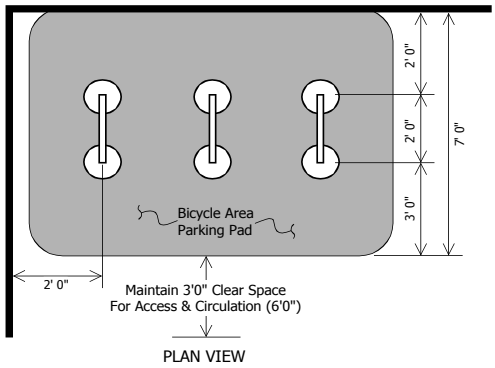
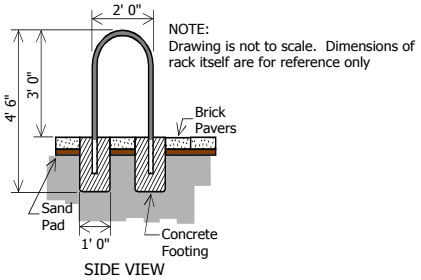



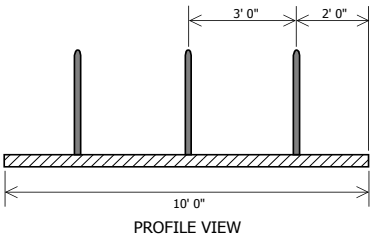
**Figure 6-9**
**GUIDELINES FOR PLACEMENT OF INVERTED U-RACK**




PLAN VIEW



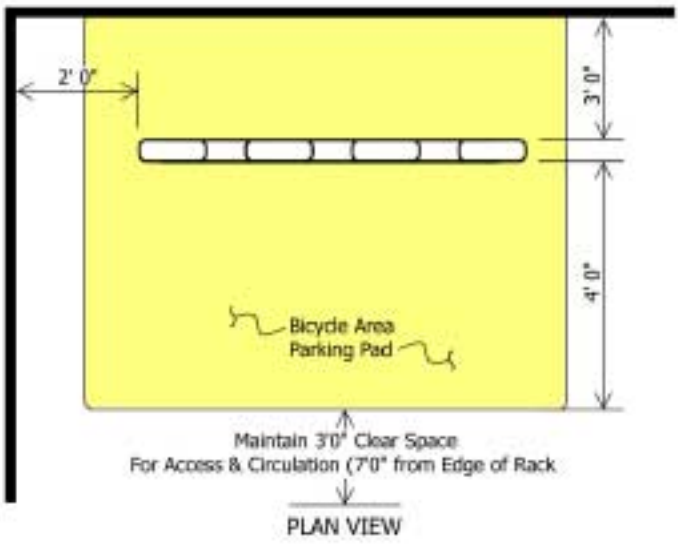

SIDE VIEW

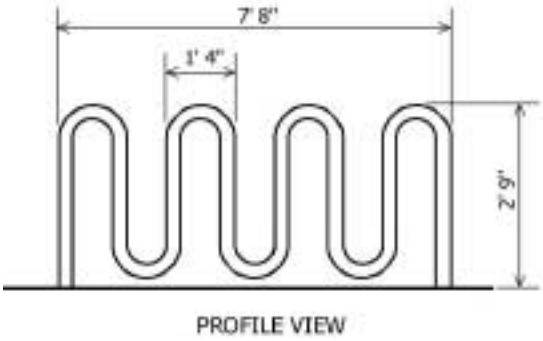



PROFILE VIEW

*When installed next to curb/sidewalk, bikes should park parallel to curb.

**Figure 6-10**
**GUIDELINES FOR PLACEMENT OF WAVE RACK**

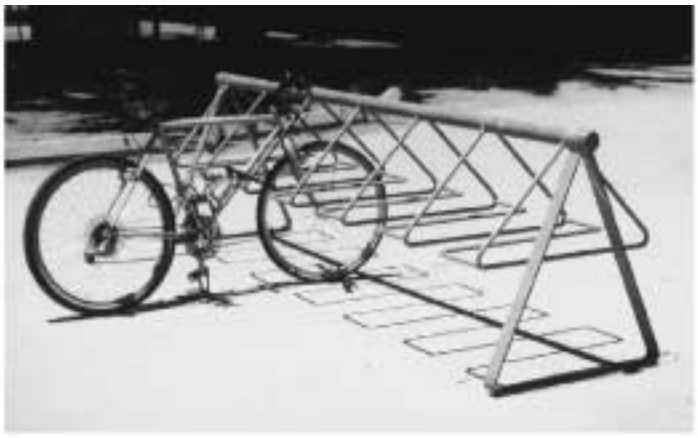


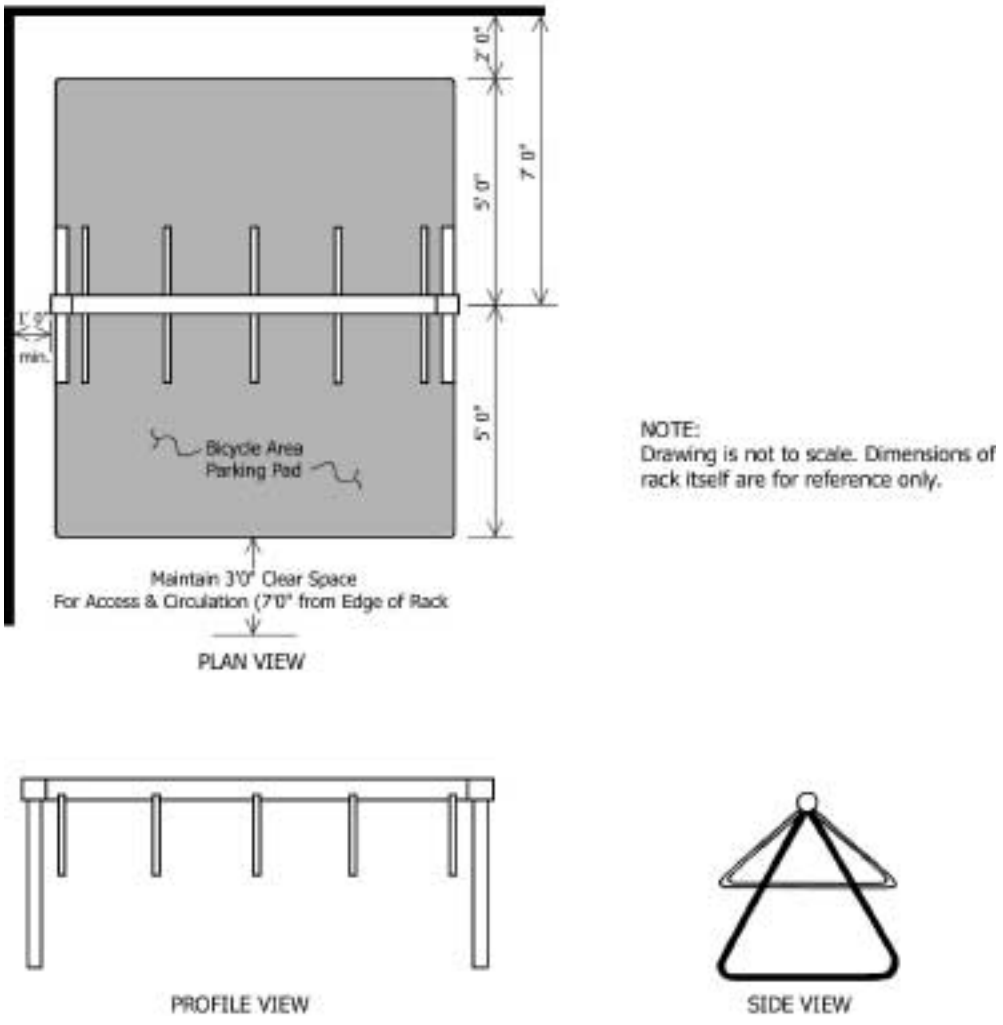





NOTE:
Drawing is not to scale. Dimensions of rack itself are for reference only.

**Figure 6-11**
**GUIDELINES FOR PLACEMENT OF COAT HANGER RACK**





## RECOMMENDED PEDESTRIAN DESIGN PRACTICES

Community designs that are predictable, interesting and allow for short distance trips are conducive to pedestrian travel. Environments that provide places for people to walk, such as networks of sidewalks, crosswalks, and protection from automobile traffic, are most likely to encourage walking. When land uses are mixed and close together, distances are reduced and walking and trip-linking become realistic. In addition, reducing automobile speeds encourages walking. A number of specific ways to design for foot traffic are described in Appendix F-2. Because the focus of this plan is on bicycles, the recommendations in this section focus on common areas between bicyclists and pedestrians.

***Accommodating Pedestrians at Traffic Signals***

**Recommended Best Practices**

- Actuated pedestrian signals: These signals can be timed to change automatically as a pedestrian reaches the crossing, or change when the pedestrian pushes an activation button. Unlike pre-set signals, real-time signals respond to immediate pedestrian needs.
- Signal timing: Pedestrian phases should provide 2.5 feet per second for slower pedestrians (elderly, disabled, etc.) where appropriate. (The state of California requires a maximum of 4 feet per second.)
- Countdown signals: Instead of a flashing red hand, countdown signals provide information on the number of seconds remaining to cross.
- "Ped scramble": These signals include an all-way red phase for motor vehicles that allows pedestrians to cross in every direction, eliminating conflicts between pedestrians and turning vehicles. Ped scrambles are in use throughout the Financial District in San Francisco.
- Accessible signals: These may include audible signals for blind pedestrians, and foot-pedal pedestrian activated signals for pedestrians with limited use of the upper body.

***Bicycle/Pedestrian Conflicts***

**Recommended Best Practices**

- Sidewalks should not be signed as bike routes
- Roller blades should be permitted in bike lanes
- Wherever possible, trails should be designed to separate faster users

such as bicycle commuters from slower users such as pedestrians and children on tricycles

- Where cyclists and pedestriains share the same space, install signs advising users to pass on the left

## MODEL BICYCLE EDUCATION PROGRAMS

The following programs, described in Table 6-6, serve a variety of bicycle outreach and education purposes. They are all good examples of a recommend program to reach a particular target audience. As such, they are considered “best practices” for in-county programs.

**Table 6-6**
**MODEL BICYCLE EDUCATION PROGRAMS**

| Agency / Group | Target Audience | Program |
|---|---|---|
| Walnut Creek Police Department<br>Officer Sue Garcia<br>925.943.5883 | Bicycle traffic offenders | Citation Diversion Program (education/traffic school in lieu of citation) |
| Bicycle Trails Council of Marin | Trail /mountain bikers | On-bike outreach on trails, regarding etiquette and safety |
| Almaden Cycle Touring Club (San Jose) | Casual adult commuters or recreational riders | "Almaden Academy": Multi-week training for touring and everyday cycling, with group training rides. |
| League of American Bicyclists | Casual adult/older youth transportation bicyclists | Effective cycling program, a modular curriculum for adult and youth cyclists. Core class is "Road 1", with 5 hours classroom and 5 hours on-bike training. |
| Palo Alto Unified School District | School – Age Children | Third-graders learn the skills they need for neighborhood-street commutes to school. Fifth graders learn cross-town skills for middle school and after-school trips. Parent volunteers conduct escorted rides over 5th grade summer, to familiarize incoming middle-schoolers with their route. |
| Trips For Kids (Marin County) | Urban School – Age Children | Trips For Kids gives urban youths the opportunity to get away from city streets and learn mountain biking in a group setting. |
| Constellation Middle School, Long Beach | Middle School – Age Children | According to sources in the Los Angeles area, this school has offered a semester-long kids version of Effective Cycling for about three years. |
| Oahu Bicycle Education and Encouragement Program (OBEEP) | Middle School – Age Children | On-bicycle student education program which brings a trailer of bikes and helmets to the students. Has a good introductory video for parents. |
| Berkeley Police Department<br>Sgt. Bruce Agnew<br>Traffic Division<br>510.644.6682 | Middle School – Age Children | Helmet-based bicycle Citation Alternative Program. Kids not wearing helmets attend a 1-hour class and given a free fitted helmet. Open to kids even without citation. |
| Hayward Police Department<br>Sgt. Lambert<br>510.293.7036<br>Theresa Dominguez<br>Crime Prevention Unit<br>510.293.7151 | Middle School – Age Children | Teaches bicycle and pedestrian safety at schools up to 6th grade (classroom presentation), , Bike rodeos, ages 5-9. Helmet sale at front counter Helmet raffle and giveaway to kids who can't afford them. |
| City of Oakland<br>(Parks & Rec.)<br>Jose Ortiz<br>Bicycle Safety Program<br>510.615.5850 | Middle School – Age Children | "Earn Your Bike" program for youths, based on community service. |