

CHAPTER 7

BICYCLE FACILITY PLANNING AND DESIGN

7.1 SELECTING FACILITY TYPE

To varying extents, bicycles will be ridden on all roadways where they are permitted. Therefore, all new roadways, except those where bicyclists will be legally prohibited, should be designed and constructed under the assumption that they will be used for bicycling.

The *Guide for the Development of Bicycle Facilities* (or *Bike Guide*) by the American Association of State Highway and Transportation Officials (AASHTO), 1999, is the primary source for bikeway guidelines used by HDOT. The department also refers to AASHTO's more general design manual, *A Policy on Geometric Design of Highways and Streets* (or *Green Book*), 2001.

Selecting the most appropriate type of bikeway is dependent on many factors, including the targeted user group(s), specific corridor conditions, potential impacts, and facility costs. The FHWA has developed procedures to assist transportation professionals in making appropriate recommendations for on-road bicycle facilities in its publication *Selecting Roadway Design Treatments to Accommodate Bicycles*. At the heart of this document are “look-up” tables that suggest appropriate design treatments given various factors related to traffic operation and design and the environment. HDOT routinely incorporates recommendations derived from this document into the bikeway planning and engineering process.

Making Streets More Bicycle Friendly

Problem Surveys indicate more people would bicycle more often if they had safer places to ride. But so many of today's streets are crowded with fast motor vehicle traffic that nothing is left for the slower cyclist. A lack of operating space along a roadway can make bicyclists and motorists feel uncomfortable or even unsafe.

Solution Provide appropriate on-road facilities and adequate operating space for bicyclists:

- Bike lanes and wide curb lanes in urban and suburban locations
- Paved shoulders along rural highways
- Bicycle access to and from transit stops
- Secure bicycle parking
- Proper maintenance, with regular sweeping and repairs

Source: *Increasing Physical Activity through Community Design*. National Center for Bicycling and Walking, May 2002.

Key parameters that need to be considered when identifying and evaluating roadway treatments to better accommodate bicycling include the following.

User Groups. The intended user needs are identified based on the three types of bicycle users: A-Advanced, B-Basic, and C-Children. Group A riders can generally be accommodated on the majority of roadways by making these facilities more “bicycle friendly.” Group B/C riders can generally be accommodated by identifying select travel corridors (often those with lower traffic demands or lower speeds) and by providing designated bicycle facilities on these routes. (See, also, Chapter 2)

Environment. Urban and rural settings may need different design treatments to appropriately reflect their surroundings.

On-street Parking. The presence of on-street parking increases the width needed in the adjacent travel lane or bike lane to accommodate bicycles. Extended mirrors, inadequate sight lines, and opening car doors can pose potential hazards for bicyclists.

Traffic Volume. Roadways with relatively higher traffic volumes generally represent greater potential risk for bicyclists. Frequent passing and overtaking situations are less comfortable for Group B/C bicyclists unless special design treatments are provided.

Traffic Speed. The average operating speed is more important than the posted speed limit. Wind turbulence caused by higher speed levels can cause bicyclists traveling within the roadway to become unstable and lose control.

Heavy Vehicles. The regular presence of trucks and buses can increase risk and have a negative impact on the comfort of bicyclists. At high speeds, the wind blast from such vehicles can increase the risk of falls. Even at lower operating speeds, shared lane use is less compatible. Bicyclists prefer extra roadway width to accommodate greater separation from such vehicles.

Other Parameters. Other parameters that need to be considered may include curb-cut (driveway) frequency, high crash locations, rumble strips, and grade. Each roadway is unique, and proper measures need to be taken to identify all potential obstacles and opportunities for bicycle travel. For off-road facilities, considerations include landownership, conditions of use, surrounding land uses, and environmental resources.

Signage

Another key document in bikeway planning is the *Manual on Uniform Traffic Control Devices (MUTCD)*, 2000, (also at <http://mutcd/fhwa.dot.gov/>) which contains standards for signs and striping used on public roadways. Signs fall into four categories with strict standards as to their shape and color depending on the category:

- Regulatory
- Warning
- Construction
- Information/Guide

The placement of signs should be limited to those necessary to:

- Inform highway users of traffic laws or regulations (regulatory signs).
- Convey a warning that would not be reasonably apparent to a vehicle operator in the interest of his/her safety or that of other vehicle operators, bicyclists, or pedestrians (warning signs).
- Notify drivers and bicyclists of hazards or detours relative to a construction or maintenance project (construction warning signs). Signs should be placed so as not to obstruct bikeways or force cyclists into traffic lanes.
- Guide or direct motorists, bicyclists, or pedestrians (information signs).



(far left) Regulatory sign: black lettering on white
Information sign: white lettering on green

(left) Warning sign: black lettering on yellow



(bottom) Construction warning sign: black lettering on orange

7.2 BICYCLE COMPATIBLE ROADWAYS

On-road bicycle facilities have the most potential to provide key connections in a bicycle network because roadways form the circulatory system of most communities. Generally the most critical variable affecting the ability of a roadway to accommodate bicycle traffic is width. Sufficient roadway width mitigates the impacts of adjacent traffic characteristics (such as traffic volumes, travel speeds, heavy vehicles) on bicyclists. Adequate roadway width for bicycle travel may be achieved by providing paved shoulders, wide curb lanes, or bike lanes.

A resource in bikeway planning is *Flexibility in Highway Design, U.S.* Department of Transportation, Federal Highway Administration. Publication No. FHWA-PD-97-062 (www.fhwa.dot.gov/environment/flex/).

On many streets where traffic volumes and speeds are low, bicyclists can share the road with no modifications to the roadway. Honolulu, Oahu.



7.2.1 PAVED SHOULDERS

Shoulders are appropriate and preferable to bike lanes in rural areas if they are paved and maintained. Given that there are legal differences between shoulders and bike lanes (motor vehicles can use the former, but not the latter), planners and engineers must consider all factors before deciding to implement one versus the other.

The AASHTO *Bike Guide* specifies a minimum width of 4 feet for paved shoulders. Where 4-foot widths cannot be provided, any additional shoulder width is better than none. A shoulder width of 5 feet is recommended when side obstructions are present, such as parked cars, guardrails, barrier curbing, fire hydrants, and utility poles. Additional shoulder width may also be appropriate with increased traffic speeds and truck volumes.

Paved shoulder on Kamehameha Highway, North Shore, Oahu.



A highway right-of-way has several potential uses, including walkway for pedestrians, waiting area for bus riders, and bikeway. Kalanianaʻole Highway, Hawaiʻi Kai, Oahu.

Guidelines for shoulder width in AASHTO's *Green Book* are usually sufficient to accommodate bicyclists.

Reasons for Roadway Shoulders

Safety—highways with paved shoulders have lower accident rates because they:

- Provide space to make evasive maneuvers
- Accommodate driver error
- Add recovery area to regain control of a vehicle
- Provide space for disabled vehicles to stop or drive slowly
- Provide increased sight distance
- Reduce passing conflicts between motor vehicles and bicyclists and pedestrians

Capacity—highways with paved shoulders can carry more traffic because they:

- Allow for easier exiting from travel lanes to side streets
- Provide greater effective turning radii for trucks
- Provide space for disabled vehicles, mail trucks and other delivery vehicles, and bus stops, leaving the travel lane unobstructed
- Provide space for bicyclists to ride at their own pace

Maintenance—highways with paved shoulders are easier to maintain because they:

- Provide structural support and durability to the pavement
- Discharge water further from the travel lanes, reducing the undermining of the base and sub-grade
- Provide space for maintenance operations

Source: Oregon Department of Transportation. June 1995. *Oregon Bicycle and Pedestrian Plan*, 2nd Edition.

7.2.2 WIDE CURB LANES

Wide curb lanes for bicycle use are usually preferred where paved shoulders are typically not provided, such as urban areas where streets are improved with curbs and gutters. In general, 14 feet of usable lane width is recommended for shared use in a wide outside lane. Usable width is defined from lane stripe to edge stripe. Curb lanes less than 14 feet can be intimidating to bicyclists because it is difficult for motor vehicles (especially trucks and buses) to pass. A slightly wider outside lane (15 feet) may be necessary on steeper stretches of roadway where bicyclists need more maneuvering space, adjacent to on-street parking where hazardous conditions for passing bicyclists exist, and where drainage grates and raised reflectors reduce the effective width of the outside lane. Widths much wider than 14 feet that extend continuously along a stretch of roadway may encourage the undesirable operation of two motor vehicles on one lane, especially in urban areas, and are not recommended. Where more than 15 feet of pavement width exists, consideration should be given to striping bike lanes or shoulders.

To implement wide outside lanes on multi-lane roadways where roadway widening is not practical, it is recommended that the inner lanes, left-turn lane, and/or median be narrowed in order to provide more width in the outer lane. AASHTO supports reducing inner lanes to 11 feet meet the minimum design criteria to provide greater width in the right-hand lane.

7.2.3 SIGNED SHARED ROADWAYS

Signed shared roadways are roads that have been identified by signing as preferred bike routes. Signed shared roadways can include paved shoulders or wide outside lanes. There are several reasons for designating signed bike routes:

- the route provides continuity to other bicycle facilities such as bike lanes and shared use paths
- the road is a common route for bicyclists through a high-demand corridor
- in rural areas, the route is preferred for bicycling due to low motor vehicle traffic volume or paved shoulder availability
- the route leads to an internal neighborhood destination, such as a park, school, or commercial district, that is not readily apparent from the main thoroughfare

Signing indicates to bicyclists that there are particular advantages to using these routes compared to alternate routes. However, such routes may not represent ideal conditions for all bicyclists. Signage is also intended to make motorists more aware of potential bicycling activity along a particular roadway and heightens the overall presence of bicycling within the corridor. Conversely, excessive signage can be confusing and distracting to both motorists and bicyclists, and may lessen the effectiveness of signs in general.

Bicycle Boulevard

Some cities on the Mainland have developed a bikeway type called the “bicycle boulevard,” distinguished by signs or pavement markings. These are residential streets that provide routing alternatives to more highly traveled arterials. To improve travel time for bicyclists, unnecessary “Stop” signs have been removed. At the same time, traffic calming measures may be necessary to discourage motorists from using them as short-cuts. Residential streets meeting the following conditions are optimal locations for bicycle boulevards:

- Existing low vehicle volumes
- Very little commercial frontage
- Roadway parallel to a major arterial or a high-traffic collector street (within approximate ¼ mile)
- Not a transit or truck route
- Roadway is reasonably continuous

The City and County of Honolulu’s Young Street Park Boulevard—currently in design—will establish a prototype facility. The design objective of this project is to create a park-like atmosphere along the street by introducing landscape and hardscape elements to calm traffic, yet retain access for local vehicular traffic. Another prime candidate for designation as a bicycle boulevard is a route in Kaneohe, Oahu, along Pua Inia, Puohala, Aumoku and Namoku Streets (Map Nos. 71 and 71). These interior roadways allow bicyclists to avoid the higher volume traffic on Kamehameha Highway and Kaneohe Bay Drive.

The AASHTO *Bike Guide* recommends that the following criteria be considered prior to signing a route:

- The route provides through and direct travel in bicycle-demand corridors.
 - The route connects discontinuous segments of shared use paths, bike lanes, and/or other bike routes.
 - An effort has been made to adjust traffic control devices (e.g., stop signs, signals) to give greater priority to bicyclists on the routes, as opposed to alternative streets. This could include the placement of bicycle-sensitive detectors where bicyclists are expected to stop.
 - Street parking has been removed or restricted in areas of critical width to provide improved safety.
 - A smooth surface has been provided (e.g., adjust utility covers to grade, install bicycle-safe drainage grates, fill potholes, etc.)
 - Maintenance of the route will be sufficient to prevent accumulation of debris (e.g., regular street sweeping).
 - Wider curb lanes are provided compared to parallel roads.
- Shoulder or curb lane widths generally meet or exceed minimum width requirements: 4 feet for shoulders and 14 feet for wide curb lanes.
 - Placement of reflective bollards and rumble strips allows safe passage by cyclists in traffic and wet weather without causing abrupt maneuvering into the traffic lane.

(left) Bike Route signs can give clearer direction if destination information is provided.

(right) As in this sign, posted along the Airport Viaduct bike path. Makalapa, Oahu.



7.3 BIKE LANES

Bike lanes are constructed when it is desirable to delineate and separate available road space for use by bicyclists and motorists. Bike lanes are typically appropriate for urban and suburban settings. They are marked with the bike lane symbol (the figure of a bicyclist with helmet). Pavement stenciling should include a straight directional arrow to reinforce the one-way travel flow of the bike lane.

The recommended width of bike lanes is 5 feet; however, the optimum width should increase as the roadway conditions become more challenging for bicyclists.

Recommended Bike Lane Widths	Roadway Characteristics
5 feet (4 feet minimum)	Exclusive of the gutter pan and curb
5 feet	Adjacent to barrier curb or other static obstruction on the side of the roadway
5 feet	Adjacent on-street parking

A bike lane should be delineated from the motor vehicle travel lanes with a 6-inch solid white line. An additional 4-inch solid white line can be placed between the parking lane and the bike lane. This second line will encourage parking closer to the curb, providing added separation from motor vehicles and, where parking is light, it can discourage motorists from using the bike lane as a through travel lane.

Bike lanes should be one-way facilities that carry bike traffic in the same direction as adjacent motor vehicle traffic. Two-way bike lanes on one side of the roadway are not recommended when they result in bicycle riding against the flow of motor vehicle traffic. On one-way streets, the bike lane generally should be placed only on the right side of the street. Where this occurs, one-way road couplets should be provided to accommodate bicycle travel in both directions.



Bike lane on Farrington Highway, Kapolei, Oahu.

If on-street parking is permitted, the bike lane should be placed between the parking area and the travel lane. Bike lanes should never be placed between the parking lane and the curb line. The minimum width for combining a bike lane and parking is 13 feet. Pavement markings should be provided to delineate the parking stalls.

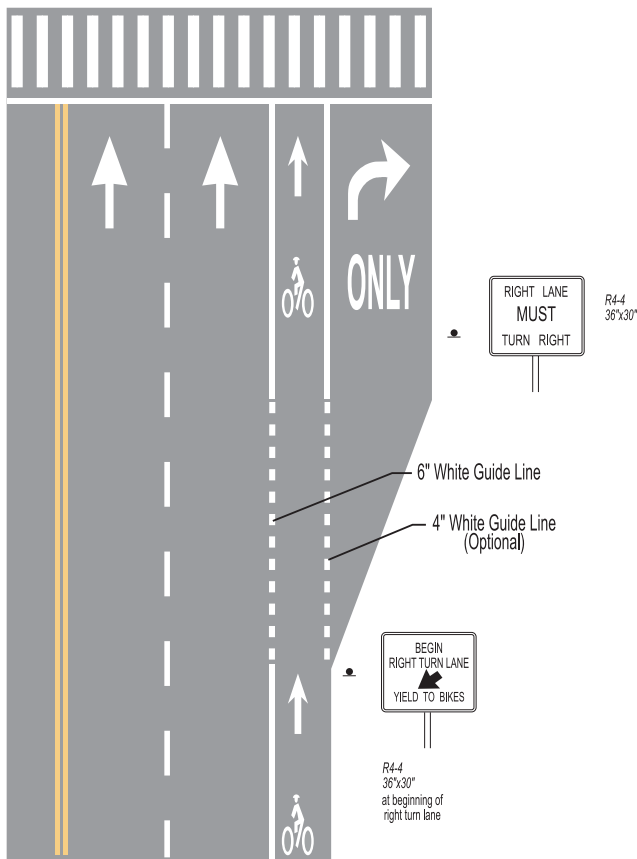
7.3.1 INTERSECTION AND INTERCHANGE STRIPING AND STENCIL PLACEMENT

If a loop detector is embedded in the bike lane, striping can encourage bicyclists to wait in the area where the device is effective. The width of the approaching bike lane should remain consistent and be placed to minimize potential conflicts between bicycles and motor vehicles.

At intersections with exclusive right-turn lanes, the bike lane should continue along the left side of the right-turn lane (see Figure 7-1). In addition, the approach shoulder width should continue through the intersection, where feasible, to accommodate right-turning bicyclists or bicyclists who prefer to use crosswalks. The solid striping to the approach should be replaced with a broken line consisting of 2-foot dashes and 6-foot spaces. The length of the broken line section is usually 50 to 200 feet.

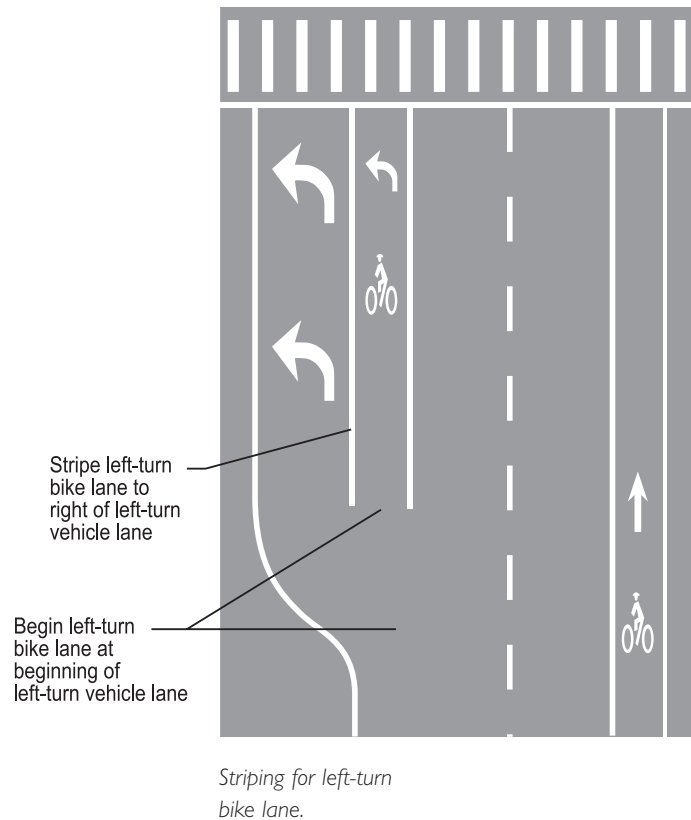
When significant bicycle volumes are present, a left-turn bike lane may be provided, in which case it should be located to the right of the right-most left-turn only lane (see Figure 7-2).

Figure 7-1



Bike lane striping for through travel at intersections with right-turn only lane.

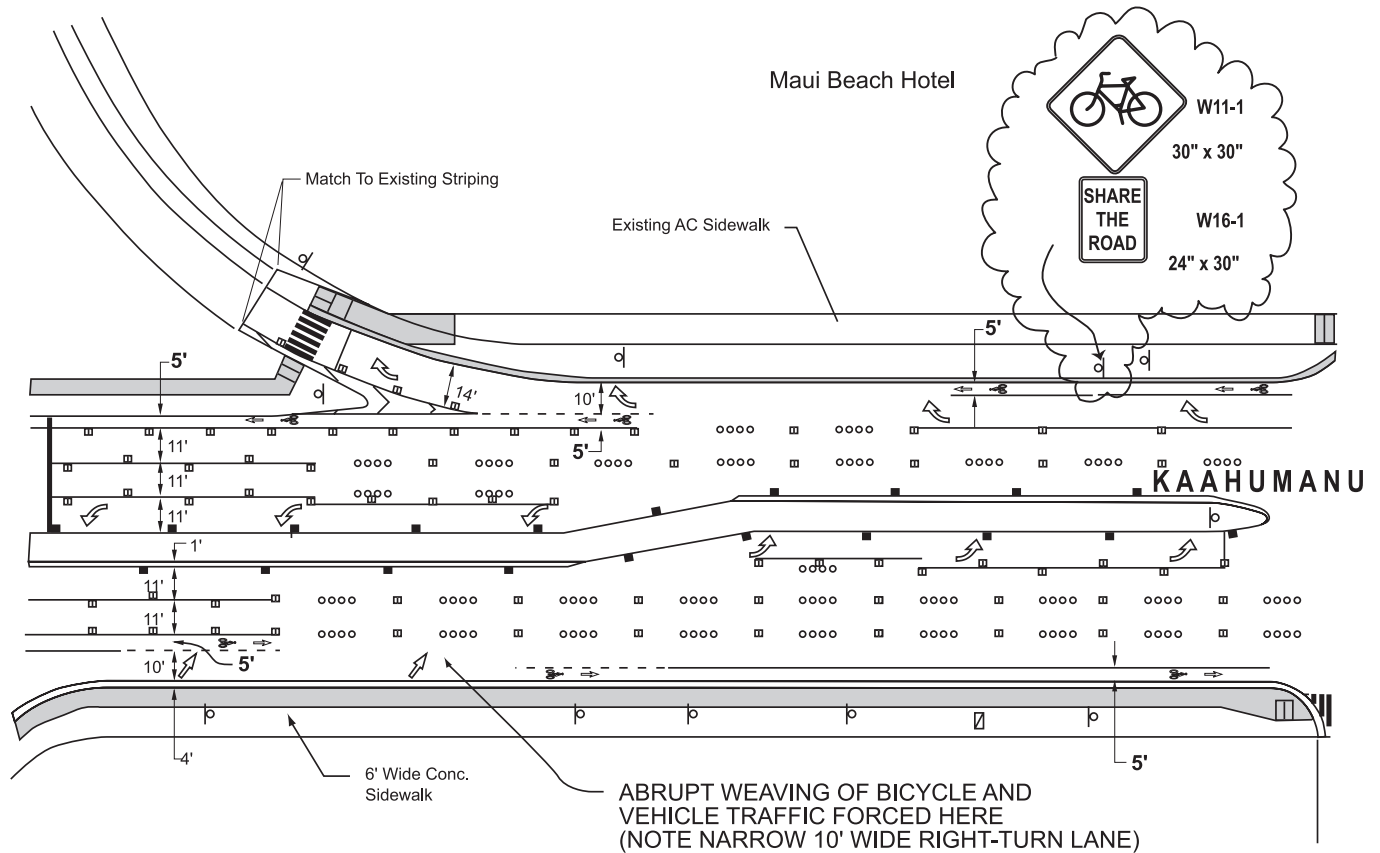
Figure 7-2



Striping for left-turn bike lane.

Figure 7-3 shows an actual example of pavement markings at an intersection involving a right-turn deceleration lane (Kaahumanu Avenue at Kahului Beach Road, Kahului, Maui). While Figure 7-1 shows a more desirable lane configuration, not all roadways have the option of being designed with a separate deceleration lane. Figure 7-3 illustrates a way to make the lane drop more “bike friendly,” with pavement markings that make the bicycle travel zone more predictable to motorists and cyclists.

Figure 7-3



Ingress and egress points at interchange ramps create a similar situation requiring bicyclists to merge, weave, or cross other vehicles. These potential conflict points are more difficult when there is a wide disparity in speed between traffic on the ramp and bicycle traffic crossing the ramp, or significant grade separations. If a bike lane or route must pass through an interchange area, appropriate signage and striping should be designed to limit potential conflict areas and define the crossing/weaving area.

Example of bike lane with dedicated right-turn lane. Kaahumanu Avenue, Kahului, Maui.

Where adequate road space is available, bike lane-type striping through intersections is recommended even in areas with shoulder bikeways or wide curb lanes.

Stencils should be placed after most intersections; this alerts drivers and bicyclists entering the roadway of the exclusive nature of the bike lanes. Stencils should be placed after every intersection where a parking lane is placed between the bike lane and the curb. Supplementary stencils may also be placed at the end of a block to warn cyclists not to enter a bike lane on the wrong side of the road. To prevent premature wear, care must be taken to avoid placing stencils in an area where motor vehicles are expected to cross a bike lane—usually driveways and the area immediately after an intersection.

Figure 7-4 shows a typical intersection layout, including bike lane striping and placement of stencils and signs. The intersection is made bike friendly by providing space near the traffic islands, as well as pavement markings and signs denoting shared lanes.

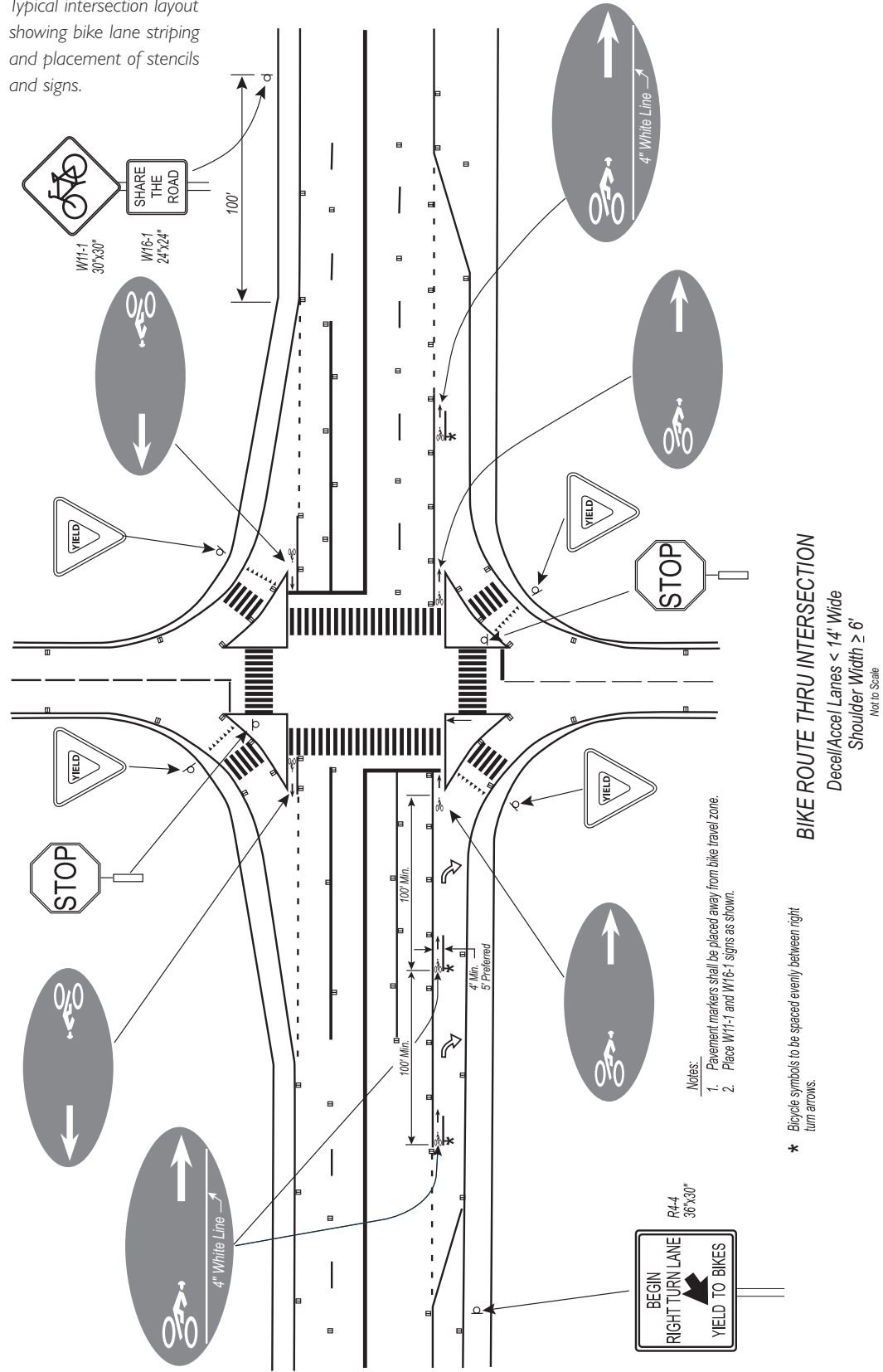
Figure 7-5 contains details of bike lane striping and stencils.

*The bike lane directs bicyclists to ride close to traffic, where they are more visible to motorists.
Honolulu, Oahu.*



Figure 7-4

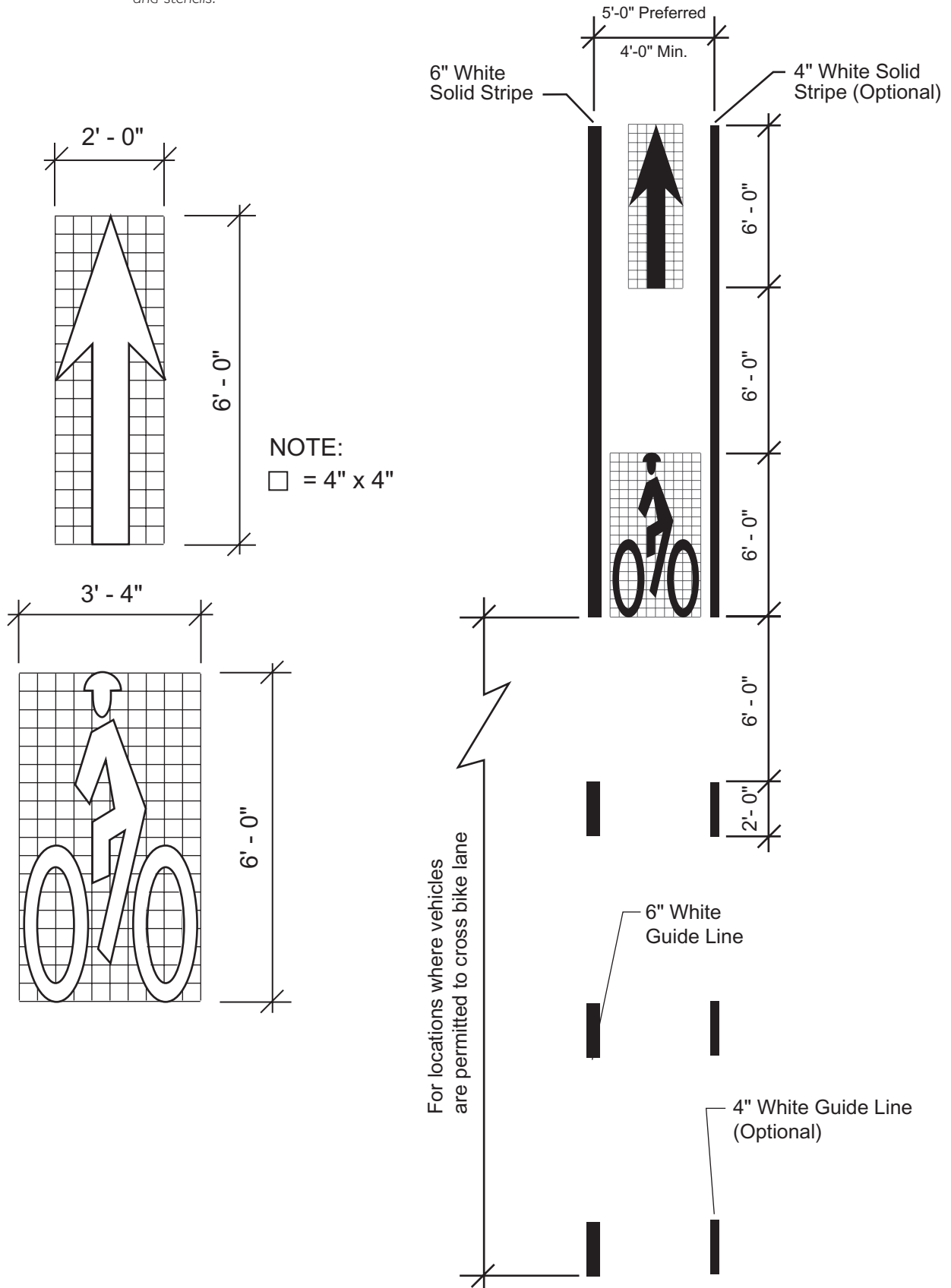
Typical intersection layout showing bike lane striping and placement of stencils and signs.



BIKE ROUTE THRU INTERSECTION
 Decel/Accel Lanes < 14' Wide
 Shoulder Width ≥ 6'
 Not to Scale

Figure 7-5

Detail of bike lane striping and stencils.



7.3.2 FINDING SPACE FOR BIKE LANES

A number of alternatives are available where roadways must be retrofitted to accommodate bike lanes.

Alternatives	Considerations
Prohibit on-street parking to provide bike lane	Bike lanes are infeasible on streets with variable parking, i.e., where parking is permitted during the day, but turns into a travel lane during peak periods.
Reduce travel-lane width—12-foot lane widths could be narrowed to 11 feet and bike lane provided	This scheme is usually impractical if existing travel lanes are already 11 feet or less. For local urban streets, lanes may be reduced to 10 feet with due consideration to existing traffic characteristics based on an engineering study.
Remove travel lane and convert to bike lane	Loss of roadway capacity may result in congestion for motor vehicles.
Widen existing roadways to provide bike lane	An extremely expensive undertaking if buildings are already constructed up to property line. May be possible if a building setback has been delineated.

Where space is a major limitation, bike routes will have to suffice until space can be made available. Nevertheless, it is recommended that bike lanes be the ultimate goal in urban areas.

7.4 SHARED USE PATHS

A shared use path is a bikeway that is physically separated from motor vehicle traffic by open space or a barrier. Shared use paths typically are developed on a continuous right-of-way that experiences minimal crossflow by motor vehicles. Installing a shared use path should not preclude the installation of on-road bicycle facilities.

Shared use paths are commonly designed for two-way travel. Under most conditions, the recommended paved width for a bi-directional path is 10 feet. Users may include bicyclists,

Using Sidewalks as Bikeways

In residential areas, sidewalk riding by young children is common. Potential conflicts are somewhat lessened with lower bicycle speeds and lower auto speeds; however, they still exist and the use of sidewalks for bicycle travel is generally unsatisfactory. Even if extra-wide sidewalks are constructed, it does not necessarily add to the safety of bicycle travel, since wide sidewalks encourage higher speed bicycle use and increase the potential for conflicts with motor vehicles at intersections and driveways—where drivers generally do not expect fast-moving objects to be traveling on sidewalks, and may not be able to respond quickly enough. Conflicts between bicyclists and pedestrians or bicyclists and fixed objects may also occur.

Sidewalk bikeways should be considered only under very limited circumstances, such as:

- Providing bikeway continuity along high speed or heavily traveled roadways having inadequate space for bicyclists, and uninterrupted by driveways and intersections for long distances
- On long, narrow bridges, where ramps are installed at the sidewalk approaches.

The Pearl Harbor Historic Trail is popular with many types of users. Aiea-Pearl City, Oahu.



Pedestrian (left) and bicycle (right) paths are separated by a hedge. Waikēle, Oahu.



skaters, skateboarders, wheelchair users (both non-motorized and motorized), and pedestrians including walkers, runners, people with baby strollers, and dog-walkers. If the path is expected to carry a large number or wide variety of users, or is required to accommodate large maintenance vehicles, or involves steep grades, it may be necessary or desirable to increase the width to 12 feet, or even 14 feet. Shared use paths can also be striped to separate user types and reduce potential conflicts.

A minimum 2-foot wide graded area should be maintained adjacent to both sides of the path; 3 feet if there are signs, trees, poles, fences, guardrails, and other obstructions. Where the path is adjacent to canals, ditches, or steep slopes, a wider separation should be considered. Other situations may dictate a physical barrier, such as dense shrubbery, railing, or chain link fence.

Preferred Locations for Shared Use Paths

- Coastlines
- Abandoned railroad rights-of-way
- Cane haul roads
- Streams and canals
- Parks and nature areas
- Utility easements
- Connections between streets with cul-de-sacs



Longer, unbroken corridors, such as this remnant of Old Mamalahoa Highway, have good potential as off-road bikeways. South of Waimea, Hawaii.



A short-cut connects this residential street with a school campus just beyond. Mililani Mauka, Oahu.

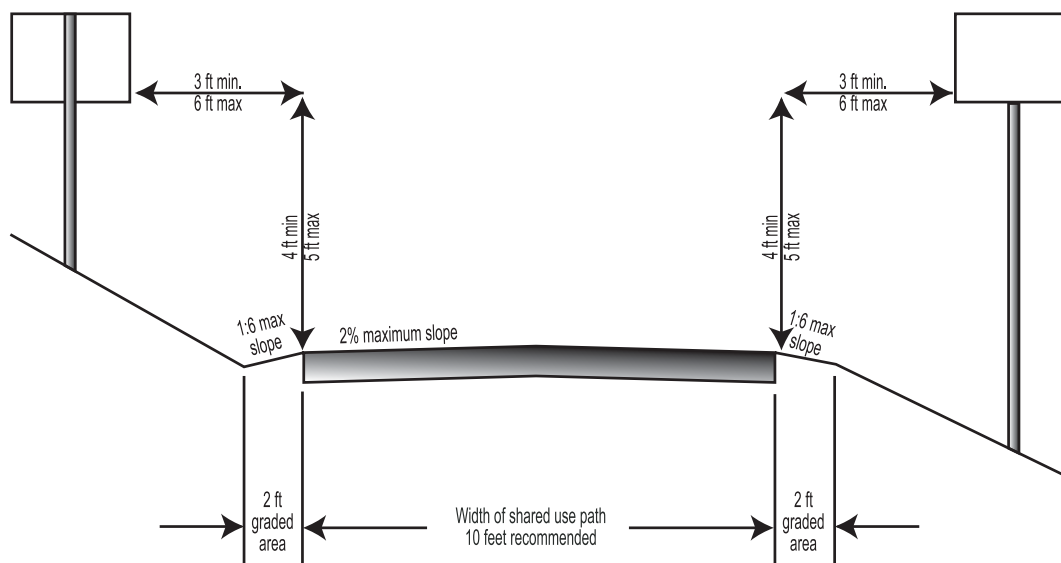
The vertical clearance to obstructions should be a minimum of 8 feet. Vertical clearance may need to be greater to permit passage of maintenance and emergency vehicles. See Figure 7-6 for a typical section of a shared use path.

When a shared use path is located adjacent to a roadway, a wide separation is desirable. This demonstrates to both the bicyclist and the motorist that the path functions as an independent facility. A 5-foot separation between the edge of the highway shoulder and the shared use path is desirable. If this is not possible, a suitable physical barrier is recommended.

ADA guidelines require that cross slopes not exceed 2% to avoid the severe difficulties that greater cross slopes can create for people using wheelchairs. In addition, grades on shared use paths should be kept to a minimum. Grades greater than 5% are undesirable.

Figure 7-6

Typical cross-section of a two-way shared use path.



7.4.1 STRIPING AND SIGNAGE

Adequate signing and marking are essential on shared use paths. Crossing signs are needed on roadways to provide appropriate warning to motorists of an upcoming path intersection. In addition, directional signing on a path—for example, to indicate destinations, distances, route numbers, and names of cross streets—should be used in the same manner as they are used on highways.

7.4.2 INTERSECTIONS

Intersections between paths and roadways are often the most critical issue in shared use path design. Shared use paths should cross roadways as close to an intersecting road as practical. This allows for good sight distances for both motorists and bicyclists. As the path approaches the

This mid-block crossing on the Ala Wai Promenade near the Hawaii Convention Center is a challenge for users. Honolulu, Oahu.



crossing, it should be aligned with the destination of the crossing on the other side of the road. Curb cuts should be appropriately aligned and be the same width as the path. The crossing should also be as perpendicular as possible to the road being crossed.

7.5 PAVEMENT CONDITION AND OBSTRUCTIONS

Bicyclists tend to ride a distance of 32 to 40 inches from a curb face; therefore, it is important that the surface in this area be smooth and free of debris. The smoothness of the riding surface affects the comfort, safety, and speed of bicyclists. Wide cracks, joints, or drop-offs at the edge of the travel way can trap a bicycle wheel and cause loss of control. Holes and bumps in the pavement can cause bicyclists to swerve into the path of adjacent motor vehicle traffic. In areas with irregular surface conditions, either the obstacles need to be addressed or the width of the bicycle accommodation adjusted to maintain a uniform usable pavement width.



Rumble strips on Kalanianaʻole Highway, Waimanalo, Oahu.

Manhole covers and utility plates present obstacles to bicyclists due to their slipperiness and change in surface elevation with the surrounding pavement. While they can be retrofitted to minimize their adverse impacts, it is best to design the roadway so they are not located within the typical path of bicyclists.

Drainage grates should be placed outside the paved shoulder area. If the grate encroaches on

the shoulder, there should be a minimum of 4 feet of clear asphalt. Regardless of placement or type of roadway, all grates on the roadway should be bicycle safe.

Rumble strips are vertical interruptions in the pavement surface intended to alert drivers through sound and vibration. Where bicyclists are expected to share the road with motorists, a clear space of 18 to 24 inches through which bikes may travel should be provided at the right-hand

edge and in the center of the travel lane. They should not be installed in bike lanes on streets with bike lanes. On shoulders, rumble strips can be depressed grooves or raised pavement markers. Shoulder rumble strips should be placed adjacent to the edge stripe with a minimum of four feet of usable shoulder width available to the right of the grooves or raised pavement markers.

In existing roadways where there are no roadside swales or curbs and gutters, shoulders also act as a drainage swale. Hydraulic capacity in those cases should not be reduced. Spread from the runoff will encroach into the driving lane and might create a hazardous driving situation.

When asphalt berms (sometimes called “slugs”) are constructed on roadway shoulders to divert storm water into catch basins, or to separate non-motorized travel from the vehicular travel lane, they should be constructed in a manner that will not obstruct bicyclists from using the shoulder or transitioning between the shoulder and the travel lane (for example to pass pedestrians who also using use the travel way).



Asphalt berms separate motorized and non-motorized travel ways on Puainako Street, Hilo, Hawaii.

All bikeways should be maintained during construction that affects high speed arterials or highways. If construction detours are implemented, they should accommodate bicycles through the entire length of the detour. Construction warning and detour signing designed for bicycles should be used throughout the entire construction zone, with care taken not to obstruct any operational bike lane or shoulder. Construction plates used on the roadway should be skid resistant and installed flush with the surrounding pavement or marked as an obstacle. When they cannot be provided flush, then ramps of asphalt should be provided to reduce the difficulty for bicyclists.

7.6 OTHER BICYCLE FACILITIES

If commuting and recreational bicycling are to be encouraged in Hawaii, some thought must be given to facilities that enhance the convenience and enjoyment of bicycling. Other accommodations for bicyclists include secure parking facilities, comfort stations and rest stops, and easy transitions to other modes of transportation.

7.6.1 BICYCLE PARKING AND STORAGE

Secure bicycle parking facilities must be provided at important bicycle destinations. These would include major employment and shopping centers, schools and universities, cultural and recreational centers, and in particular, mass transportation stops/stations (such as park-and-ride

facilities, bus terminals and major transfer points, and ferry landings).

Many types of parking facilities are possible. The degree of security depends on (1) the structural design and (2) the location of the facility. The following types are listed according to degree of security offered by each, low to high:

- Personal chain, cable, and lock
- Bicycle rack
- Bicycle rack with chain or cable
- Bicycle rack with frame or wheel clamp
- Bicycle rack with frame or wheel clamp and lock
- Bicycle locker
- Bicycle enclosure
- Supervised or attended parking facility

Guidelines for locating bike racks:

- Racks should not be obscured by landscaping, fences, or other obstructions
- Racks should be lit at night to protect both the bicycle and the user
- Racks should be located within 50 feet of building entrance and clearly visible from the building entrance and its approaches, or there should be a sign indicating the location of bicycle parking

Bike racks have become a common feature of the streetscape. Honolulu, Oahu.



Bike Rack Program in Honolulu

The City and County of Honolulu has engaged in an extensive program to install bicycle racks in high-demand areas. Purchase and installation of the racks has cost about \$125,000 with monies from the Bikeway Fund. Chris Sayers, Honolulu Bicycle Coordinator, explains the effort, as follows:

In 1994 I started with the “ribbon” racks in municipal lots and places where there was sufficient space. These racks hold up to 9 bikes. In 1996 I started looking at the sidewalk area because, by ordinance, bicycles are prohibited from parking on sidewalks except in bike racks. Well there weren’t any racks on the sidewalks. So we started with the inverted U-shaped racks. In 1998 Mayor Harris decided he wanted something more aesthetically pleasing and asked me to find some new designs. I found the Dero “BikeBike” on the internet. We have since installed about 330 of these.

As far as where they get installed, we don’t have any set guidelines but I like to get 5 feet of clearance so generally we need an 8-foot sidewalk. Sometimes I get requests but mostly I’ve been going out looking for locations. The main thing is that they don’t impede pedestrian traffic.

I’ve gotten many positive comments about the “Bike bike racks.” People feel that even when there are no bikes parked in them it’s sort of free advertising for bicycling. Another subtle benefit is that we install them in the direction that bikes should be traveling—sort of a subliminal way of deterring wrong-way riding. And of course they look nice.

- Signage directing bicyclists to an appropriate parking location should be readily apparent wherever a “No Bicycle Parking” sign is posted
- Ground surface of the bicycle parking area should be an all-weather and drainable material, such as asphalt or concrete
- Racks should be located outside the typical pedestrian travel path, and visible to pedestrians
- Racks should be located a sufficient distance from motor vehicles to prevent damage to parked bicycles and motor vehicles



*Bike rack on Kapiolani Boulevard.
Honolulu, Oahu.*

7.6.2 COMFORT STATIONS AND BIKE STATIONS

Comfort/bike stations could be a more significant part of Hawaii’s bikeway system, especially in relation to recreational and commuter bicycling and in conjunction with intermodal use of bicycles.

In many cases, facilities available at state and county parks already provide places for bicyclists to rest, obtain water, and find protection from the weather. If they are located at intervals suited to the average pedal distances of bicyclists, additional comfort stations need not be specially constructed. More basic stops, providing only shelter and water, might be considered near steep terrain and in high-rainfall areas. In other areas, more comprehensive comfort stations may be warranted, for example, as part of longer distance, perimeter bikeways. These would be especially convenient for touring bicyclists and could include restrooms, drinking water, secure parking facilities, and shelter. Shower facilities are another feature that could be provided at comfort stations located at intermodal terminals, employment centers, and larger educational institutions.

The City and County of Honolulu is currently building the first bicycle station on the Kapiolani Community College campus, adjacent to Diamond Head Road. The facility is located along an existing bike path. Users are expected to include college commuters and recreational cyclists touring the Diamond Head area. The new building will house men’s and women’s restrooms and shower/dressing room facilities, with bike racks, drinking fountain, and picnic tables nearby.

7.7 INTERMODAL ACCOMMODATIONS

Being light and compact, bicycles offer a variety of opportunities for use in conjunction with other modes of transportation. Transporting a bicycle on a car, bus, ferry, or airplane gives a bicyclist greater flexibility in terms of travel distance, effort expended, and time needed.

7.7.1 BIKES ON BUSES

The entire fleet of the Oahu Transit Service (TheBus) is outfitted with racks capable of holding two bicycles at any one time. Since 1995, older buses have been retrofitted, while new buses have been ordered with racks attached. There is no additional charge for bicycles.



Hele-on Bus on the Big Island is also capable of transporting bicycles. The fleet includes two types of buses—vehicles with underneath storage space which is used for bicycles and refurbished buses from Oahu in which case bicycles are brought on board. The Hawaii County Bus Transit Agency recommends that bicyclists call to pre-arrange transport since the ability to accommodate bicycles is contingent on space availability.

*TheBus with bike rack.
Honolulu, Oahu.*

7.7.2 BIKES ON AIRPLANES AND FERRIES

Regularly scheduled, commercial flights generally allow passengers to check in bicycles as baggage. Each of the three major interisland carriers will transport bicycles for a fee of \$20.00 one way. Bicycles must be packed in passenger supplied boxes or hard cases, and are loaded on a space-available basis.

Ferry service is currently available between Maui and Molokai and between Maui and Lanai. Bicycles can be transported on board the ferries for fees of \$10-15 one way. They do not have to be packed, but passengers may need to supply ropes or elastic cords to secure their vehicle.

7.8 OPERATION AND MAINTENANCE OF FACILITIES

*Shoulder maintenance
needed on this stretch of
Kamehameha Highway.
Windward Oahu.*



John Goody

Maintenance is an important consideration for all transportation facilities including on-road bicycle facilities and shared use (off-road) paths. A well-cared facility will help to reduce accidental falls and is more likely to attract users. For bicyclists, roadway surface condition is a major factor in their choice of routes, safety of travel, and enjoyment of the experience.

Maintenance operations are usually undertaken by the public agency with jurisdiction over the facility; however, in some instances, nonprofit groups and private organizations may assist in some maintenance tasks.

Sweeping and litter removal is the central task of routine maintenance. Periodic maintenance also include a more extensive set of activities, such as trash and litter removal, pavement repair,

replacement of signs, restriping, and pruning and mowing to control landscaping encroachment into the bikeway. Table 7-1 identifies a potential schedule for various maintenance activities.

Some of the needed maintenance activities represent new tasks for maintenance crews and would require additional or re-allocated funding to be accomplished.

**Table 7-1
Potential Maintenance Schedule**

Maintenance Activity	Recommended Frequency
<i>On-road Bikeways</i>	
Routine inspection and identification of needed repairs	2 times per year
Respond to reports of hazardous pavement failure	As needed
Sweep street with bike lanes and highway shoulders	4 times per year (once a quarter)
Maintain street traffic markings	As needed, at least every 3 years
Repair or replace signs and pavement markings	As needed
Maintain landscaping encroachment	As needed
Sweeping during construction	Daily
<i>Off-road Bikeways</i>	
Routine inspection and identification of needed repairs	2 times per year
Sweep paved bikeways	2 times per year
Path repairs	As needed
Repair or replace signs and pavement markings	As needed
Vegetation control	As needed
Path resurfacing	10-12 years



Street sweeping along Farrington Highway, Waianae Coast, Oahu.

Nonprofit groups and organizations may be able to assist in some tasks. In the past volunteers have cleaned up segments of the Pearl Harbor Bike Path as a public service activity. Implementation of a regular volunteer program, similar to the Adopt a Highway Program, would help to extend State and local resources that are available for maintenance activities.

Volunteers clean up the Pearl Harbor Bike Path as part of a community service project.



Lisa Reinke

Citizens may notify HDOT of bikeway hazards on state roadways and submit specific maintenance requests by contacting the State Bicycle and Pedestrian Coordinator. *Bike Plan Hawaii* also recommends that the HDOT bike webpage be configured to allow bikeway users to report maintenance concerns.

The City and County of Honolulu Bicycle Coordinator and the Departments of Public Works on the neighbor islands are available to field reports of bicycling hazards on county roadways.



Lisa Reinke