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CLASS IV BIKEWAY GUIDANCE (Separated Bikeways / Cycle Tracks)

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FOREWORD

It is the goal of the State to increase the number of trips Californians take by bicycling, walking, and other forms of active transportation in order to help meet the State's greenhouse gas emissions reduction goals, improve Californians' health by helping more people be active, and stimulate the economy. Bicycle facilities are a vital part of the transportation infrastructure that is used by many to commute to and from work and other destinations and provide alternatives to vehicles that otherwise would transport citizens across California's roads and highways. Class IV Bikeways, also referred to as separated bikeways or cycle tracks, provide an alternative to other bikeways that may minimize interactions with other modes of travel by introducing a vertical element separation. The objective is to foster bicycling as a means of transportation, in a manner that improves safety for all users, including motorists, transit users, and pedestrians, including persons with disabilities.

The Protected Bikeways Act of 2014 (Assembly Bill 1193 - Ting, Chapter 495) established Class IV Bikeways for California and required the California Department of Transportation (Caltrans), in cooperation with local agencies and in consultation with the existing Caltrans advisory committee dedicated to improve access for persons with disabilities, to establish design criteria for separated bikeways. This Design Information Bulletin (DIB) was prepared to provide that design criteria and other general guidance on best practices related to separated bikeways to establish uniform guidance for the use of owners of these facilities.

The design criteria and guidance in this DIB has been written to allow designers to exercise sound judgment when applying it, consistent with the Project Development philosophy (see Caltrans *Highway Design Manual* Index 81.1) when designing projects and has been written to allow for flexibility in applying the design criteria, taking into consideration the context of the project location; which enables the designer to tailor the design, as appropriate, for the specific circumstances while maintaining safety.

1.0 INTRODUCTION

Various separated bikeway/cycle track design criteria are in use around the world and the United States. California state and local laws and ordinances need to work together. This Design Information Bulletin (DIB) establishes design guidance and criteria to facilitate consistent user expectations. Best practices from cities, states and countries currently operating separated bikeways have been used to formulate this guidance and design criteria for the State of California. As with all guidance and design criteria, as engineers and practitioners gain more experience with the use of separated bikeways, this DIB will be updated, as necessary, to reflect the lessons learned.

The Federal Highway Administration (FHWA) publication *Separated Bike Lane Planning and Design Guide* (FHWA Guide) should be used to design separated bikeways **in conjunction with this DIB**. The FHWA Guide can be accessed at:

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/page00.cfm.

The FHWA Guide used the *Urban Bikeway Design Guide*, a National Association of City Transportation Officials (NACTO) publication, as part of its source material. The NACTO publication also provides additional guidance not covered in this DIB. The use of that guidance, coupled with sound engineering judgment, can be used in collaboration with the guidance in this DIB.

This DIB provides additional design criteria and **references** traffic operations guidance (signing and markings) in accordance with existing California codes and the *California Manual on Uniform Traffic Control Devices* (CA MUTCD). In addition, this DIB is also referenced in the Caltrans *Highway Design Manual* (HDM). Design guidance in the HDM on various topics of highway design should also be utilized in combination with this DIB. In particular, bikeway design guidance for Class I Bikeways (bike paths) in Chapters 200 and 1000 for vertical clearance, design speed, stopping sight distance, drainage, landscaping, etc., may be used as appropriate for the Class IV Bikeway design. For the State Highway System, DIB 82 is also applicable in all aspects of pedestrian design in order to comply with the Americans with Disabilities Act of 1990. Similarly, off the State Highway System the ADA applies to local agencies per Chapter 11 of the Caltrans *Local Assistance Procedures Manual*.

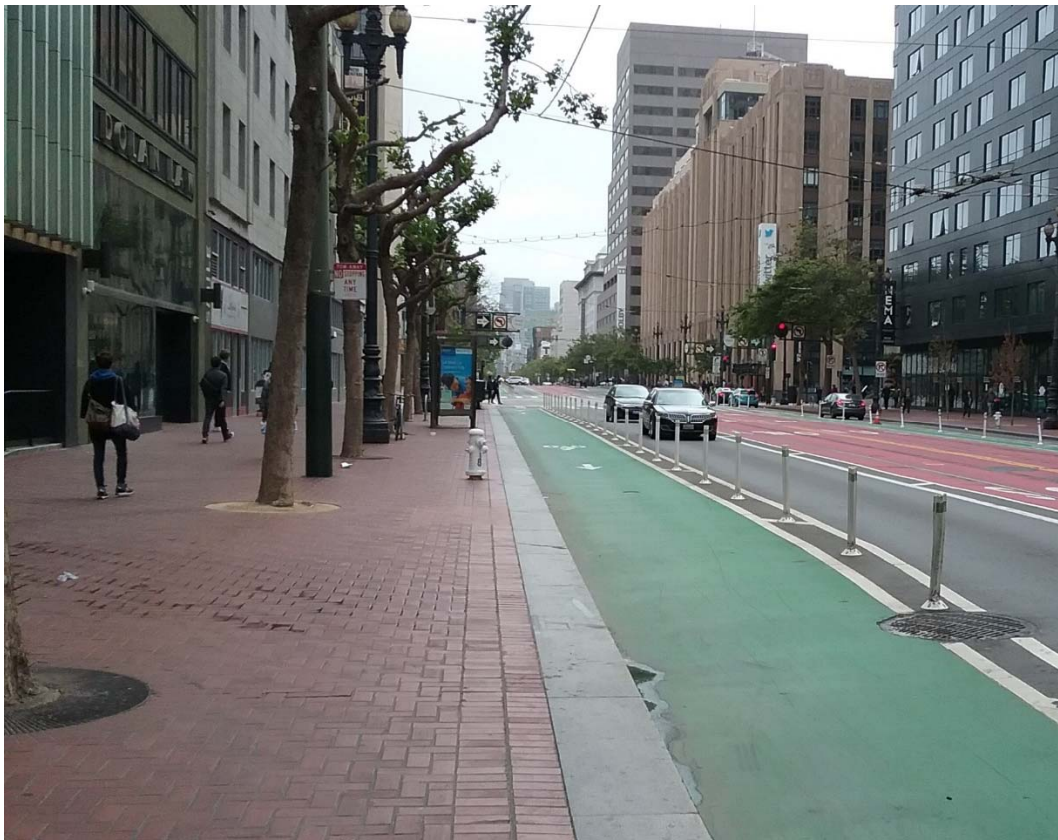


Photo 1: Separated Bikeway in San Francisco

Some local jurisdictions may have published standards for facilities that they own and operate. When Caltrans projects impact adjacent transportation facilities, local standards should be used in conjunction with this DIB to encourage designs that are sensitive to the local context and community values. Agreeing on which standards will be used needs to be decided early in the project development process. Chapter 5 of the FHWA Guide presents a Four Step Design Process to determine various features of the Class IV Bikeway design. These are important considerations for the project development process.

Planning Considerations

Local jurisdiction authority includes establishing a bicycle transportation plan and bikeways. Adding a Class IV Bikeway into an already built-out street environment usually requires a reevaluation of service needs and a level of service analysis for capacity, because some transportation feature(s) may need to be reduced or eliminated, e.g., vehicular lanes, shoulder, parking or sidewalk. Local jurisdictions must be involved when analyzing these community impacts with the local residents, businesses, and advocacy groups and deciding what features are to be included in the street modification. Thus, community planning is necessary when local agencies are contemplating a Class IV Bikeway route. Whether in an overall planning document or in a specific project document, effective public engagement is vital to the successful development of the Class IV Bikeway. Further planning considerations are discussed in Chapter 4 of the FHWA Guide, which is helpful in deciding how the Class IV Bikeway will function within the local community context.



Photo 2: Two-way Separated Bikeway in Redondo Beach

2.0 CLASS IV BIKEWAY (SEPARATED BIKEWAY)

A Class IV Bikeway (separated bikeway) is a bikeway for the exclusive use of bicycles and includes a separation required between the separated bikeway and the through vehicular traffic. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking. As an example, see Photo 1 and page 59 of the FHWA Guide. Separated bikeways typically operate as one-way bikeway facilities in the same direction as vehicular traffic on the same side of the roadway. However, two-way separated bikeways can also be used. **Since there is a potential for bicycles traveling in two directions simultaneously at intersections, two-way separated bikeways should be designed in lower speed (35 miles per hour or less) environments unless traffic control devices are employed to prohibit the conflict (e.g., use of bicycle signals with protected vehicular right-turn movement).** See Photo 2 and page 46 of the FHWA Guide for examples (Note: a yellow longitudinal marking is required in the separation buffer marking to denote traveling in the opposite direction **per CA MUTCD Part 9**). For the separated bikeway in higher speed environments using an inflexible physical barrier, see Section 3.2(3) of this DIB. On one-way streets, the one-way separated bikeway may be on either side of vehicular traffic, but they are usually favored to be on the left side of vehicular traffic in order to avoid conflicts with transit vehicle operations, unless a design accounts for these conflicts on the right side of vehicular traffic.

Where there is on-street parking, the separated bikeway is typically between the parking and the sidewalk. See Photos 3, 4 and page 78 of the FHWA Guide. The separated bikeway may also be raised vertically to an elevation higher than the finished grade of the roadway; but should not be raised at intersections, alleys and driveways **unless the raised pavement is also for the purpose of traffic calming.** When a separated bikeway converts a portion of a sidewalk or is at the same grade and adjacent to the sidewalk, it is at a different grade from the roadway and separated by a curb/vertical taper; with this option, the sidewalk portion used for the separated bikeway can no longer be used by pedestrians. In order to separate pedestrians a continuous

detectable vertical element (barrier, planters, etc.) or curb is needed. If a continuous detectable vertical element is used, periodic openings for bicyclists to access buildings or points of interest would be needed; so this option may not be compatible with parking because access to parked vehicles and the sidewalk would mostly be blocked. However, if parking must be provided, adequate buffer width behind the curb face is needed to account for vehicle doors, see Section 3.2(1) of this DIB. Separated bikeways could also be on their own structure as a bicycle overcrossing or undercrossing. See HDM Index 208.6 for more information. As is necessary, vehicles will need to cross the separated bikeway to access driveways and alleys. Also, pedestrians will need to cross the separated bikeway from parked vehicles or transit facilities.

Where on-street accessible parking is proposed for the block, it may be better to avoid the side of the block face adjacent to the separated bikeway. The federal *Public Rights-of-Way Accessibility Guidelines* contains the accessible parking provisions on a block perimeter basis. However, if accessible parking is required on the block face adjacent to the separated bikeway, the separated bikeway will have to be modified. See Figure 19 of the FHWA Guide.



Photo 3: Separated Bikeway with parking curbs and planter in Long Beach



Photo 4: Separated Bikeway with parking in Oakland

2.1 Community Context

The vertical element feature of separated bikeways afford some bicyclists a greater sense of comfort and usability, thereby increasing the number of bicyclists on the roadways. The development of a well-conceived bikeway network that includes separated bikeways can have a positive effect on bicyclist and motorist behavior and on the community. Providing an interconnected network of bikeways along with education and enforcement can improve the safety and access for bicyclists. The decision as to which type of bikeway facility to use should be made in coordination with the local agency that the facility travels through. Regarding the various bikeway facilities, there is potential overlap of bikeway designations, so the following helps to clarify the distinction:

- A contraflow bike lane is a Class II Bikeway that is designed for travel in the opposite direction as vehicular traffic. However, contraflow bike lanes are not placed on two-way roadways. See the CA MUTCD Part 9 for more information.
- A buffered bike lane is a Class II Bikeway that has a marked buffer without the Class IV Bikeway separation between the bike lane and the vehicular traffic lane. See the CA MUTCD Part 9 for more information. If a marked buffer is provided with the Class IV Bikeway separation, this is considered a separated bikeway.
- A two-way bikeway adjacent to the roadway is typically a bike path (Class I Bikeway) and can be for the exclusive use of bicycles if there is an adjacent pedestrian facility (e.g., a sidewalk) per CVC 21966. However, if the Class IV Bikeway separation is used, this is regarded as a separated bikeway. See the HDM Index 1003.1 for more information.

In many contexts, it may be appropriate to have the various bikeway classifications interconnect in an overall network. Also, it may not be appropriate or feasible to have a continuous separated bikeway through certain

street environments, as **on the same side of** a street with many driveways. A bike lane may perform better in this context.

The FHWA has issued an Interim Approval (IA-14) for the optional use of green colored pavement in marked bicycle lanes and extensions of bicycle lanes through intersections and other traffic conflict areas. See Photo 5. Caltrans has obtained statewide approval for all local agencies to use green colored pavement for **Class II and IV Bikeways** eliminating the need to obtain a project-specific approval from FHWA. However, any local agency that wants to use green colored pavement must notify the California Traffic Control Devices Committee (CTCDC) Executive Secretary regarding the location of the placement once installed. **This procedure also applies for any other Interim Approval referenced in this DIB.**



Photo 5: Separated Bikeway with green pavement at driveways in Los Angeles

2.2 Crossing Points: Intersections, Alleys and Driveways

Intersections

The FHWA Guide Chapter 5 provides a thorough discussion regarding the conflict points associated with **intersection crossings**. Crossing points offer unique challenges to the design and operation of a separated bikeway. While grade separated crossings are preferred to eliminate conflicts altogether, building them is often infeasible for various reasons. In their absence, the usability and safety of the separated facility depends heavily on the manner in which intersections, including the pedestrian facilities, interact with and connect to the separated bikeway and bikeway network. As such, it is critical that careful thought and planning go into the design of all intersections located along a bikeway.

Intersection design should strive to minimize **the potential conflict** between the separated bikeway user and the crossing **or turning of** motorized traffic and pedestrians. Providing space for motorists to wait while

yielding to bicyclists and pedestrians, separating bicycle crossing from pedestrian crossing, and providing space for turning and queuing bicyclists should be considered. If on a sidewalk, bicyclists and pedestrians should be separated with push buttons placed to accommodate separated crossings together with appropriate signs and markings.

Separated bikeways should also be separated from crosswalks at intersections to discourage bicyclists from mixing with pedestrians, such that the separated bikeway path of travel will be adjacent to the crosswalk, see Photo 6, Figure 2.2 and page A-9 of the FHWA Guide. This example provides a concept of a protected intersection and can be adjusted for various features as needed. Separated bikeways could also apply to roundabouts in lieu of the bike ramp design that allows access to the sidewalk. Sometimes it may be desirable to direct the bicyclist to cross the intersection similar to crossings for Class II Bikeways (bike lanes). To accomplish this, the separated bikeway should end and become a bike lane and continue with the operations of a bike lane prior to and through the intersection; typically, the separation feature will terminate before the intersection and resume after the intersection (unless a separation is designed at the intersection). However, the markings may extend through the intersection denoting the bikeway projection as dotted white lines and/or with green colored pavement, see the CA MUTCD Part 9.



Photo 6: Protected intersection in Davis

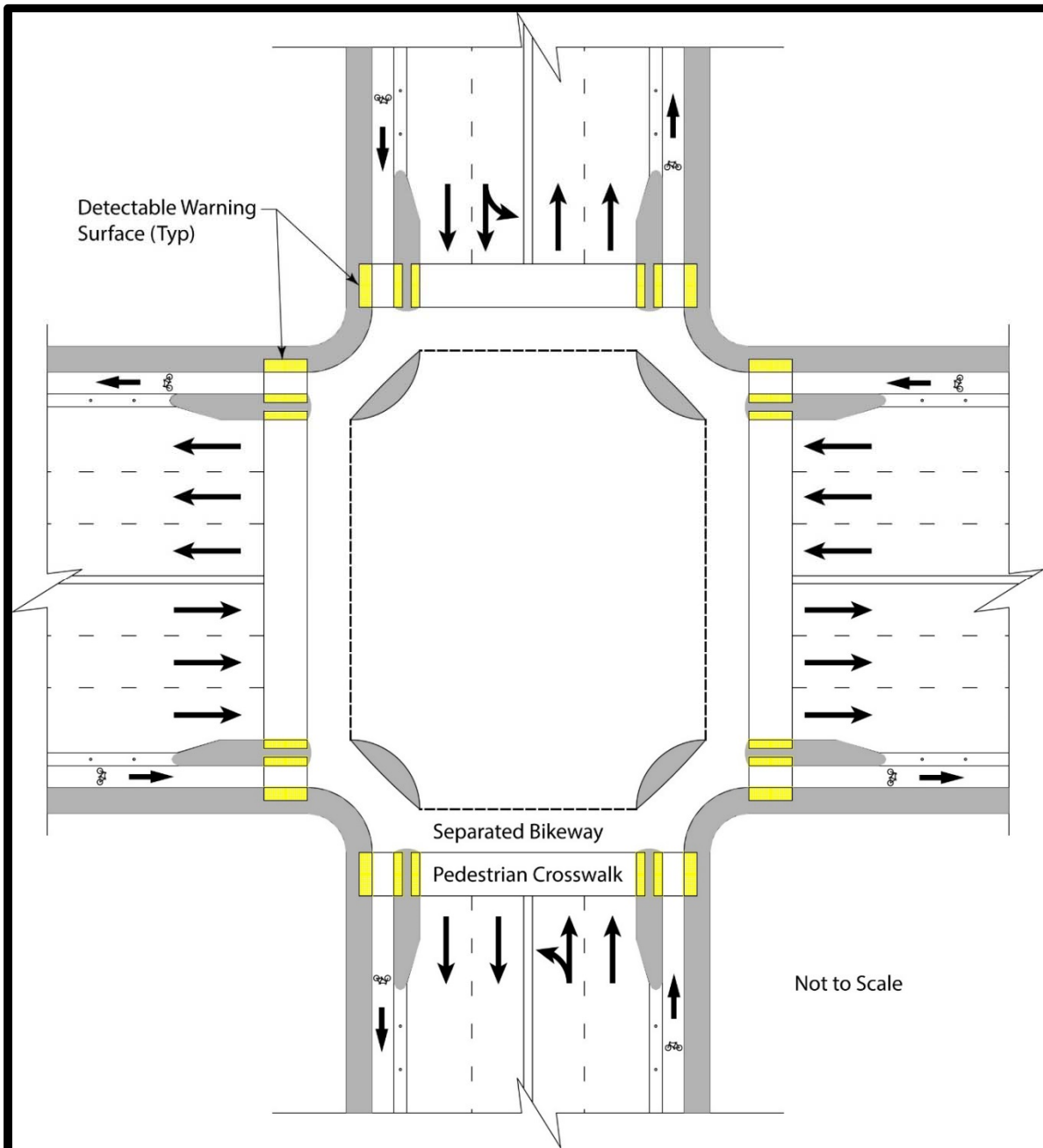
At intersections, right-turn lanes may necessitate that the separated bikeway be modified or terminated. If terminated before the intersection, the approach markings can be the same as a bike lane positioned to the left side of the right-turn lane. See the CA MUTCD Part 9. If it is desired to maintain the separated bikeway path through the intersection, Figures 22, 23, 25 and 26 in the FHWA Guide may be used. However, Figure 23 will necessitate an interruption to allow a vehicle to cross the separated bikeway; therefore, the separated bikeway marking should be dotted. When using the Figure 22 option, consider utilizing the CA MUTCD Part 4 guidance to provide a bicycle signal in order to eliminate conflicts between turning vehicular traffic

and bicycles proceeding straight through the intersection in the separated bikeway. Figures 25 and 26 are without the right-turn lanes. For bicycle detection, see the CA MUTCD Part 4.

At an interchange it may be better to discontinue the separated bikeway so that it would function as a bike lane due to the weaving of entry and exits vehicles on the local road. See the CA MUTCD Part 9.

Bikeway left-turns may be accomplished by utilizing the guidance in the FHWA Interim Approval for bike boxes and/or 2-stage turn queue boxes per IA-18 and IA-20, respectively, see Figures 30 and 31 of the FHWA Guide. Interim Approval information may be accessed at: <http://www.dot.ca.gov/trafficops/camutcd/interim.html>. Also, the separated bikeway may discontinue on the approach to the intersection and be designed as a bike lane for a designated space for the left turn, adjacent to the left-turn lane. Public involvement, typically in the planning process, will help make this and other key design decisions.

Figure 2.2
Example of a Protected Intersection



Alleys and Driveways

Separated bikeways at alleys and driveways should remain as a separated bikeway facility. However, the physical separation feature, such as flexible posts, planters, etc. will be discontinued at alley or driveway locations. The separation markings may continue at these locations. For examples, see Figures 14 and 15 of the FHWA Guide. **Note the importance of including traffic control devices for the benefit of sight distance.**

Marking the separated bikeway with green colored pavement may be used, see Photo 5 and Section 2.1 of this DIB, at alleys and driveways. This may raise the driver's and bicyclist's awareness of these potential conflict areas. Many other traffic control devices may be used as well, see the CA MUTCD Part 9.

2.3 Loading and Unloading Zones, Transit Stops and Valet Parking

Loading and unloading zones, transit stops (e.g., bus stops) and valet parking pick-up or drop-off should take place in the standard parking space adjacent to the marked buffer separating the separated bikeway. Additionally, a modification to the separated bikeway may be necessary, e.g., narrowing the separated bikeway width and/or raising the separated bikeway. See Figures 20, 21 and page 101 of the FHWA Guide for more information. However, due to anticipated high levels of pedestrian activity, consideration should be given to discontinue the separated bikeway before the loading and unloading zone, transit stop and valet parking area and be designed as a bike lane or buffered bike lane to the left of the parking area, and then resume as a separated bikeway thereafter. This type of discontinuous design, from a separated bikeway to a bike lane and back to a separated bikeway, can be problematic because of repositioning of parking spaces, so it may be better to do this on a block by block basis. In the case of a bus stop at the far side of an intersection, this method of transitioning to a bike lane through the intersection has benefit because the bus ADA lift deploys on the sidewalk, with bicycles positioned to the left of the bus; the separated bikeway would then transition immediately after the bus stop. Alternatively, the FHWA Guide Figure 16 shows the island platform as the transit stop. This option should include a marked crosswalk to designate pedestrian crossing.

3.0 CLASS IV BIKEWAY (SEPARATED BIKEWAY) DESIGN CRITERIA

Documenting design decisions is recommended when employing these criteria. Documentation for the State Highway System is prescribed in HDM Index 82.2. Documentation on the local road system is per Chapter 11 of the Caltrans *Local Assistance Procedures Manual*. The documentation process must also comply with the provisions in the California Streets and Highways Code Section 891(b). The separated bikeway design criterion is provided herein along with a graphical representation in Figure 3.0, showing an example for one-way travel. The separated bikeway traffic control devices are prescribed in the CA MUTCD Part 9.

3.1 Separations

The separated bikeway separation shall be at least one of the following to discourage the intrusion of motor vehicles into the bikeway:

- (1) Grade Separation. A vertical alignment that is on a different elevation from the adjacent roadway. The horizontal alignment may also be separate from the roadway.
- (2) Flexible Posts. Class 1 Flexible Posts or similar. See the CA MUTCD Part 3. A 10-foot to 20-foot on-center spacing should be used.
- (3) Inflexible Physical Barrier. Barrier, railing, landscape planters or similar. A 10-foot to 20-foot on-center spacing or continuous inflexible physical barrier should be used. These items should include signs/markers per the CA MUTCD Part 2.
- (4) On-Street Parking. Parking allowed all times of the day, except for maintenance. If continuous inflexible physical barriers, raised island or curb/dike are used in the buffer, an opening should be such that a 5-foot minimum clear width is provided for pedestrians to access their vehicle and the sidewalk. Also, this placement should be designed to accommodate drainage. In the case of a separated bikeway on a hill, a curb or dike is required in order for the wheels of parked vehicles to be turned against, per CVC 22509.
- (5) Raised Island. Raised channelization islands that may include landscaping and signs/markers per the CA MUTCD Part 2. Curb, dike or wheel stops (i.e., parking bumpers) may also be used. Drainage design for runoff is also needed.

3.2 Separation Width

The separation includes a width or buffer:

- (1) **Grade Separation.** For a separated bikeway on the same grade as a sidewalk, the separated bikeway separation width should be 1.5 feet minimum including the curb width (may include landscaping), 3 feet minimum with parking to account for vehicle doors. Note, this portion of the sidewalk can no longer be used by pedestrians. If the separated bikeway is in the roadbed and is raised, the vertical taper occurs in the buffer between the separated bikeway and the vehicular traffic lanes. The vertical taper is included in the buffer width of 3 feet preferred, with 2 feet being the minimum where there is no parking. With parking this width should be 3 feet minimum and 5 feet with accessible parking. If no parking, the buffer includes either flexible posts, inflexible physical barrier or a raised island because the vertical taper itself may be too subtle to be recognized by drivers; these are not required with parking. See Section 3.5 of this DIB for raised separated bikeway and vertical taper guidance.
- (2) **Flexible Posts.** The flexible posts should be placed in the center of a marked buffer that is 3 feet wide preferred, with 2 feet being the minimum width. For the separated bikeway on a sidewalk, the separation may include the flexible posts 1.5 feet minimum from face of curb.
- (3) **Inflexible Physical Barrier.** An inflexible physical barrier should be used in lower speed environments (where the posted speed is 35 miles per hour or less). An inflexible physical barrier should be placed in a marked buffer of 3 feet wide preferred, with 2 feet minimum width. In higher speed environments a concrete barrier should be used. On a sidewalk, the separation may include the inflexible physical barrier 1.5 feet minimum from face of curb.
- (4) **On-Street Parking.** A marked buffer between the on-street parking and the separated bikeway should be a minimum width of 3 feet. However, at on-street accessible parking the minimum width is 5 feet. The flexible posts, inflexible physical barrier or raised island may be included.
- (5) **Raised Island.** Raised islands may be between the separated bikeway and vehicular traffic or parking. These should be 3 feet preferred if no parking is allowed, with 2 feet being the minimum width; 1-foot if used with flexible posts. Three feet is the minimum width with parking; 5 feet with accessible parking.

3.3 Separated Bikeway Width

Separated bikeway width is designated by the clearance between markings, inflexible physical barriers, bridge barriers or railings, and curbs. Also, consideration for maintenance, such as street sweeping, snow removal, and debris removal from de-icing practices should be part of the decision for the width selected. Anticipated bicycle volume, need for passing, bicycle commuting route, and availability of right-of-way are some of the factors where the separated bikeway width may exceed the minimum or preferred stated below.

- (1) The separated bikeway clear width should be 7 feet preferred, with 5 feet being the minimum width for one-way travel when adjacent to a roadway. For two-way travel, the same width as a Class I Bikeway (bike path) should apply. On a structure, the same width as a Class 1 Bikeway should also apply. See HDM Index 1003.1 for more information. When located at accessible parking or a bus stop, the separated bikeway minimum width should be 4 feet. See the CA MUTCD Part 9 for additional guidance on longitudinal pavement markings and the symbol marking.

3.4 Separated Bikeway Approach Tapers

Separated bikeway approach tapers will occur primarily at intersections, but may occur at other locations depending on the presence of traffic signal hardware, etc. For example, reducing the separated bikeway width may be required due to the presence of accessible parking, bus stops, or transit stations.

- (1) A 10:1 separated bikeway approach taper transition is preferred, with 5:1 being the minimum.

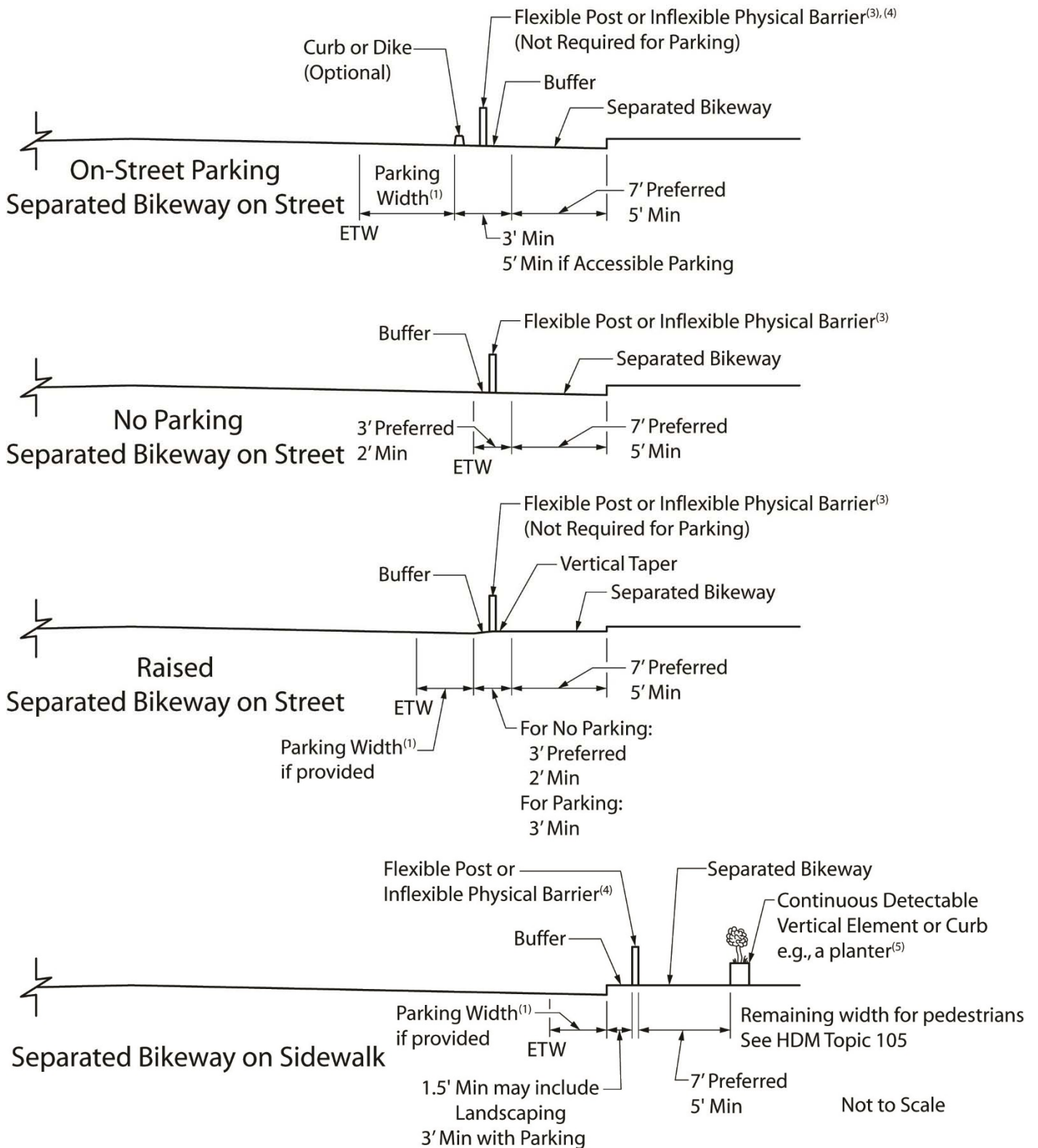
3.5 Raised Separated Bikeways

If the separated bikeway is to be raised, it should be designed to accommodate drainage. Also, the transition from the bikeway to the roadway may be designed to allow the bicyclist to enter the adjacent traffic lanes.

- (1) A raised separated bikeway should be elevated 3 inches minimum above the finished grade, but no higher than the adjacent curb in order to allow drainage towards the street unless some other drainage design is implemented.
- (2) A vertical tapered edge should be 4:1 or flatter occurring in the marked buffer.

Figure 3.0

Typical Class IV Bikeway (Separated Bikeway) Cross Sections



NOTES:

(1) See CA MUTCD Section 3B.19 for parking guidance.

FIGURE 3.0 NOTES CONTINUED:

- (2) For separated bikeway marking and signing guidance, see the CA MUTCD Part 9.
- (3) May be a raised island in lieu of flexible posts or inflexible physical barriers.
- (4) Flexible posts or inflexible physical barriers may be omitted.
- (5) Periodic openings should be provided for bicyclists to access buildings.

4.0 CLASS IV BIKEWAY (SEPARATED BIKEWAY) MAINTENANCE

Separated bikeways require routine maintenance similar to other roadway facilities. However, because of their location near the edge of the roadway they may more likely accumulate debris. Since bicyclists are inhibited from entering and exiting separated bikeways at their discretion, maintaining the separated bikeway surface and removing debris in a manner similar to the adjacent roadway is recommended. Maintenance plans should address routine maintenance and long term maintenance needs, such as removing debris, maintaining landscaping, repairing and replacing the separation vertical elements, maintaining the pavement and traffic control devices. Narrow street sweeping vehicles may be needed depending on the separated bikeway width and separation selected, see page 65 of the FHWA Guide.

Separated bikeways located in areas that receive significant snowfall may influence the type and width of separation used in order to accommodate snow removal equipment, taper front ends of curbs, and vertical delineators at above-ground features to prevent snowplow blade contact. See page 64 of the FHWA Guide.

If using Caltrans equipment, the narrowest setting of the sweeper is 8 feet. The pickup plow blade can be rotated for a 6.5- or 7.5-foot plow width. The 7-foot preferred separated bikeway width in combination with the standard buffer width can accommodate the Caltrans equipment.

5.0 CLASS IV BIKEWAY (SEPARATED BIKEWAY) TEMPORARY WORK ZONES

Temporary traffic control zones can impact a wide range of State highway users, including bicyclists. During the design phase, a decision should be made regarding the traffic handling plans to accommodate bicyclists through construction zones. The CA MUTCD Part 6 contains examples of how to manage bicycles through work zones and recommends the traffic control devices to be used. For State highway projects, if plans and/or special provisions are provided for this purpose, the Caltrans *Transportation Management Plan Guidelines* should be followed.