

## Chapter 1: Purpose and Policy Guidance

The VTA Bicycle Technical Guidelines (BTG) present standards and guidance for planning, designing, operating, retrofitting and maintaining roadways and bikeways. They are intended to improve the quality of bicycle accommodation and to ensure countywide consistency in the design and construction of not only bicycle projects but all roadways. Bicycles are permitted on every roadway in California except as noted in the side bar. Moreover, countywide guidelines are intended to aid Member Agencies in providing a high quality and seamless bicycle network and to facilitate and encourage the use of bicycles as a transportation mode in the County. The BTG apply to projects that are a part of the countywide bicycle network, projects that are funded by the Countywide Bicycle Expenditure Program (BEP) and also to all VTA funded roadway projects.

The BTG draw from the main state and federal design manuals, as indicated in Table 1-1, and are not likely to present an additional burden on agencies. The BTG also highlight best practices used by Member Agencies in order to share information among peers and to foster consistency throughout the County. In the eight years since the first BTG was published, real-world application has yielded better design options as well as has raised more issues to be addressed; thus the BTG refine and expand upon the various options, optimal designs and best practices presented in the 1999 BTG. The BTG should be an invaluable resource for both roadway and bikeway designers.

## 1.1 ORGANIZATION OF MANUAL

There are four parts to this manual:

- 1) Introduction and General Guidance;
- 2) Technical Guidance for Roadways;
- 3) Technical Guidance for On-Roadway Bike Facilities; and
- 4) Technical Guidance for Bike- Only Facilities.

Part 1 Introduction and General Guidance

- Chapter 1: Purpose and Policy Guidance

This chapter describes the purpose and organization of this document and its relation to other manuals and VTA guidelines.

- Chapter 2: Bicycle Characteristics

This chapter presents the dimensions of the bicycle as a vehicle and discusses types of bicyclist skill levels and the facilities that best accommodate them. These physical dimensions are the basis for many of the technical recommendations.

NOTE

Bicycles are permitted on every roadway in California except freeways where prohibited per California Vehicle Code (CVC) §21960 and toll bridges per CVC §23330. These CVC sections are contained in Appendix A along with pertinent Streets and Highways Code sections.

Table 1-1: Design Standards and Guidance Manuals for Streets and Bikeways

TOPIC	CALIFORNIA	NATIONAL	VTA
Road Design	Caltrans HDM Chapters 000-900	AASHTO Geometric Design of Highways and Streets aka "Greenbook"	Bicycle design best practices are in the Bicycle Technical Guidelines
Road and Bikeway Design Element Details	Caltrans Standard Plans	No Federal Manual	Bicycle design best practices are in the Bicycle Technical Guidelines
Bikeway Design	Caltrans HDM Chapter 1000	AASHTO Guide for the Development of Bicycle Facilities	Bicycle design best practices are in the Bicycle Technical Guidelines
Pedestrian/ Bike Bridges	Caltrans HDM Section 208, and Caltrans Bridge Design Specifications	AASHTO Guide Specifications for Design of Pedestrian Bridges	Bicycle design best practices are in the Bicycle Technical Guidelines
Signs and Markings	MUTCD – CA	MUTCD	Bicycle design best practices are in the Bicycle Technical Guidelines
Signs and Markings on Bikeways	MUTCD – CA Chapter 9	MUTCD Chapter 9	Bicycle design best practices are in the Bicycle Technical Guidelines
Policies pertaining to Bicycle Facilities and Design	Caltrans Various Documents including Deputy Directive 64 and Design Bulletins	FHWA Various Documents	Bicycle design best practices are in the Bicycle Technical Guidelines
Bike Parking	No statewide manual	No Federal Manual	Bicycle design best practices are in the Bicycle Technical Guidelines
Miscellaneous Best Practices	Professional Journals	Professional Journals	Bicycle design best practices are in the Bicycle Technical Guidelines

**NOTES**

*Pedestrian best practices are included in VTA's Pedestrian Technical Guidelines. CDT best practices are included in VTA's CDT Manual of Best Practices.*

*HDM: Highway Design Manual*

*AASHTO: American Association of State Highway Transportation Officials*

*MUTCD: Manual of Uniform Traffic Control Devices*

*MUTCD - CA: California Manual of Uniform Traffic Control Devices*

## Part 2 Technical Guidelines for Roadways

Part 2 provides technical guidance for roadways and is divided into four chapters

**Chapter 3: Roadway Design Elements** This chapter includes best practices for lane and cross-section widths, design details for drainage systems and grates, and guidance on reducing surface obstructions, pavement marking materials and signage.

- **Chapter 4: Construction Zones and Maintenance**

This chapter discusses construction zones, design guidance for detour planning and design guidance for bike-friendly roadway maintenance procedures.

- **Chapter 5: Intersections and Interchanges**

This chapter addresses the common conflicts between motorists and bicyclists that occur at intersections due to right- and left-turning vehicles. It also presents the preferred freeway/interchange design and options for striping bike lanes at interchanges.

- **Chapter 6: Signals**

This chapter provides a discussion on bike-friendly signal timing and bike-sensitive detection.

## Part 3 Technical Guidelines for On-Road Bikeways

### Chapter 7: Bikeways on Major Roads

This chapter outlines the physical dimensions and details of constructing and retrofitting bike lanes, use of shoulders as bikeways, and use of “sharrows” on bike routes.

- **Chapter 8: Local Roads as Bikeways**

This chapter includes bicycle boulevards and general bike routes, and addresses traffic calming techniques that are compatible with bicycling.

## Part 4 Technical Guidelines for Bike-Only Facilities

### Chapter 9: Bike Paths and Bridges

This chapter addresses the allocation of width within a right-of way for a bike path and guidance for bicycle bridges.

- **Chapter 10: Bicycle Parking**

This chapter describes the recommended types of bicycle storage, placement criteria and quantity for particular locations.

## 1.2 WHO USES THESE GUIDELINES?

The BTG are for use on all projects in the VTA Capital Improvement Program (CIP) including freeway projects that involve ramps and ramp intersections with surface streets. In particular, the BTG are used by:

- VTA staff
  - when screening and scoring projects for inclusion in the Bicycle Expenditure Plan.
  - when designing all roadway and bikeway projects funded through VTA.
  - as the basis for development review comments on proposed projects and mitigation measures.
- Member Agencies
  - when designing all bike and roadway projects funded through VTA.
  - as a reference for all other bike and roadway projects.
  - encouraged to adopt the BTG as part of their Bike Master Plans.
- Developers
  - to consult the BTG in the pre-design and design phase of their projects.
  - by providing the BTG to their design consultants.
- Bicycle and Pedestrian Advisory Committee (BPAC) members
  - when reviewing roadway and bikeway projects.
  - when commenting on development projects in their jurisdictions.

## 1.3 RELATION TO OTHER DESIGN MANUALS

### 1.3.1 Relation To state and Federal Design Manuals

The California Department of Transportation (Caltrans) Highway Design Manual (HDM), Chapter 1000 is the primary source for bikeway standards in California. The American Association of State Highway Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities (hereafter referred to as the AASHTO Bike Guide) also presents guidelines to follow when constructing or improving highways and designing and constructing bicycle facilities. It is used by states who do not have their own guidelines and also contains some guidance that is not included in the HDM. Pursuant to SHC 890.6 HDM Chapter 1000 and provides minimum design criteria for various aspects of bikeways together with the AASHTO Bike Guide also provide some discussion on best practices, as well as practices to avoid. The BTG are intended to supplement these manuals, by providing guidance on when and how to better accommodate the many types of bicyclists. Also, since

bicycles are allowed on all roadways, the BTG provide guidance on roadway design elements that affect bicycling.

See Section 2.1, 2.2 and 2.3 for discussion of types of bicyclists.

#### NOTE

SHC 890.6 “The Department shall establish minimum safety design criteria for the planning and construction of bikeways and roadways where bicycle travel is permitted”. See Appendix A for the full text.

### 1.3.2 Relation to VTA Documents: Valley Transportation Plan 2030, Pedestrian Technical Guidelines (PTG) and Community Design and Transportation Best Practices Manual (CDT)

The BTG are the companion document to the VTA Countywide Bicycle Plan (CBP) which is the Bicycle Element of the Valley Transportation Plan (VTP) 2030). First published in 1999, the BTG are one of the steps toward the implementation of two policies from the CBP:

- Facilitate and encourage inter-jurisdictional cooperation in the development and implementation of non-motorized projects; and
- Develop a standard checklist of bicycle and pedestrian access guidelines to be used in the planning and programming of all VTA funded transportation projects.

The BTG are one of three technical guidelines authored by VTA. The Pedestrian Technical Guidelines (PTG) offer guidance on pedestrian facilities design and the Community Design and Transportation (CDT) Best Practices Manual offers guidance on Land Use and Transportation Design and Integration. These three documents complement each other, and the BTG references these documents where appropriate.

### 1.3.3 Relation to Interjurisdictional Trail Design, Use and Management Guidelines (TDMG)

In 1995, an update of the Countywide Trails Master Plan was adopted by the Santa Clara County Board of Supervisors as an element of the Santa Clara County General Plan. The Countywide Trails Master Plan includes guidelines for Class I Bike Paths and bike routes along rural roads within the unincorporated areas of Santa Clara County. Subsequently on April 15, 1999, the Santa Clara County Parks and Recreation Department, working through an interjurisdictional committee, published the Uniform Interjurisdictional Trail Design, Use and Management Guidelines. The BTG complement those found in the 1995 Countywide Trails Master Plan by specifically addressing the design of Class I Bike Paths within the urban areas of the County. Therefore, the BTG will not address Bike Path design, except for a few specific issues regarding bike transportation on bike paths that need elaboration including optimum and constrained rights-of-way, intersection control, and bike bridges and rail heights.

## 1.4 CONSISTENCY WITH EXISTING POLICIES

The BTG are consistent with recent federal, state and regional policies recognizing that bicycle facilities are an important component of the transportation infrastructure. The most pertinent federal, state and regional policies are as follows:

Federal: US DOT Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure, March 2000

The Policy Statement was drafted by the U.S. Department of Transportation (DOT) in response to Section 1202 (b) of the Transportation Equity Act for the 21st Century (TEA-21) with the input and assistance of public agencies, professional associations and advocacy groups.

The Policy Statement incorporates three key principles:

1. A policy statement that bicycling and walking facilities will be incorporated into all transportation projects unless exceptional circumstances exist;
2. An approach to achieving this policy that has already worked in State and local agencies; and
3. A series of action items that a public agency, professional association, or advocacy group can take to achieve the overriding goal of improving conditions for bicycling and walking.

CA Assembly: Concurrent Resolution No. 211  
August 20, 2002 (See Appendix A)

Resolved.. in order to improve the ability of all Californians who choose to walk or bicycle to do so safely and efficiently, the Legislature... hereby encourages all cities and counties to implement the policies of ... DD64 and the US DOT's design guidance document on integrating bicycling and walking when building their transportation infrastructure.

CA State Department of Transportation Main Streets: Flexibility in Design & Operations, January 2005

The California Department of Transportation (Caltrans) recognizes the value of a main street to a community for many reasons such as its scenic or historical value, its service to pedestrians, bicyclists, and public transit, and its access to businesses, residential roads, and other nearby properties. This value does not change when dealing with a main street that also serves as a state highway. When developing highway improvements, planners and designers need to address those community values especially providing access for bicyclists and pedestrians.

Deputy Directive 64 Accommodating Nonmotorized Travel, March 26, 2001

This directive states that Caltrans “fully considers the needs of nonmotorized travelers (including pedestrians, bicyclists and persons with disabilities) in all programming, planning, maintenance, construction, operations and project development activities and products. This includes incorporation of the best available standards in all of the Department’s practices. The Department adopts the best practice concepts in the US DOT Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure.” The full Directive is contained in Appendix A.

DIRECTOR’S POLICY Context Sensitive Solutions Effective Date: 11-29-01

The Department uses “Context Sensitive Solutions” as an approach to plan, design, construct, maintain, and operate its transportation system. These solutions use innovative and inclusive approaches that integrate and balance community, aesthetic, historic, and environmental values with transportation safety, maintenance, and performance goals. Context sensitive solutions are reached through a collaborative, interdisciplinary approach involving all stakeholders. (See Appendix A)

The context of all projects and activities is a key factor in reaching decisions. It is considered for all State transportation and support facilities when defining, developing, and evaluating options. When considering the context, issues such as funding feasibility, maintenance feasibility, traffic demand, impact on alternate routes, impact on safety, and relevant laws, rules, and regulations must be addressed.

Metropolitan Transportation Commission

Transportation 2030 and Routine Accommodation of Bicyclists and Pedestrians in the Bay Area, June 2006

One of the “Calls to Action” included in the Metropolitan Transportation Commission’s (MTC) 2005 Regional Transportation Plan (RTP) calls for full consideration of the needs of non-motorized travelers during project development, design, construction, and rehabilitation. In part, the Call to Action says that “...bicycle facilities and walkways must be considered, where appropriate, in conjunction with all new construction and reconstruction of transportation facilities.” The Routine Accommodation report makes eleven recommendations for increasing the routine consideration of such facilities in the future. Recommendations include improving review and design strategies to ensure that transportation projects routinely accommodate bicycles and pedestrians. The MTC resolution adopting the Routine Accommodation Policy is contained in Appendix B.

# Chapter 2: Bicycle Characteristics

## 2.1 DEFINING OPTIMUM, SHOULD AND SHALL

In referencing widths and other measurements, the BTG make frequent use of the word “optimum” to present optimal design guidelines for bikeways and for roadways where bicycles are permitted. In these cases, “optimum” means the best or most favorable condition for a particular roadway or bikeway, from the perspective of the safety and convenience of the typical bicyclist expected to use the facility (see Section 2.2 and 2.3). The purpose of providing optimum as opposed to minimum standards is to set high expectations, build projects to higher design standards, improve the quality of bicycle facilities and encourage bicycling as a transportation mode. (The extent to which “optimum” is provided is in accordance with the resources available.) Similarly, “should” is used where a practice would result in optimum conditions for bicyclists, and “shall” is used to reference a State or Federal design standard. In some contexts, the design standard refers to the minimum allowable dimension, but larger dimensions are not only permissible but preferable. See sidebar example.

## 2.2 BICYCLE USER TYPES

The BTG recognizes the varying needs and preferences of the different types of cyclists. There are many ways to categorize the various types of bicyclists, for example, age, skill, trip purpose and even the type of bicycle ridden. These variations affect the type of facility where they ride and ultimately whether they choose to bike at all. For the purposes of the BTG, the types of bicyclists generally fall into five categories based on skill and basic trip purpose, as shown in Table 2-1.

### TECH TIP

#### Shall vs. Should

Example of use from HDM § 1003.2(1)c If no gutter exists, the minimum bike lane width shall be 4 feet. With a normal 2-foot gutter, the minimum bike lane width shall be 5 feet... Wherever possible, the width of bike lanes should be increased 6 feet to 8 feet to provide for greater safety.

Table 2 – 1 Bicyclist Type By Skill Level By Trip Purpose

Skill Level	Transportation Trip Purpose	Recreation Trip Purpose
Experienced	Typically adult	Typically adult
Casual	Typically adult or teen	All ages – including families with young children
Novice	Novice adult or young cyclist	All ages – including families with young children

## 2.3 FACILITY TYPES AND BICYCLE USERS

With training, most persons over age 10 can ride safely on most roadways. This does not mean, however, that most persons would choose to do so. This is corroborated by the

existing bicycle mode split for work trips in Santa Clara County of less than two percent. The tendency of the five basic types of bicyclists to use roadways and bike paths is presented in Table 2-2. The BTG recommends that in planning bicycle networks, the type of bicyclist expected to use the facility be considered. For example, only experienced cyclists are expected to ride on expressways whereas bike paths typically attract all skill levels and ages. Trip purpose also affects facility choice: the route chosen by a skilled adult rider for a recreational ride will be much different than for a commute trip. To serve the full range of cyclists in a community, a variety of bikeway types should be provided.

Table 2 – 2 Bicyclist Type Versus Facility Type

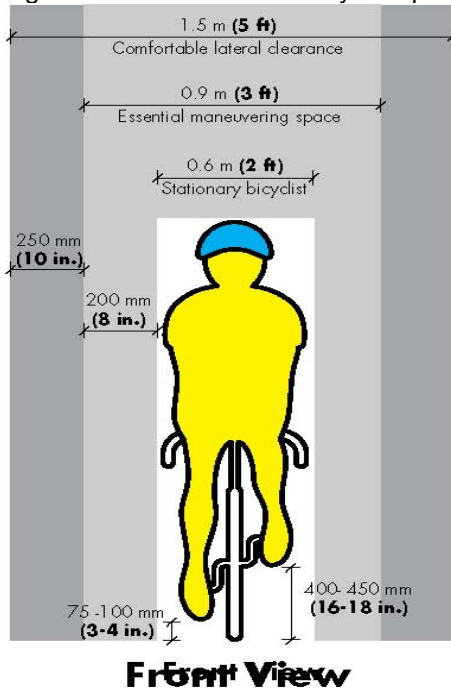
Facility Type	Experienced Adult Bicyclist	Casual Adult Bicyclist	Novice Adult/Youth Bicyclist	Experienced Recreational Bicyclist	Family Recreational Bicyclist
Expressways	Yes	No	No	No	No
Bicycle Blvd. or < 2000 VPD – no bike lanes	Yes	Yes	Yes	Yes	Yes
< 13' curb lane – no bike lanes	Yes	No	No	Yes (low ADT)	No
14' curb lane – no bike lanes	Yes	Yes	No	Yes	No
15' + curb lane – no bike lanes	Yes	Yes	No	Yes	No
Minimum width bike lanes – low ADT	Yes	Yes	Yes	Yes	No
Minimum width bike lanes – medium ADT	Yes	Yes	No	Yes	No
Minimum width bike lanes – high ADT	Yes	No	No	Yes	No
Optimal width bike lanes – low ADT	Yes	Yes	Yes	Yes	Yes
Optimal width bike lanes – med/high ADT	Yes	Yes	Yes	Yes	No
Bike path/shared use path – 8 feet wide	No	Yes	Yes	Yes	Yes
Bike path/shared use path – 12 feet wide high ped. volumes	No	Yes	Yes	No	Yes
Bike path/shared use path – 12 feet wide low ped. Volumes	Yes	Yes	Yes	Yes	Yes

VPD = Vehicles Per Day; ADT = Average Daily Traffic

Note: This table attempts to illustrate how bicyclists' preferences tend to manifest themselves and does not imply that all bicyclists fit into one of these categories.

## 2.4 OPERATING SPACE OF A TYPICAL BICYCLIST

Figure 2-1 shows the dimensions and operating space required by a typical bicyclist on a typical bicycle. The width of a stationary bicyclist is approximately 2.0 feet, while a moving bicyclist typically takes up an additional 12 to 16 lateral inches for essential maneuvering space. Added to this is the required clear distance between the bicyclist and other objects and vehicles for a requirement of five feet for comfortable bicycle operation. A bicyclist pulling a trailer requires even more lateral width as shown in Figure 2-2. Figure 2-3 illustrates a two-way bike path which requires ten feet for optimal bicycle accommodation.

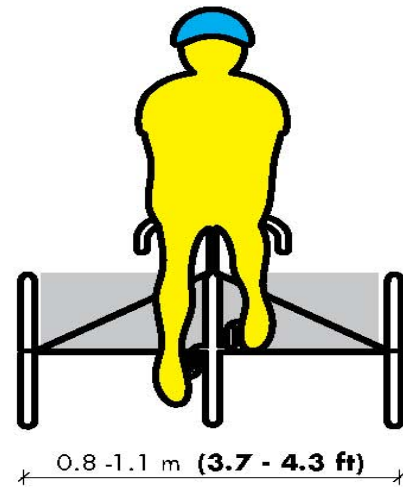


**Front View**

**Figure 2-1:**

**Bicyclist Essential Operating Space**

Source: Minnesota Department of Transportation



**Front View**

**Figure 2-2:**

**Stationary Bicyclist with Trailer**

Source: Minnesota Department of Transportation

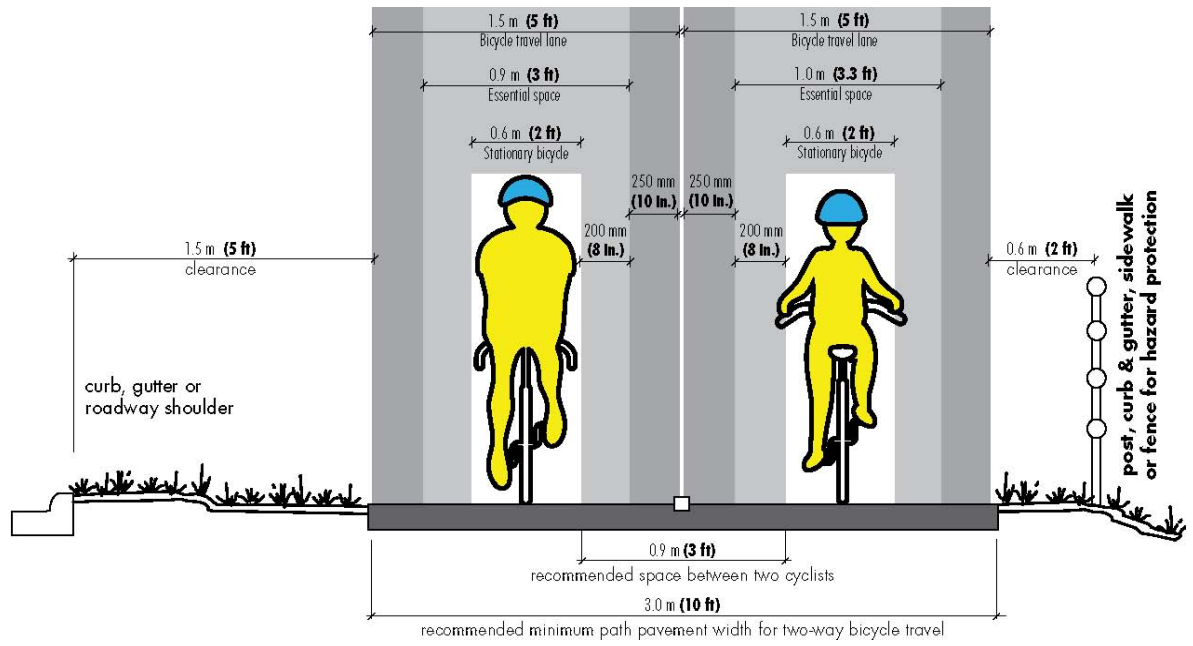


Figure 2-3: Bicyclist on Two-Way Path - Essential Operating Space

Source: Minnesota Department of Transportation