SANTA CLARA
Valley Transportation Authority

BICYCLE & PEDESTRIAN ADVISORY COMMITTEE

Wednesday, January 11, 2012

BPAC WORKSHOP MEETING WILL IMMEDIATELY FOLLOW THE ADJOURNMENT OF THE BPAC REGULAR MEETING

VTA Auditorium
3331 North First Street
San Jose, CA

AGENDA

CALL TO ORDER

1. ROLL CALL

2. PUBLIC PRESENTATIONS

This portion of the agenda is reserved for persons desiring to address the Committee on any matter not on the agenda. Speakers are **limited to 2 minutes**. The law does not permit Committee action or extended discussion on any item not on the agenda except under special circumstances. If Committee action is requested, the matter can be placed on a subsequent agenda. All statements that require a response will be referred to staff for reply in writing.

3. INFORMATION ITEM - Review and comment on the proposed guidance for five new topics in the Bicycle Technical Guidelines.

4. ANNOUNCEMENTS

5. ADJOURN

In compliance with the Americans with Disabilities Act (ADA), those requiring accommodations or accessible media for this meeting should notify the Board Secretary's Office 48 hours prior to the meeting at (408) 321-5680 or e-mail: board.secretary@vta.org, TDD (408) 321-2330. VTA's Homepage is located on the Web at: http://www.vta.org/.

All reports for items on the open meeting agenda are available for review in the Board Secretary's Office, 3331 North First Street, San Jose, California, (408) 321-5680, the Monday, Tuesday, and Wednesday prior to the meeting. This information is available on VTA's website at http://www.vta.org/ and also at the meeting.

SANTA CLARA
Valley Transportation Authority

Date: December 28, 2011
Current Meeting: January 11, 2012
Board Meeting: N/A

BOARD MEMORANDUM

TO: Santa Clara Valley Transportation Authority
Bicycle & Pedestrian Advisory Committee

THROUGH: General Manager, Michael T. Burns

FROM: Chief CMA Officer, John Ristow

SUBJECT: Bicycle Technical Guidelines Update- Five New or Expanded Topics

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FOR INFORMATION ONLY

BACKGROUND:

The VTA Board of Directors adopted an update of VTA's Bicycle Technical Guidelines (BTG) in December 2007. To keep the guidelines current and valuable for Member Agencies and the public, VTA's Bicycle Program includes periodic updates to the BTG.

The purpose of the BTG is to assemble in a single document the guidelines and Caltrans' standards pertaining to the design, signing, striping, operation and maintenance of bicycle facilities. It is also designed to supplement and augment standard manuals including Caltrans Highway Design Manual (HDM) by providing guidance on when and how to better accommodate the many types of bicyclists on all types of roadways and paths. Finally, the BTG presents best practice options for some common situations, many of which were developed by VTA Member Agencies. Two cities in Santa Clara County, Cupertino and Gilroy, have adopted the BTG as their city guidelines. Others cities in the county, and cities and counties in California, use them informally.

The BTG are designed with the understanding that new issues will arise in the future, and that guidelines, best practices, standards need to evolve with time. The three-ring binder format of the BTG was chosen so that changes could be easily incorporated and VTA would not necessarily have to reprint the entire document.

Since December 2007, there have been two minor updates to the BTG: 1) revised Deputy Directive (DD) 64-R1 replaced DD 64, which describes Caltrans' Complete Streets policy; and 2) the MTC Complete Streets checklist was added to Appendix B, per the BPACs' request. In January 2012, Caltrans will adopt an updated version of the state's Manual of Uniform Traffic Control Devices (CA MUTCD) that incorporates Federal Highway Administration's (FHWA) MUTCD 2009 Edition, and the BTG will be updated accordingly. This will include issues such

as Caltrans' new guidance on signal timing for bicyclists and newly approved signs and markings. These changes are summarized in Attachment A. Caltrans is also revising the HDM, which may lead to some other BTG updates.

DISCUSSION:

VTA is initiating a comprehensive review of the BTG to identify and update areas that have changed or need correction, and to add new areas. This work will include presentations and discussions at the BPAC, workshops, and technical working sessions, and is expected to conclude by summer 2012. As a start, this memorandum outlines five topics that were either not included or not fully addressed in the December 2007 BTG.

1. Woonerfs /Home Zones/Shared Spaces

Invented in the Netherlands in the 1970's and literally translated as "living yard" (corollary to a "living room"), a woonerf is a residential street redesigned to be a safe setting for bicycles, pedestrians and even children at play. It typically eliminates curbs and sidewalks thereby creating essentially a linear plaza. Cars are permitted, primarily to access the homes on the street, but they travel at very slow speeds since they must navigate around planters, trees, and parking spaces which are strategically placed, not to mention watching for the residents, children, walkers and bikers. VTA's Pedestrian Technical Guidelines and Community Design and Transportation Manual all support woonerfs. The concept has spread to many countries in Europe, and English terms in use are Home Zones, Shared Spaces, and Shared Streets; the UK Department for Transport has even released well-illustrated guidelines.

Many residential settings in the US are different from residential streets in Europe, so the concept of eliminating sidewalks might not work in some contexts. Also commercial contexts are different from residential contexts, and the Dutch even have a different word for a commercial street so designed, called a "winkelerf".

The City of Sunnyvale is currently redesigning San Andreas Court as a woonerf, in conjunction with the Mathilda Avenue/Caltrain overcrossing renovation. It is suggested that the BTG contain a prototype for three conditions: a residential woonerf eliminating sidewalks, curbs and gutter; a residential woonerf retaining sidewalks, curbs and gutter, and a commercial winkelerf.

2. Modern Roundabouts

Roundabouts are circular intersections that feature a central island, a circulatory roadway, and splitter islands on each approach. The use of modern roundabouts in the United States began in the early 1990's, and their popularity has continued to grow. There is a roundabout in Cupertino at the intersection of Cristo Rey Drive and Canyon Oak Way and also in Santa Cruz at Pacific Avenue/Center Street/ W. Cliff Drive. Roundabouts are currently proposed for three locations on state highways in District 4: one in Solano County, one in Sonoma County, and a double roundabout at the I-80 /Gilman interchange in Berkeley, Alameda County.

Caltrans published a Design Information Bulletin (DIB) in October 3, 2003 to provide assistance

in ensuring their proper use on the State Highway system. According to DIB 80-01, *Key to the proper implementation of [modern roundabouts] is the understanding that roundabouts rely upon two basic and important principles:*

A. *Speed reduction through the facility, achieved through geometric design, which ensures optimal operational benefits and safety enhancement; and,*

B. *The yield-at-entry rule, which requires traffic entering the intersection to yield to traffic that is traveling in the circulatory roadway when conflicts occur between them.*

This second point describes how roundabouts are fundamentally different from small traffic circles used as traffic calming on residential streets and also from the large traffic circles common in the northeast that control entry points with traffic signals. In fact roundabouts are used in lieu of traffic signals and four-way stop sign control and have documented improved safety records compared to both of these controls. They also provide benefits for bicycles over STOP signs in that bicyclists, just like motorists, do not come to a complete stop. Thus cyclists retain their momentum which dramatically improves travel time and reduces fatigue. The benefit of roundabouts over traffic signals is that cyclists encounter much less delay than at a signalized intersection, and there are reduced collision rates and injury severity due to the slower speeds of motor vehicle traffic through the intersection.

As discussed in DIB 80-01, one-lane entry roundabouts can be very compatible with bike traffic and bikeways. However, bike lanes must be terminated in advance of the roundabout per CA MUTCD. Multi-lane roundabouts are more problematic for bicycles; for this reason, they are not recommended for the BTG.

Proposed guidelines for bike lanes at modern roundabouts consistent with FHWA and the CA MUTCD are proposed to be inserted into the BTG in Part III - Bikeway on Roadways.

3. Colored Bike Lanes

The FHWA has granted an Interim Approval for the use of colored pavement for marked bicycle lanes (IA-14, April 15, 2011) based on several Request to Experiments from across the country. Interestingly, there are only completed reports on “color in conflict zones” and not for “continuous color of the bike lane”. Continuous color in bike lanes appears to be understudied, but also appears to be a fairly innocuous treatment. Based on the studies of color in weaving areas and through intersections, it appears that color in conflict zones has mixed results in terms of improving safety and improving behavior on the part of motorists or bicyclists. Based on these findings, the VTA BTG will acknowledge the interim approval status of green color in bike lanes. The BTG will not recommend the use of color in conflict zones at this time although cities may do so per the terms of the interim approval. If they choose to do so, VTA suggests that the “before” and “after” behavior of both motorists and bicyclists be documented, as well as the collision history, to add to the body of knowledge on the effectiveness of this treatment.

4. Bike Lanes with BRT and at Bus Bulb-outs

Bus Rapid Transit (BRT) has several possible configurations. Providing for bike lanes and BRT will vary first and foremost depending on the location of the BRT lane, median or curbside. Illustrations for bike lanes and BRT will be developed for three scenarios: 1) median BRT HOV lane; 2) curbside BRT HOV lane; and 3) curbside BRT in a mixed-flow lane.

The curbside BRT configuration uses elongated bus bulb-outs for the station area. Standard bulb-outs at intersections reduce pedestrian crossing time and distance, and are now a well accepted practice in urban areas. Providing a similar treatment the full length of a bus loading zone for passenger-loading purposes also provides many benefits, particularly for BRT. However, when a bike lane is present on the street and the BRT and /or buses use a mixed flow curbside lane (Case 3), then the stop will typically block the bike lane, a condition similar to a right-turning car / truck stopped at a bulb-out intersection. Various strategies and options for integrating bulb-out BRT stations and bike lanes on arterials will be presented and discussed with the BPAC.

5. Bollards on Bike Path Entry

Bollards are often used primarily to prevent motorized vehicles from entering bike paths. In many if not most cases, illegal motor vehicle use of bike paths is not a problem. Bollards within the paved area or tread of the bike path present an obstruction to bicyclists and if used, must be marked as such per the HDM. The BTG will present alternatives to providing bollards that achieve the goal of alerting motor vehicle traffic to not enter the bike path. The BTG also presents the preferred bollard design if bollards are deemed necessary.

Next Steps

Discussions at the January 2012 BPAC meeting may identify additional areas for revision or inclusion. A draft schedule for the BTG update is presented below:

- Review of draft areas of revision: January and February 2012 BPAC Workshops
- Technical Working sessions (if necessary): February or March 2012
- Technical Advisory Committee Subcommittee: March 2012
- Draft BTG: March 2012
- BTG adoption: April 2012 committees, May 2012 BOD

Prepared By: Michelle DeRobertis
Memo No. 2573

Attachment A
Edits to be Consistent with the 2009 MUTCD & 2012 CA MUTCD

BTG Page, §	2007 BTG Text	Change to Read	Topic and Notes
pp 3-9 § 3.5.1	**VTA Best Practice** **Bikes Allowed Use of Full Lane (VTA SR-1) (Proposed MUTCD Section 9B-06) & Proposed MUTCD R4-11** [delete text in this paragraph and replace as indicated.]	**[Insert to be first entry under Caltrans Standard]** **Bikes May Use Full Lane R4-11 (MUTCD-CA 9B.06)** The R4-11 may be used on roadways where no bike lanes or usable shoulders are present and where travel lanes are too narrow for bicyclists and motor vehicles to operate side by side. The R4-11 may be used in locations where it is important to inform road users that bicyclists might occupy the travel lane. The Shared Lane marking (Section 9C.07) may be used in addition to or instead of the R4-11 to inform road users that bicyclists might occupy the travel lane. **VTA Best Practice** Streets with lanes that are too narrow are less than 13 feet (or 20 feet with onstreet parking). *See Section 7.3*	**Regulatory Sign-** (Added to the 2009 MUTCD §9B.06 and the 2012 CA MUTCD)
pp 3-10 §3.5.2	NA	Add signs W11-15 and W11-15p to margin 	**Warning Signs: Trail X-ing** (Added to the 2009 MUTCD and the 2012 CA MUTCD)

pp 5-2 §5.1.1	MUTCD-CA Section 9C.103	MUTCD-CA Section 9C.07	Pavement Markings- Sharrow (Added to the 2009 MUTCD, formerly only in the CA MUTCD 2006 §9C.103)
pp 5-4 § 5.1.4	MUTCD-CA Section 9C.103	MUTCD-CA Section 9C.07	Same as above
Pp 6-1, §6.1.1	$g + y + r_{clear} \geq t_{cross} + t_{lost}$ The value of t_{cross} can be determined by estimating the full speed crossing time *(w + l)/v ...*	$g_{min} + y + r_{clear} \geq$ 6 sec + (*w* + 6 ft)/14.7 ft/sec The value of t_{cross} = *(w + 6)/v, can be varied where slower than average bicyclists are expected ……*	Minimum Green Time per CA MUTCD 4D.105
pp 6-5 §6.2	[Add indicated text to the end of the last paragraph]	This is now California Law per CVC 21400 and CA MUTCD 4D.105.	Bicycle Detection per TOPD # 09-06, Sep 10, 2009
pp 7-10 §7.3.1	MUTCD-CA Section 9C.103	MUTCD-CA Section 9C.07	Pavement Markings- Sharrow (Added to the 2009 MUTCD, formerly only in the CA MUTCD 2006 §9C.103)
pp 7-10 §7.3.1	Roadway with parallel parking	Delete this bullet	Pavement Markings- Sharrow now permitted on roadways with no parallel parking
pp 7-11 §7.3.2	Caltrans Standard	Add third bullet: • Lateral Placement: where there is no on-street parallel parking, the centerline of symbol should be at least 4 feet from the face of curb, or from the edge of pavement where there is no curb	Pavement Markings- Sharrow Placement
pp 7-11 §7.3.2	Margin Note 1: MUTCD-CA states that the lateral distance may be increased as needed for roadway and traffic conditions.	Add as VTA Best Practice	This statement is not in the MUTCD and is no longer in the California MUTCD.

the County for these situations and circumvent each city developing their own unique sign. Some of these signs, or variations, are currently used by jurisdictions both within and outside Santa Clara County.

Signs specific to Bikeways are presented in Chapters 7 and 8. The signs presented below are the more common signs that might be used along roadways with bicycles.

3.5.1 Regulatory Signs (Black on White)

Regulatory signs used in conjunction with bike lanes are presented in Chapter 7.

Regulatory Signs give notice of traffic laws or regulations.

R44 (CA)

Caltrans Standard

move here

Bicycles Must Exit R44C (CA) This sign is placed at the beginning of an off-ramp on a freeway segment where bicycles are permitted but now are required to exit.

Push Button for Green Light R62C (CA) This sign is placed where it is not intended for bicyclists to be controlled by the pedestrian indication, but rather the vehicle indication. Typically, a loop detector is installed to detect bicycles but a push button maybe more expedient in certain circumstances. If used, the push button should be installed near the edge of the sidewalk in the vicinity of where bicyclists will be waiting to cross the street.

R62 (CA)

Bicycle Signal Actuation R10-22

This sign may be installed at signalized intersections where markings are used to indicate the location where a bicyclist is to be positioned to actuate the signal (see Section 9C.05).

R10-22

Caltrans Guidance

If the Bicycle Signal Actuation sign is installed, it should be placed at the roadside adjacent to the marking to emphasize the connection between the marking and the sign.

~~VTA Best Practice~~

Bikes May Use Full Lane (VTA SR-1) (~~Proposed~~ MUTCD section 9B.06) & ~~Proposed~~ MUTCD R4-11-This sign may be used on streets with narrow lanes (less than 14 feet or 22 feet with parking) to inform both motorists and bicyclists that bicyclists might occupy the travel lane per CVC Section 21202(a)(3). This sign may be used alone or in conjunction with the sharrow pavement marking. *See Section 7.3.*

R4-11

W10-12

W4-4p

AT TWO-WAY STOP SIGN CONTROLLED INTERSECTION

new signs W11-15 and W11-15P

VTA SW- 6

W16-1

W7-5

ADVANCE OF FREE RIGHT-TURN VTA SW-1

ADVANCE OF ON-RAM P VTA SW-2

ADVANCE OF LEFT-TURN LANES VTA SW-3

VTA SW-4

3.5.2 Warning Signs (Black on Yellow)

Warning Signs give notice of a situation that might not be readily apparent.

Caltrans Standard

Bike Crossing (W11-1 and W16-7p)-Where bicycles cross a road at an unexpected location, (i.e. not at a typical intersection), these signs may be posted to alert motorists of the presence of bicycles. To alert motorists of the presence of bicycles on the roadway travelling in the same direction, see, as appropriate, SG45 (CA) Bike Route, R81 (CA) Bike Lane, or VTA SW-6.

Skewed Railroad Crossing (W10-12)-Skewed Railroad Crossing should be used to warn bicyclists and motorcyclists in advance of a grade crossing that is skewed 30 degrees or less from the roadway centerline.

14

Cross-Traffic Does Not Stop (W4-4p)-These signs may be used to supplement standard markings at intersections which have been converted from 4-way stop to 2-way stop, or when two-way stop signs have been rotated as in the implementation of a bicycle boulevard. Generally, they are used for a limited time until the traffic is used to the change.

Steep Grade (W7-5)-Steep grade sign should be used in advance of a downgrade where the percent grade, length or horizontal curvature may not be readily apparent to cyclists or where accident experience and field observations indicate a need.

VTA Best Practice

Share the Road (VTA SW-6 with MUTCD W16-1)-Share the Road signs may be posted on arterial streets where there are narrow outside lanes, i.e., less than 13 feet wide, (current practice in the City of Sunnyvale). Cupertino, Sunnyvale and Santa Clara all post Share the Road signs at their City limits; some are Warning and some are Guide signs.

Yield to Bikes (VTA SW-1, VTA SW-2, VTA SW-3)-Signs to warn right-turning motorists to yield to bicyclists should be used as appropriate. Three versions are presented: in advance of freeway on-ramps, at free-right turns, and in advance of a heavy bicycle left-turn lane.

Trail crossing (VTA SW4)-These signs should be posted where motorists would not normally expect two-way bicycle traffic such as when a bike path crosses through an intersection. See also: TDMG Policies UD-1.1.5; UD-1.1.6; UD-4.16; UD-4.17; and Figures T-12A; T-12B; T-13A; T-13B.

Pork-chop islands can be problematic for bicycles due to odd angles and high speed traffic.

through lane. Consider the Sharrow pavement marking described in Section 7.3 and MUTCD-CA Section ~~9C.103~~. 9C.07.

A bike lane should not be eliminated in order to provide a right-turn only lane. See Chapter 7.1.4 for more information on bike lanes and right turn lanes.

5.1.2 Channelized Right-Turn Lanes

If used, channelized right-turn lanes should be designed so that right-turning vehicles must slow sufficiently before they reach the crosswalk. The design should enable the motorist to easily turn his/her head to the left to look for oncoming traffic. STOP control should be considered instead of YIELD control to improve the safety of pedestrians. (See Figure 5-1). When intersections are renovated or reconstructed, it is best to eliminate the "pork chop" island and bring the right-turn movement under signal control.

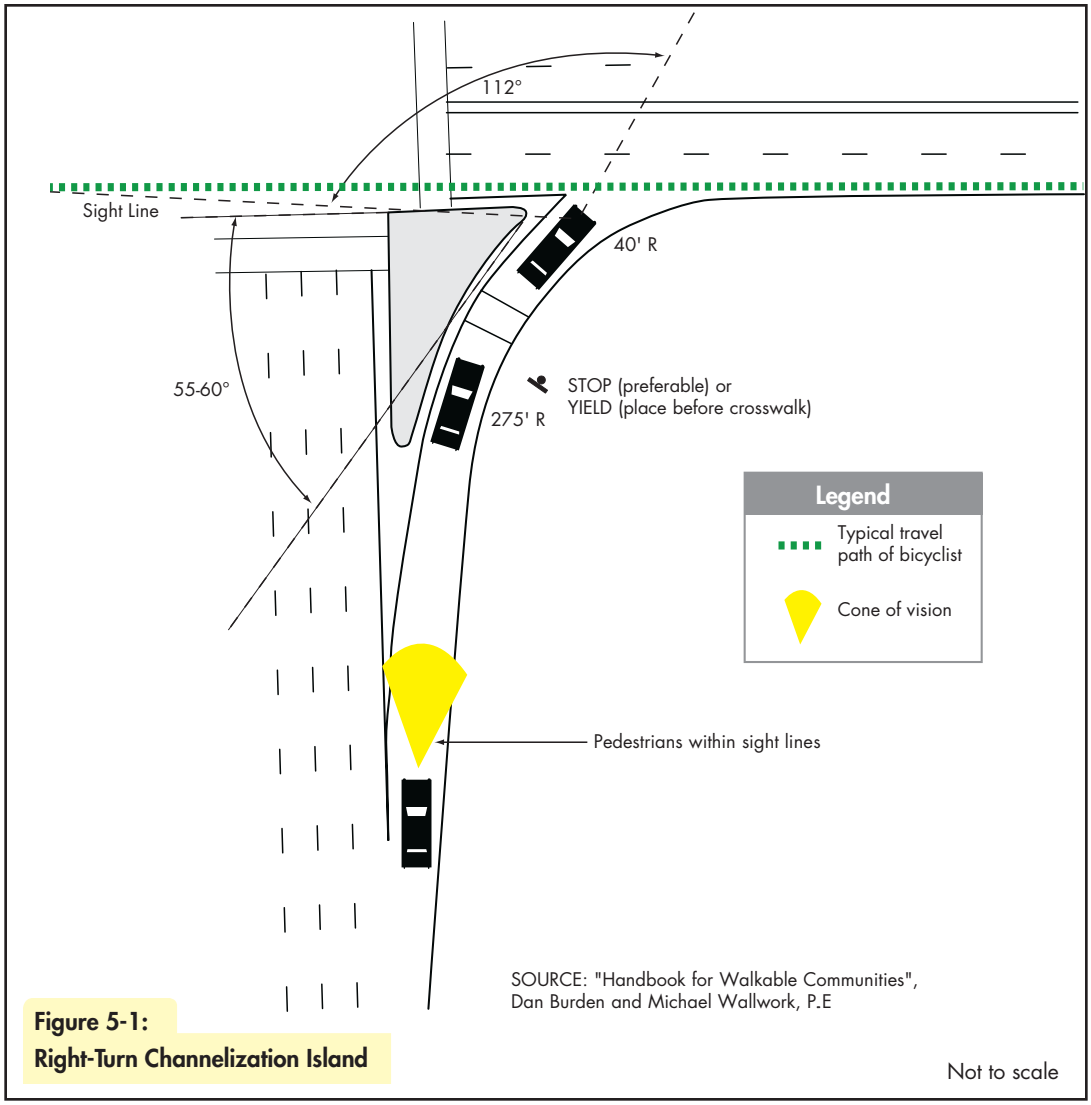
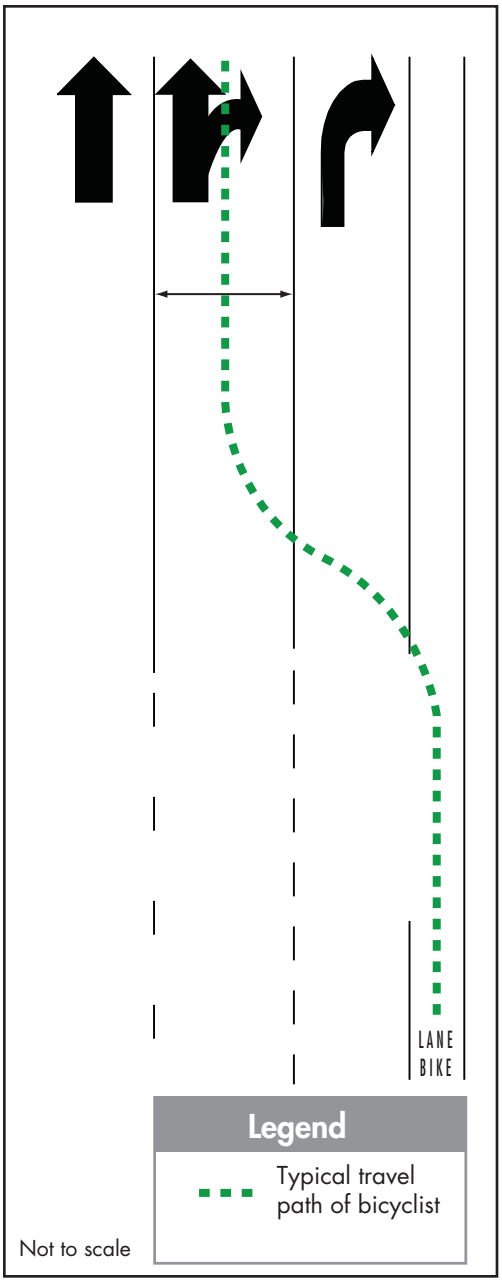


Figure 5-1:
Right-Turn Channelization Island

An approaching bicyclist would find himself to the left of this automobile entering from the cross street with a free right-turn lane.

5.1.3 Free Right-Turn Lane(s)

Free right-turn lanes, (i.e. when the roadway is striped in such a manner that a fast merge from the right receives its own lane after the turn), puts the through bicyclist at risk. The free right-turn lane design results in the through bicyclist being sandwiched in between two through lanes of high-speed traffic. This practice should be avoided on designated bikeways, including cross county bicycle corridors. Existing installations should be ameliorated by slowing the speed at which vehicles make the right turns as discussed in Section 5.1.2 and by installing warning signs. Also, the approaching through lane should be wide enough (15 feet) for bicycles and cars to share. See Figure 5-2. See Chapter 5.3.5 for a discussion of free right-turn lanes at freeway interchanges.



5.1.4 Dual Right Turns with Shared Right/Through Lane

Dual right-turn lanes should be avoided particularly on roadways with bike lanes and on signed bike routes. Shared through and right-turn lanes adjacent to right-turn only lanes should also be used sparingly and should not be used on roadways with bike lanes since a bike lane cannot be striped up to the limit line with this configuration. If the shared through and right-turn lane is greater than or equal to 15 feet wide as shown in Figure 5-3, the situation is slightly ameliorated, but not solved. Fifteen feet provides enough space for the cyclists and the motorist to share the same lane side by side, but does not solve the inherent conflict of this design. Consider the Sharrow pavement marking described in Section 7.3 and MUTCD-CA Section ~~9C.103~~. 9C.07.

Design Considerations

When a dual right-turn lane is provided by creating a shared right-turn and through lane adjacent to a right-turn only lane, it is impossible to provide bike lanes at the intersection approach. Due to the uncertainty the bicyclists are faced with on the direction the motorist in the shared lane will be going, the bicyclist can only rely on the motorist using his/her right-turn signal. Without knowing whether the motorist is going to turn right or proceed straight, the bicyclist cannot position him/herself correctly in order to avoid being turned into by a right-turning vehicle from the shared lane. For example, if the motorist in the shared lane is proceeding straight, the cyclist should ride in between the right turn lane and the shared lane. If the motorist is turning right, the cyclist should be one lane over to the left of the right-turning vehicle.

Figure 5-3:
Double Right-turn Lane

6 SIGNALIZED INTERSECTIONS

6.1 TRAFFIC SIGNAL TIMING

Signal timing affects bicyclists in four ways: (1) the minimum green times, (2) clearance intervals, (3) progression, and (4) visibility of signal heads.

IN THIS CHAPTER:

6.1.1 Minimum Green Time

The minimum green times depend on the cross street width, slope of the approach, and the bicyclist's ability. Generally eight seconds is sufficient. Specific guidance for calculating minimum green times is presented below. An example signal timing calculation is presented after the discussion of clearance intervals, Section 6.1.2 on page 6-4.

The important value is the total length of the signal phase-minimum initial green plus yellow plus red clearance-which must exceed the time t_{cross} needed for bicyclists to cross the intersection:

also

$$g + y + r_{clear} \geq t_{cross} + t_{lost}$$ = (w + 6 ft)/ 14.7 ft/sec + 6 sec.

The value of t_{cross} can be determined by estimating full-speed crossing times $(w + l)/v$ where w = intersection width, l = length of the bicycle, (typically 6 feet) and v = bicyclist speed, using the speeds given in Table 6-1 below.

Table 6 -1 Representative Bicyclist Speeds

Bicyclist Population	Average Speed	15th Percentile Speed (85 percent of cyclists)	2nd Percentile Speed (98 percent of cyclists)
Fast or commuter	18 mi/h (26 ft/sec)	14 mi/h (21 ft/sec)	12 mi/h (18 ft/sec)
Casual adult	12 mi/h (18 ft/sec)	10 mi/h (14 ft/sec)	8 mi/h (12 ft/sec)
Children	9 mi/h (13 ft/sec)	7 mi/h (11 ft/sec)	6 mi/h (9 ft/sec)

A startup time of 6 seconds should be added for time lost t_{lost} reacting to the green light and accelerating to full speed.

Subtracting from t_{cross} the actual yellow and red clearance intervals in use determines the minimum green interval on the minor street. Providing this minimum green in full minimizes the most likely type of clearance-time conflict.

NOTE

Sections 6.1 and 6.2 are a summary of the ITE Journal article *Signal Clearance Timing for Bicyclists*, Wachtel, Forester and Pelz, March 1995.

6.1.3 Progression

VTA Best Practice

Optimally, in areas such as commercial districts and Central Business Districts (CBD's), signals should be timed for bicycle speeds approximately 12 to 15 miles per hour. The high pedestrian activity typically found in these areas would also benefit from the slower speeds. This strategy is typically employed in areas such as CBD's where every block is signalized. Time-space diagrams should be checked for bicycle speed compatibility (12-15 mph) and adjusted if feasible.

Design Considerations

Signals along an arterial are often timed to maximize automobile throughput. Although this has positive benefits for fuel savings and auto-travel time, unfortunately this often means that they are ill-timed for bicyclists. A signalized arterial could be coordinated for bicycle speeds rather than motor vehicle speeds as has been done in Portland, Oregon where downtown streets are timed at 14 mph.

6.1.4 Visibility of Signal Heads

VTA Best Practice

Programmed visibility signal heads shall be positioned such that they are visible at the right-hand side of the right-most through lane or the bike lane where a bicyclist would be expected to travel. They shall also be positioned to be visible from the right-hand side of the right-most left-turn lane.

6.2 TRAFFIC SIGNAL DETECTION

Caltrans Standard

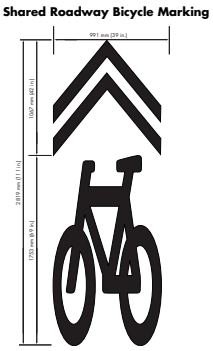
At actuated signals, the detection technology must be able to detect a bicycle. It is particularly imperative at intersections with major street recall, i.e. where minor streets only receive the green signal upon the detection of a vehicle. Bicycle detection is also important at left-turn lanes with protected left-turn phasing. Without bicycle detection, the bicyclist is forced to do one of the following: wait for a motor vehicle to arrive and trigger the light; dismount to push the pedestrian button (if there is one) or proceed on a red light.

New actuated signals or fixed timed signals that are being converted to actuated must ensure that the detection technology will detect bicycles on all approaches and movements.

This is California law per CVC 21400; Caltrans incorporated guidelines into CA MUTCD Section 4D.105

If cyclists are not detected by traffic detectors, they are subjected to undue delay from either waiting for a motorist to arrive, if at all, or having to dismount to find a pedestrian push button, if any. At times, cyclists are even forced to proceed during a gap in traffic.

inner lanes and/or left-turn lanes and/or median in order to provide more width in the outer lane. Many cities have narrowed inner travel lanes to eleven or even ten feet (and left-turn lanes even narrower); AASHTO supports reducing travel lanes to eleven feet on arterials, (and to nine feet on residential streets), which allows for greater width in the outer through lane.



MUTCD Figure 9C-104 (CA)

7.3 SHARED ROADWAY BICYCLE MARKING (SHARROW)

The "Sharrow" is used to inform both motorists and bicyclists of the safe positioning of the bicycle on a roadway without bike lanes or shoulders. It is intended to reduce the chance of drivers opening doors of parked vehicles in the path of bicyclists and to alert road users within a narrow traveled way of the lateral location where bicyclists ride. They have been shown to reduce wrong-way riding and sidewalk riding, which are associated with increased risk of collisions.

A typical layout is depicted in Figure 7-12.

7.3.1 Roadway Characteristics

9C.07

***Caltrans Standard* MUTCD 9C.~~103~~ (CA)**

Caltrans permits Sharrows on state highways only in urban areas.

Per MUTCD-CA, sharrows may be used where the roadway has the following characteristics:

- No bike lanes or shoulders
- Speed limit < 40 mph
- ~~Roadway with parallel parking~~

VTA Best Practice

In addition to the above, VTA recommends that the roadway:

- Be a designated bike route
- Have an ADT > 4,000 for a two-lane road or
- ADT > 12,000 for a four-lane road

For roadways with no on-street parking, VTA recommends that the outside lane be 14 feet (4.2 m) or less.

7.3.2 Placement

Caltrans Standard

- Lateral placement: centerline of symbol should be 11 ft min. (3.3 m) from edge of curb where there is on-street parking.
- Longitudinal placement: immediately after an intersection and every 250 feet (75 m).

~~*MUTCD CA states that the lateral distance may be increased as needed for roadway and traffic conditions.*~~

- Where there is no onstreet parking, the center line of the symbol should be at least four feet from the face of curb, or edge of pavement when there is no curb.

VTA Best Practice

VTA recommends that the lateral placement be 12 feet (3.6 m) based on the findings of a City of San Francisco study.

The lateral distance may be increased as needed for roadway and traffi c conditions.

For roadways with no parking, centerline of symbol should be ~~2.5 ft min. (0.8 m) from the curb face or~~ 2.0 ft min. (0.6 m) from gutter lip.

W11-1

7.3.3 Signage

VTA Best Practice

Urban-Install Bike Route G93 or G series per Chapter 8.

W16-1

Caltrans Option

Rural-the Share the Road Sign installation (W16-1 & W11-1) may be used to supplement the Shared Roadway Bicycle Marking. Share the Road signs should be installed after every major intersection and at one-half mile intervals.

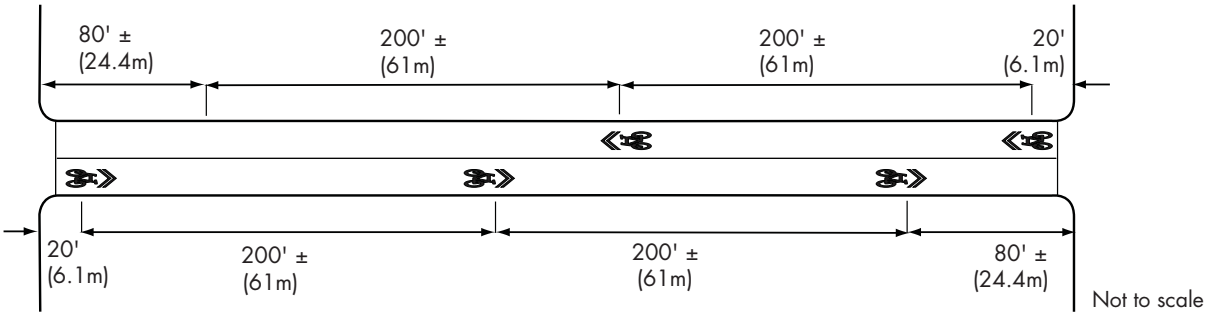


Figure 7-12:
Typical Sharrow Pavement Marking Installation