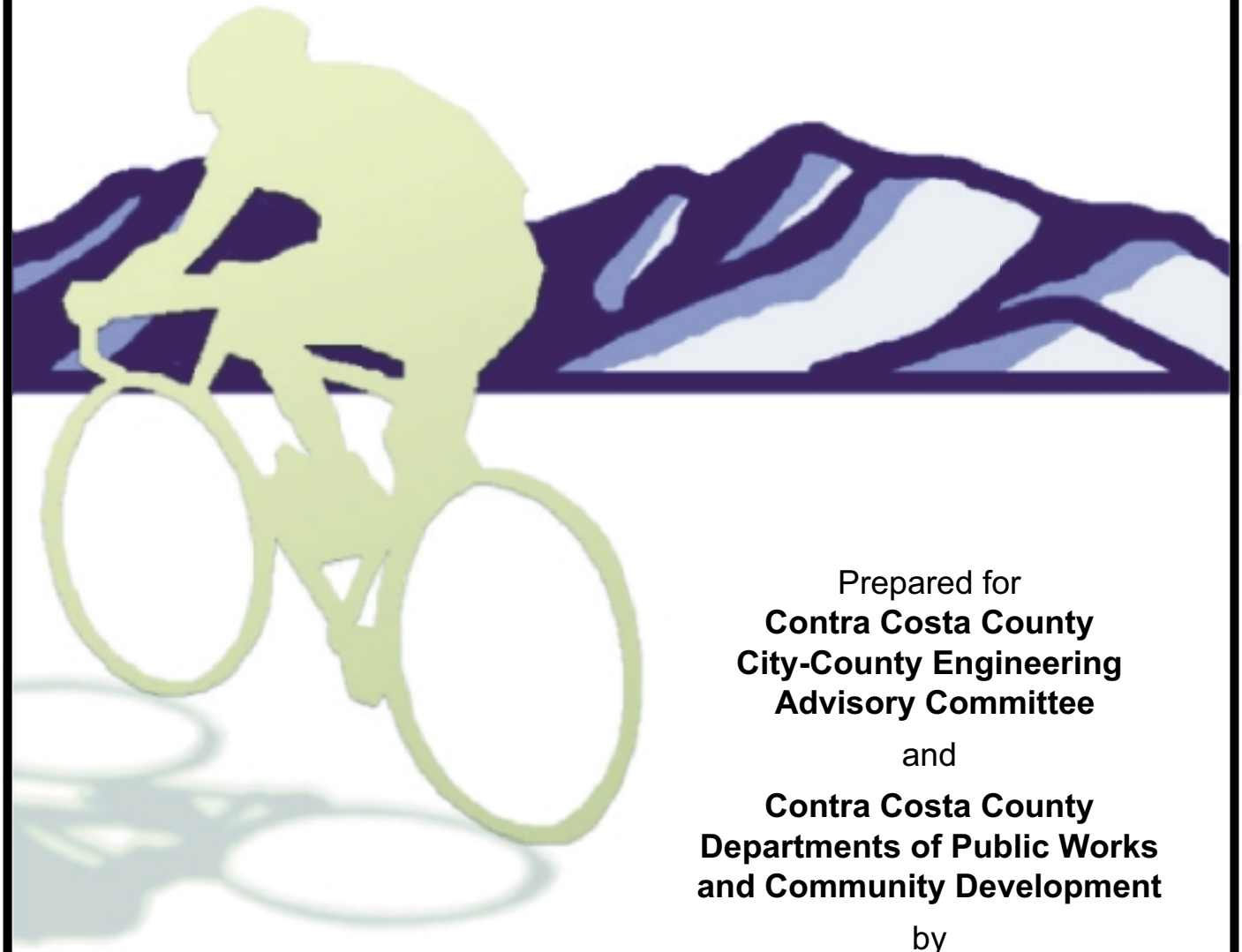
Contra Costa County
TRAIL DESIGN RESOURCE HANDBOOK



Prepared for
Contra Costa County
City-County Engineering
Advisory Committee

and

Contra Costa County
Departments of Public Works
and Community Development

by

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PURPOSE

Trails, like roadways, are designed and maintained by numerous jurisdictions and entities, even within a single city. From the user's perspective, the trails should be a seamless network. The major design features should be consistent, if not identical.

The purpose of the Contra Costa County Trail Design Resource Handbook is to facilitate and ensure consistency in the design and construction of bicycle trails throughout the county. Because mobility by bicycle, either on roadways or designated bikeways, does not stop at city limits, there is a need for a consistent countywide approach.

This resource manual is intended to be a model and a reference in the design of bicycle trails for Contra Costa's nineteen cities, the County, and park districts. Cities are encouraged to reference and/or adopt this handbook, where appropriate, as part of their own Bicycle Plans and/or General Plans.

Chapter 1000 of the Caltrans Highway Design Manual (HDM) is the primary source for bikeway standards in California. The HDM generally identifies minimum acceptable dimensions for various types of bikeways and discusses best practices as well as practices to avoid. The Contra Costa County Trail Design Resource Handbook supplements the HDM by providing guidance on when and how to exceed the HDM minimum standards for Class I bikeways (e.g. multiuse trails).

This handbook should be used in conjunction with the HDM and with sound engineering practices. It is not a textbook or a substitute for engineering knowledge, experience or judgment. This handbook does not attempt to detail basic engineering techniques; for these, standard textbooks should be used.

This handbook is intended as a reference tool for cities and the County. It is intended to address local concerns not addressed the HDM. The inclusion of any design option in this handbook is for illustrative purposes only and is not to be construed as a representation or warranty that bicycle trails in the County will conform to these designs.

This handbook does not establish a legal standard for the design and construction of bicycle trails in Contra Costa County. This handbook does not create or impose any standard of conduct or duty toward the public.

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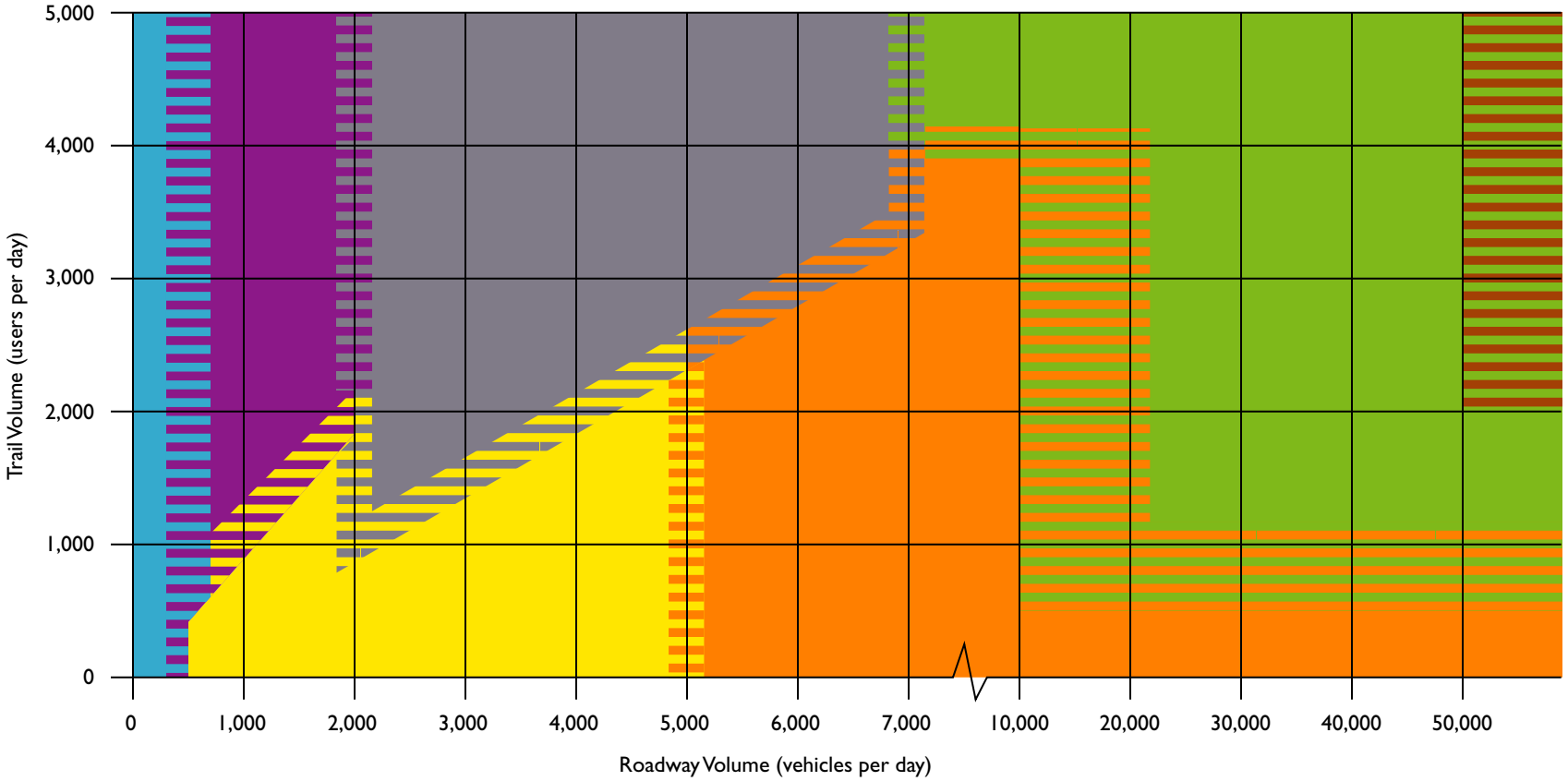
Figure 1-1: TRAFFIC CONTROL AT INTERSECTIONS
Options



Sheet must be viewed in color to be legible.

B 2-way yield - private roadway See Figure 6-1	**D/E** 2-way yield - trail at local roadway or 2-way stop-trail at local roadway See Figure 6-3	**G** 2-way stop - trail with median at collector-See Figure 6-4	**I** Traffic signal - arterial See Figure 6-4
C 2-way stop - local roadway See Figure 6-2	**F** 4-way stop at collector	**H** Flashing yellow beacon-arterial See Figure 6-5	**J** Grade separation (freeways or creeks)

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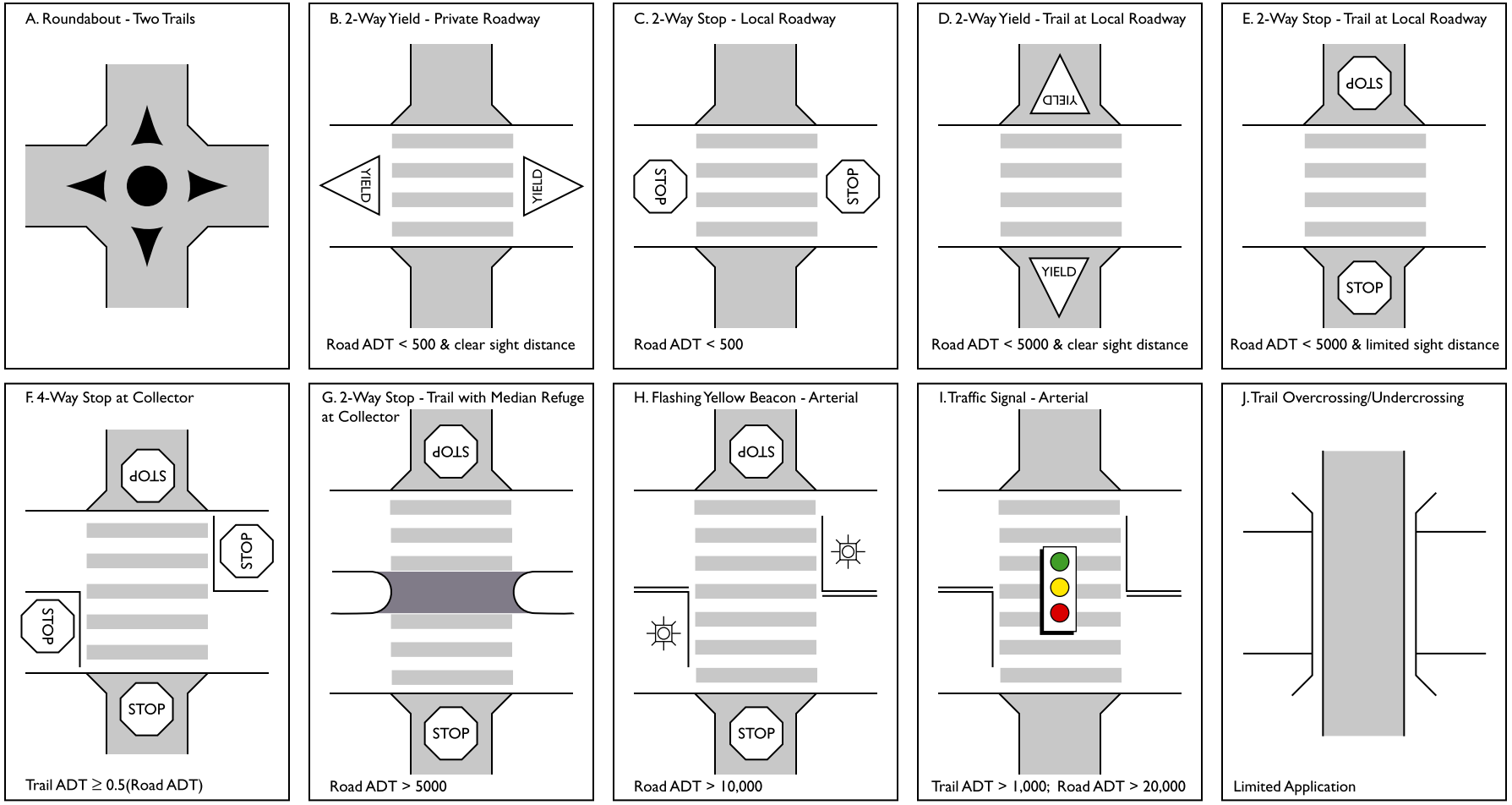
Figure 1-2

TRAFFIC CONTROL AT INTERSECTIONS
Summary

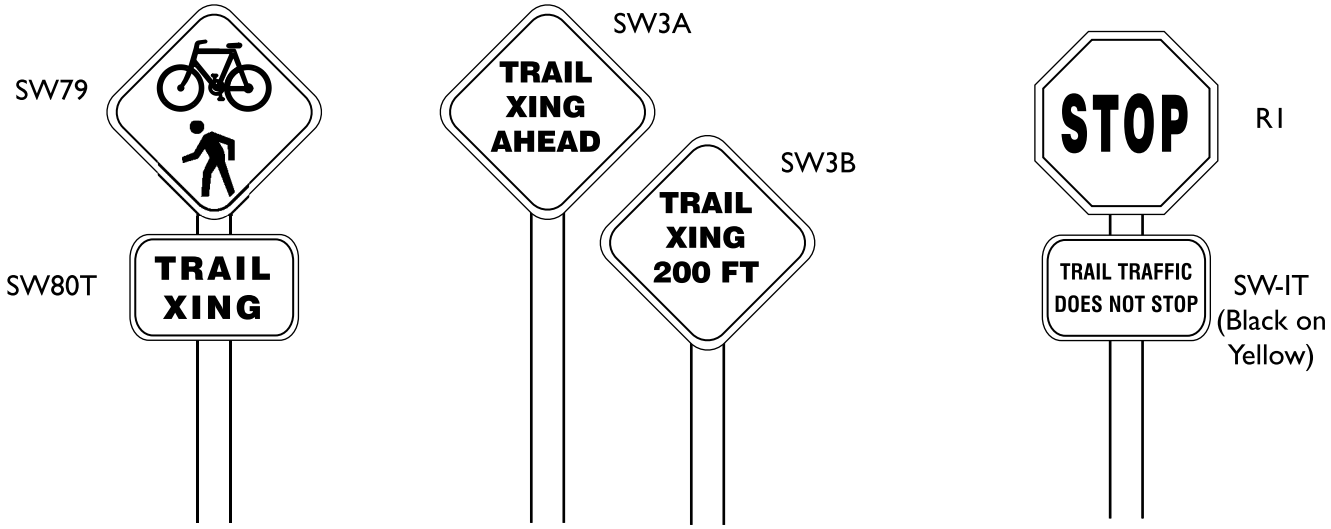


See Figure 1-1 for details of traffic control guidelines
See Figures 6-1 to 6-6 for more detailed design guidelines
Road ADT = Roadway Average Daily Traffic Volumes
Trail ADT = Trail Average Daily Traffic Volumes

Trail

Figure 2-1

ROADWAY SIGNAGE
Signs for Roadways at Trail Crossings

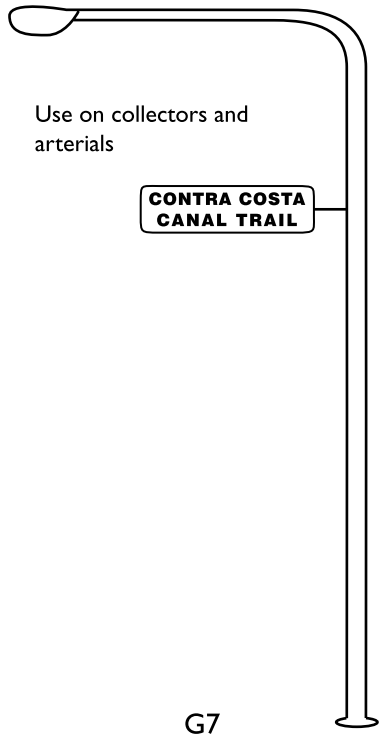


Placed at the trail crossing where roadway is not controlled by STOP, YIELD or traffic signal

Placed in advance of all trail crossings

TYPICAL FLASHING YELLOW BEACON

TYPICAL LARGE TRAIL NAME SIGN



Use on collectors and arterials

DESTINATION SIGN

SG-IR

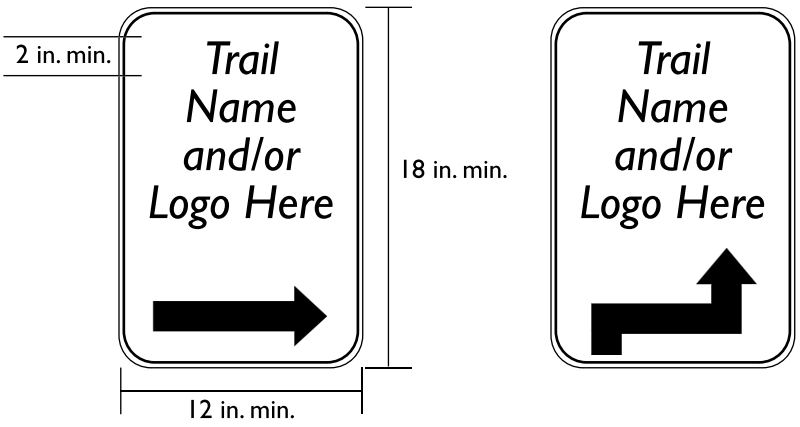
Figure 3-1

TRAIL SIGNAGE
Signs for Trails at Intersections

Trail Way-Finding Signs

EXISTING

RECOMMENDED SUPPLEMENTAL SIGNING
AT CIRCUITOUS TRAIL ROUTINGS



SG - 1R

SG - 1RL

Street Name Signs

EXISTING

Contra Costa Canal Trail

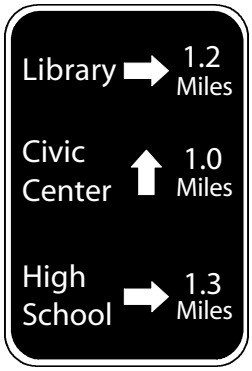
Ohlone Greenway

RECOMMENDED

Figure 3-2

TRAIL SIGNAGE
Signs for Trails at Intersections

DESTINATION SIGN



White on Green
SG-IT

TRAFFIC SIGNAL DETECTION SIGNS

MUTCD R10-13

MUTCD R62D

Figure 3-3

TRAIL SIGNAGE
Signs for Trails at Midblock

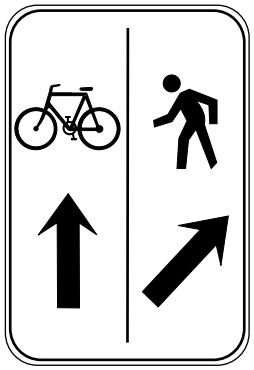
Trail Entry Signs

CONTRA COSTA CANAL TRAIL

OHLONE TRAIL

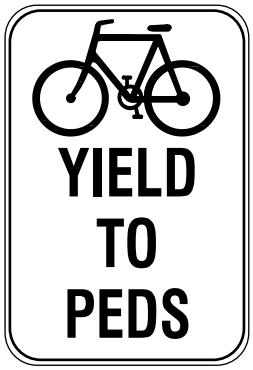
Other Recommended Signs

TRAIL WITH SEPARATE BIKE/PED PATHS



SR - R9

MULTI-USE TRAIL



MUTCD R9-6

SR-01T

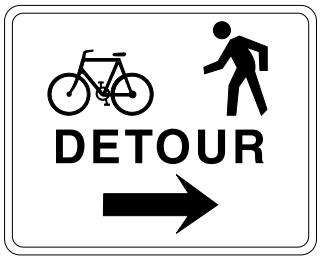
EBRPD Sign

Figure 3-4

TRAIL SIGNAGE
Signs for Maintainance/Construction Detours

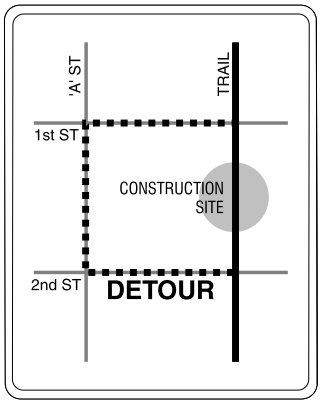
Advance Notice Sign SC-1

NOTE : Exact language of SC-1 sign will depend on circumstances at the time. Consider providing phone number of responsible agency.



Detour Sign SC-2

NOTE : Separate detours for pedestrians and bicyclists may be needed.



Schematic of Detour Route SC-3

NOTE : Providing a detour may not be practical or, alternatively, there may be several candidate detours. Trail operator should work with local agency to decide on an appropriate detour.

NOTE : Indicate trail status

Alternate messages

- **OPEN - WORK IN PROGESS**
- **HERBICIDE SPRAYING**

Figure 4-1

PAVEMENT LEGENDS

Install where trail grade >= 5% or where trail grade is 3% within 200 feet of stop sign.

Install with every R1 stop sign.

Install 100 feet in advance of stop sign.

Install with every R1-2 yield sign. (See MUTCD 2000, figure 3-24).

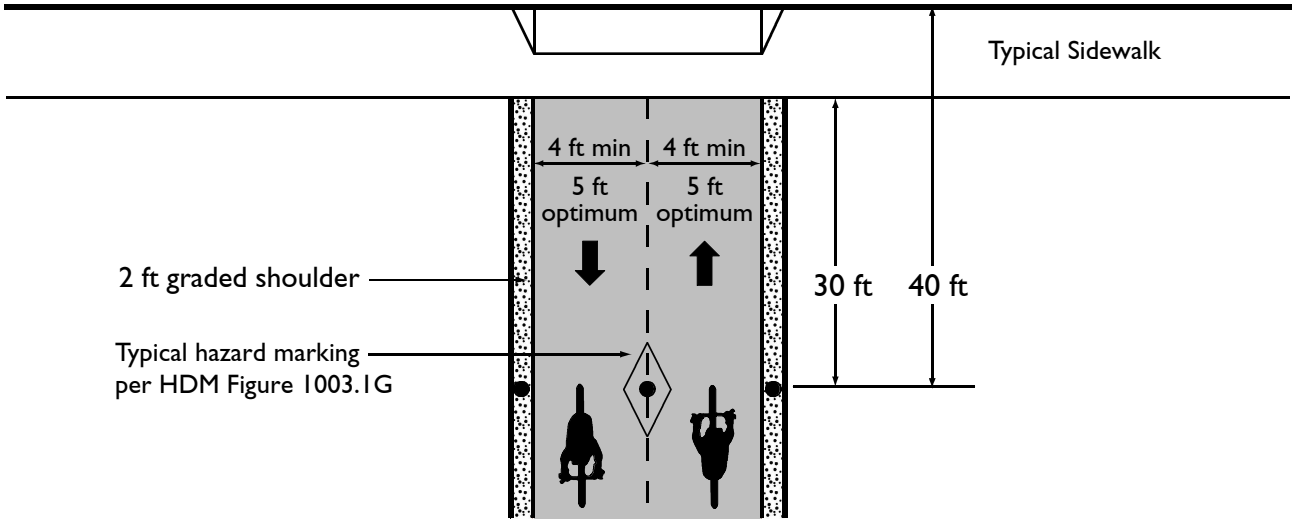
4-inch yellow centerline stripe. Install for 50 feet approaching each intersection and throughout horizontal curve. A centerline throughout entire trail would facilitate night trail use by improving visibility of trail.

Install at entrance where bikes and peds use separate paths. Place approximately every 500 feet if needed to improve compliance.

Figure 5-1

BOLLARDS

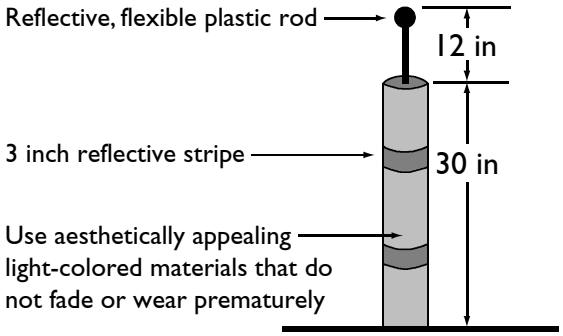
TYPICAL BOLLARD LAYOUT



NOTES

1. Bollards should only be used where there has been a documented problem of abuse by motor vehicles. Bollards may also be used to slow bicycles or draw attention to hazards.
2. One bollard in the center of the path is usually sufficient to discourage motor vehicles. If more than one bollard is used, a minimum paved width of 5 feet must be provided to allow trailers and bicycle with panniers to pass.
3. Two gaps shall be provided between the bollards so that two directions of bike traffic can pass safely.

OPTIMUM BOLLARD DESIGN



ALTERNATIVE TO BOLLARDS

An alternative to bollards where there is adequate right-of-way is to divide the trail into two short one-way segments at the intersection approach.

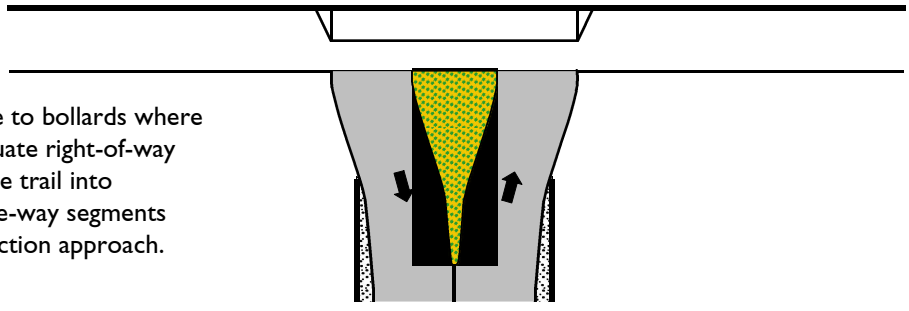
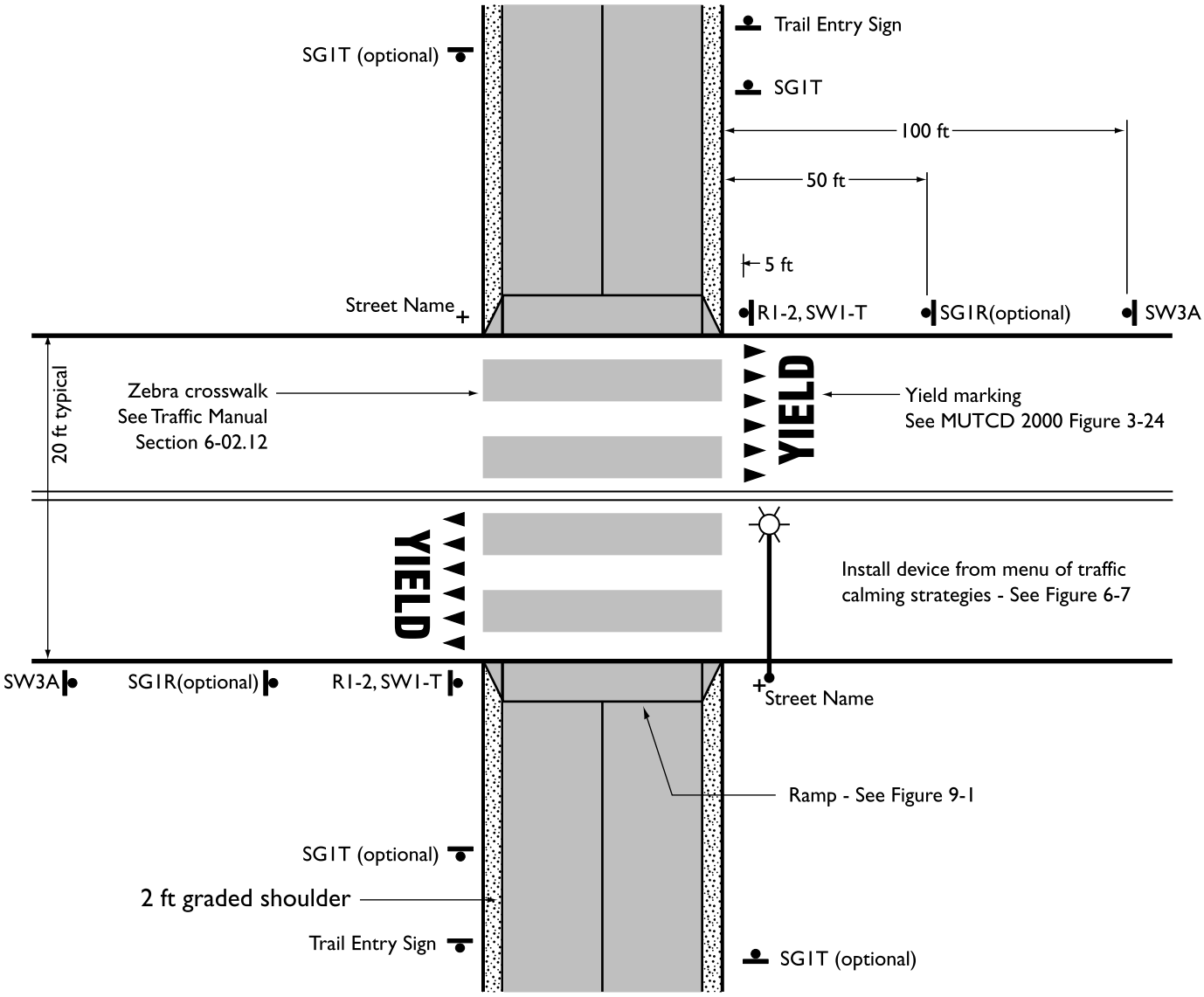


Figure 6-1

CONCEPTUAL INTERSECTION DESIGN
Condition B: Trail Crossing at Private Road/Driveway



Consider where:

Speed is <= 15 mph
ADT is <= 500vpd
Sight Distance >= 200 ft

Notes:

1. If neither speed hump nor speed bump is used, install stop sign instead of yield.
2. If sight distance is less than 200 feet, install stop sign and speed hump/bump.
3. If bollards are used, see Figure 5-1.
4. If slope of trail is > 5%, see Figure 10-1.
5. Consider on-street parking restrictions to maintain adequate sight distance.
6. Refer to Figure 6-7 for details on traffic calming strategies

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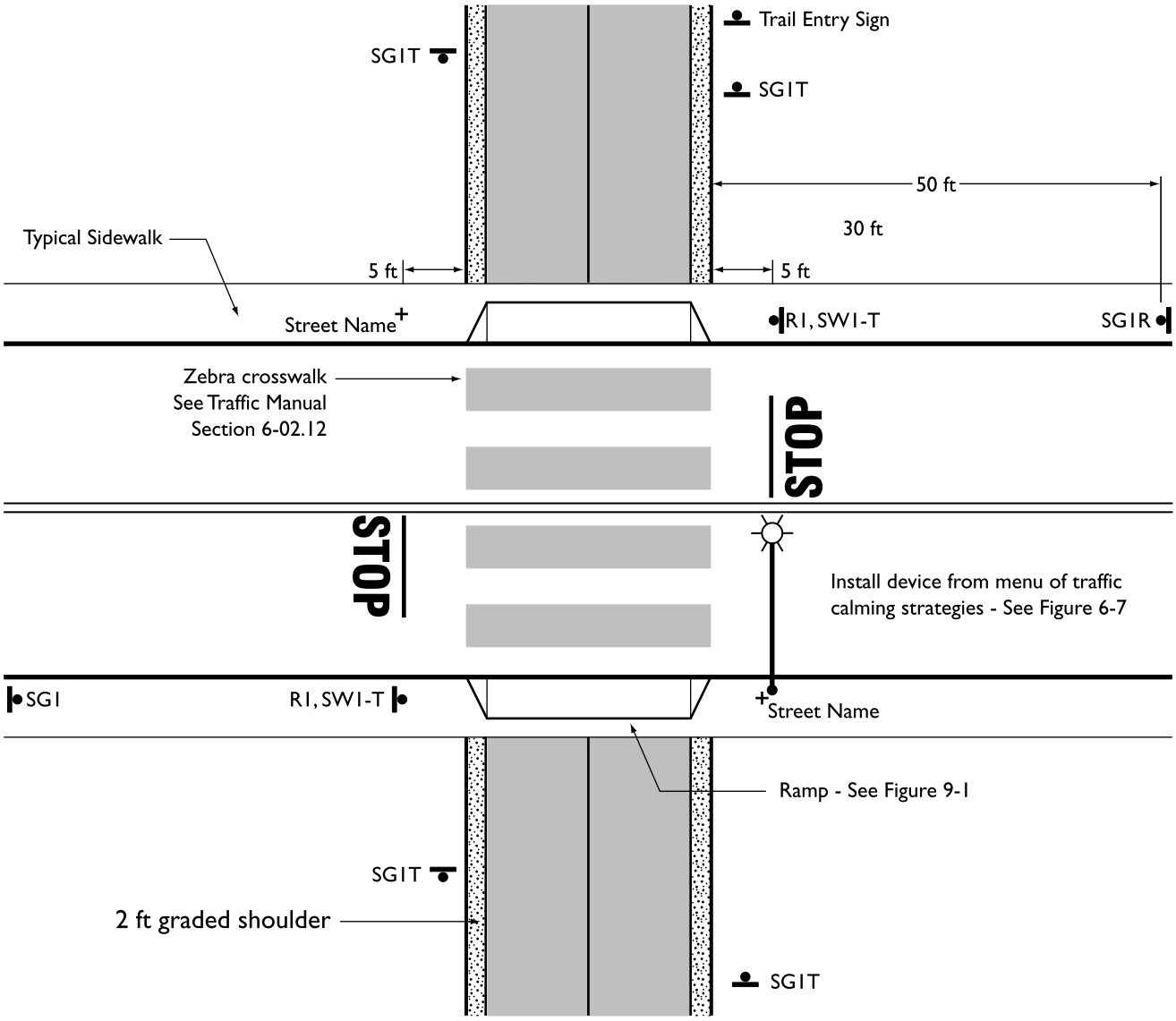
Figure 6-2

CONCEPTUAL INTERSECTION DESIGN
Condition C: Trail Crossing at Local Street with Very Low Volume



Consider where:

Speed is <= 25 mph
ADT is <= 500vpd

Notes:

1. Alternatively, use raised speed table instead of speed humps, as shown in Figure 6-3.

2. If bollards are used, see Figure 5-1.

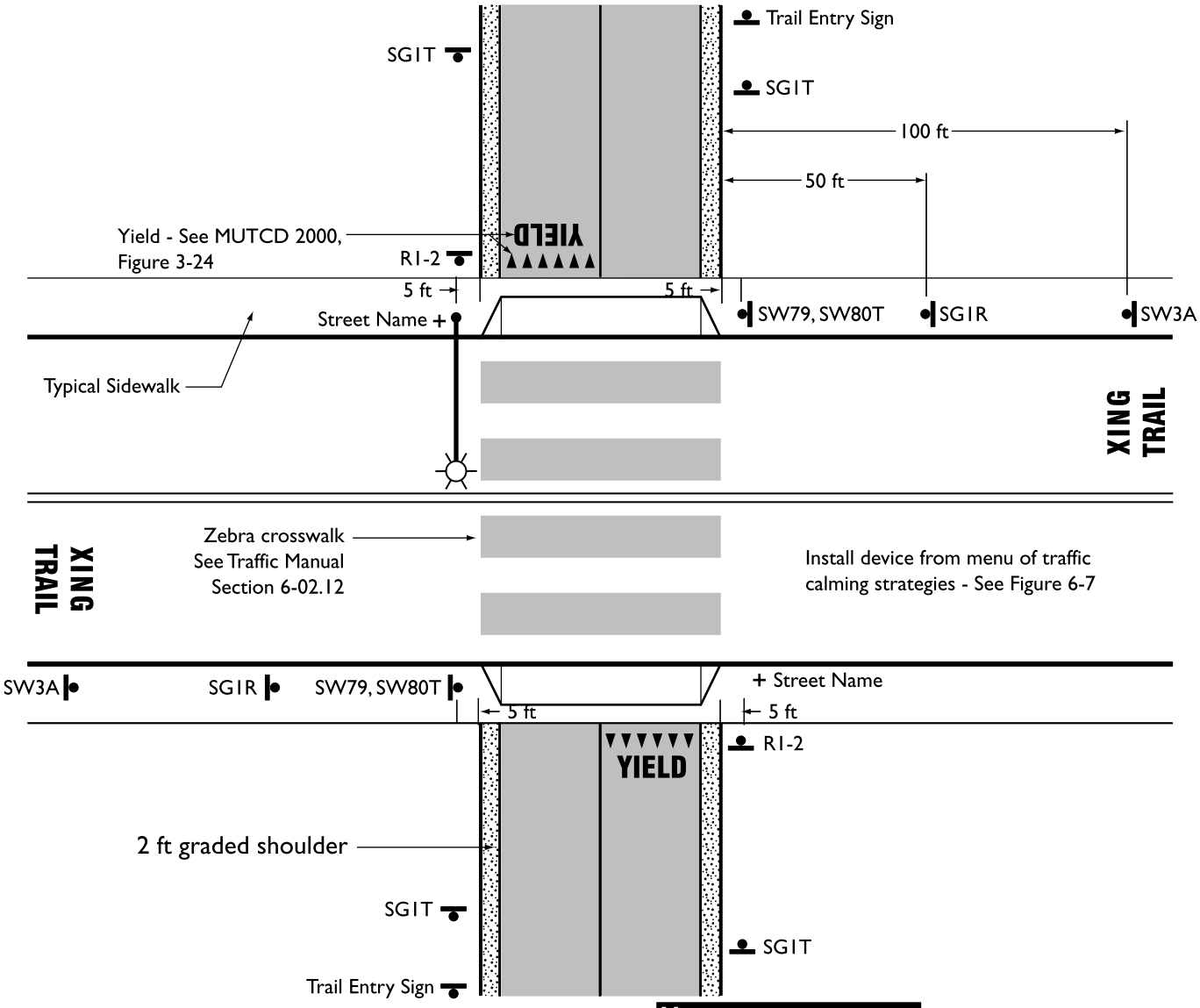
3. If slope of trail is > 5%, see Figure 10-1.

4. Consider on-street parking restrictions to maintain adequate sight distance.

5. Refer to Figure 6-7 for details on traffic calming strategies

Figure 6-3

CONCEPTUAL INTERSECTION DESIGN
Condition D and E: Trail Crossing at Local Street



Consider where:

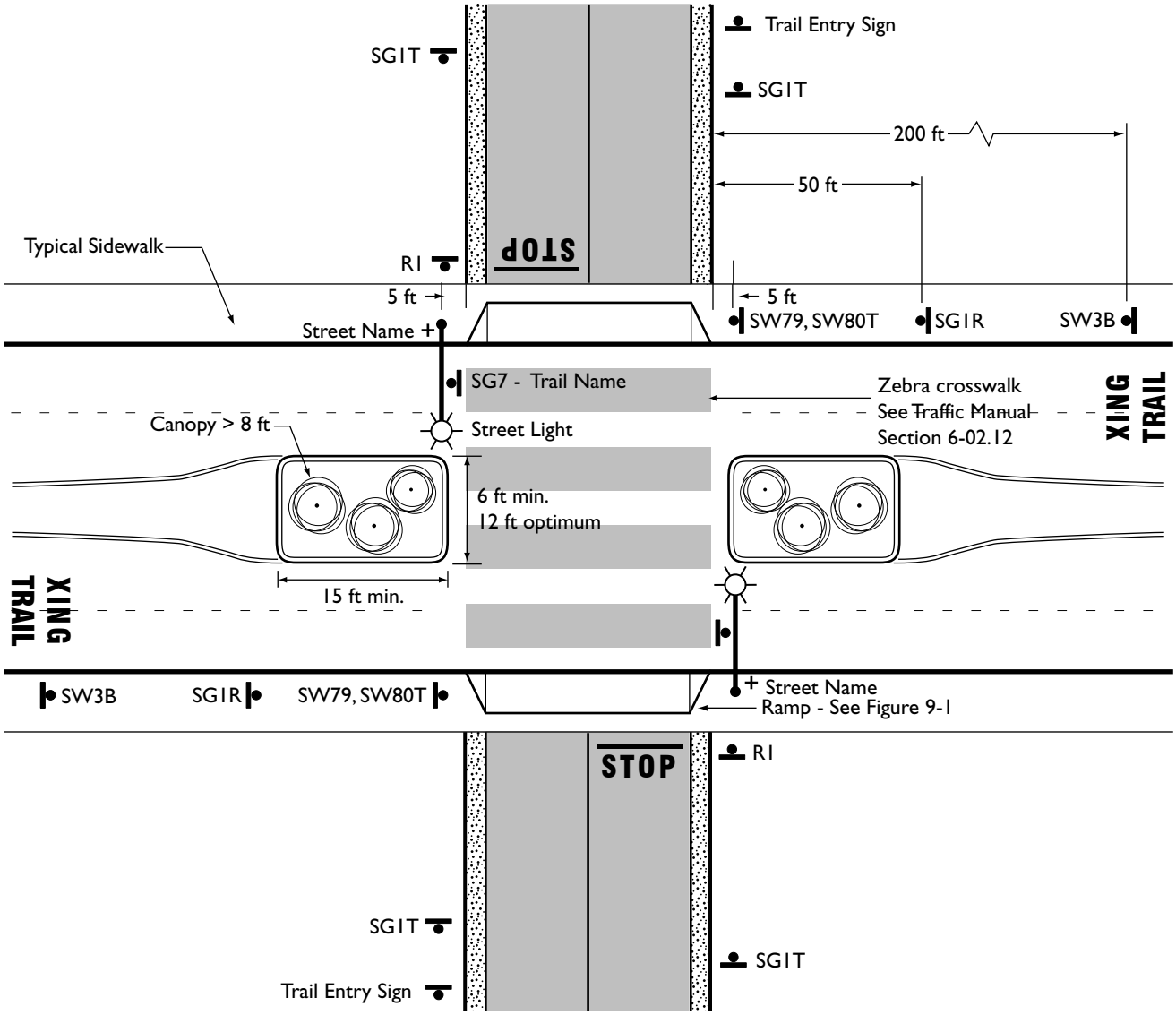
Speed is <= 25 mph
ADT is >= 500 vpd and <= 5000 vpd
Sight Distance >= 200 ft

Notes:

1. If $V_T > V_R$, install R1-2 Yield on Roadway.
2. If sight distance <= 200 ft, install R1-STOP for trail users.
3. If bollards are used, see Figure 5-1.
4. If slope of trail is > 5%, see Figure 10-1.
5. Consider on-street parking restrictions to maintain adequate sight distance.
6. Refer to Figure 6-7 for details on traffic calming strategies

Figure 6-4

CONCEPTUAL INTERSECTION DESIGN
Condition G: Trail Crossing at Arterial or Collector with Median Refuge



Consider where:

Speed is >= 30 mph or
ADT is > 5000 vpd or
4 or more lanes

Notes:

1. If bollards are used, see Figure 5-1.

2. If slope of trail is > 5%, see Figure 10-1.

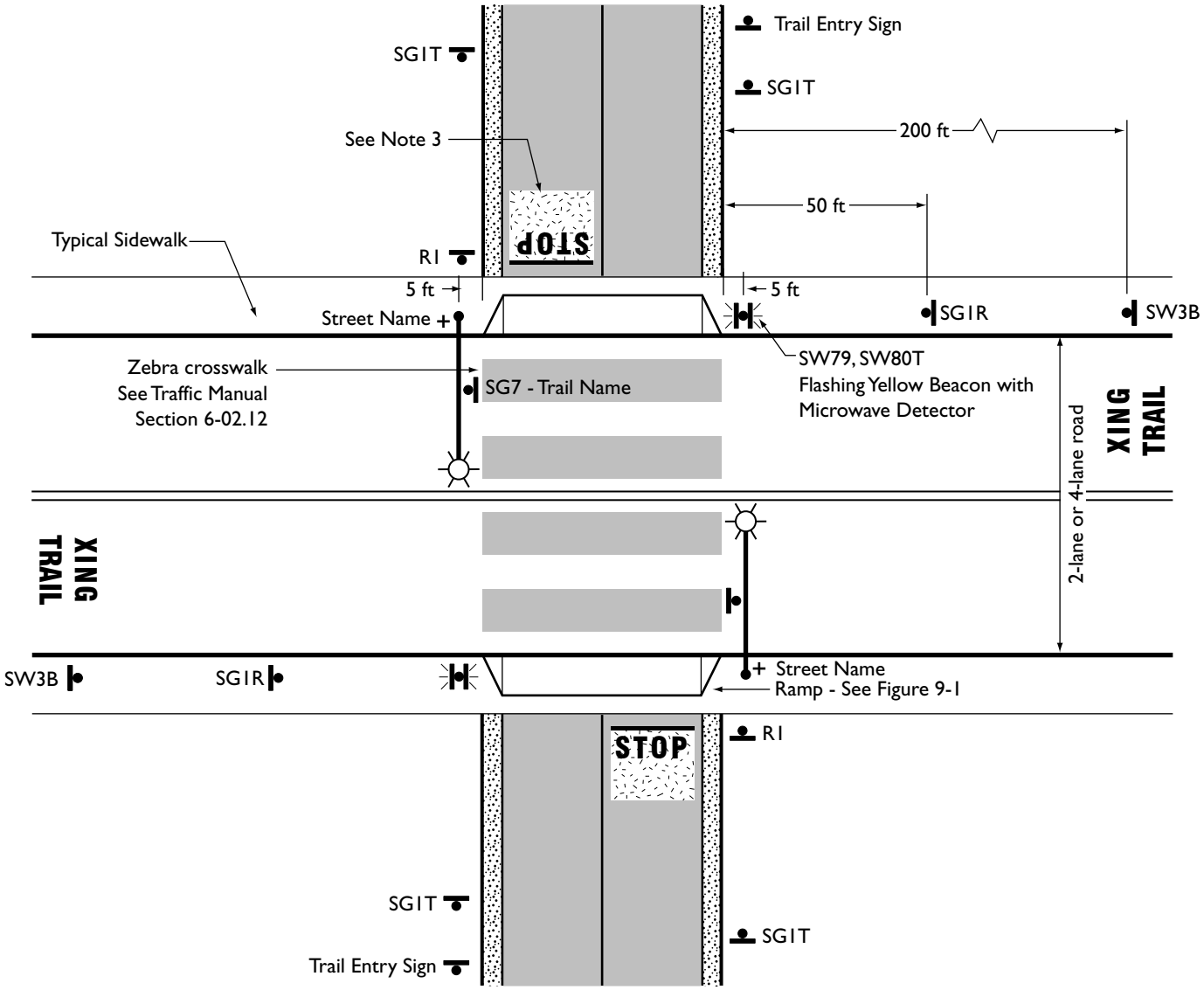
3. Maintain stopping sight distance appropriate for critical speed of motor vehicles.

4. Consider on-street parking restrictions to maintain adequate sight distance.

5. Refer to Figure 6-7 for details on traffic calming strategies

Figure 6-5

CONCEPTUAL INTERSECTION DESIGN
Condition H: Trail Crossing at Arterial/Major Collector with Flashing Yellow Beacon



Consider where:

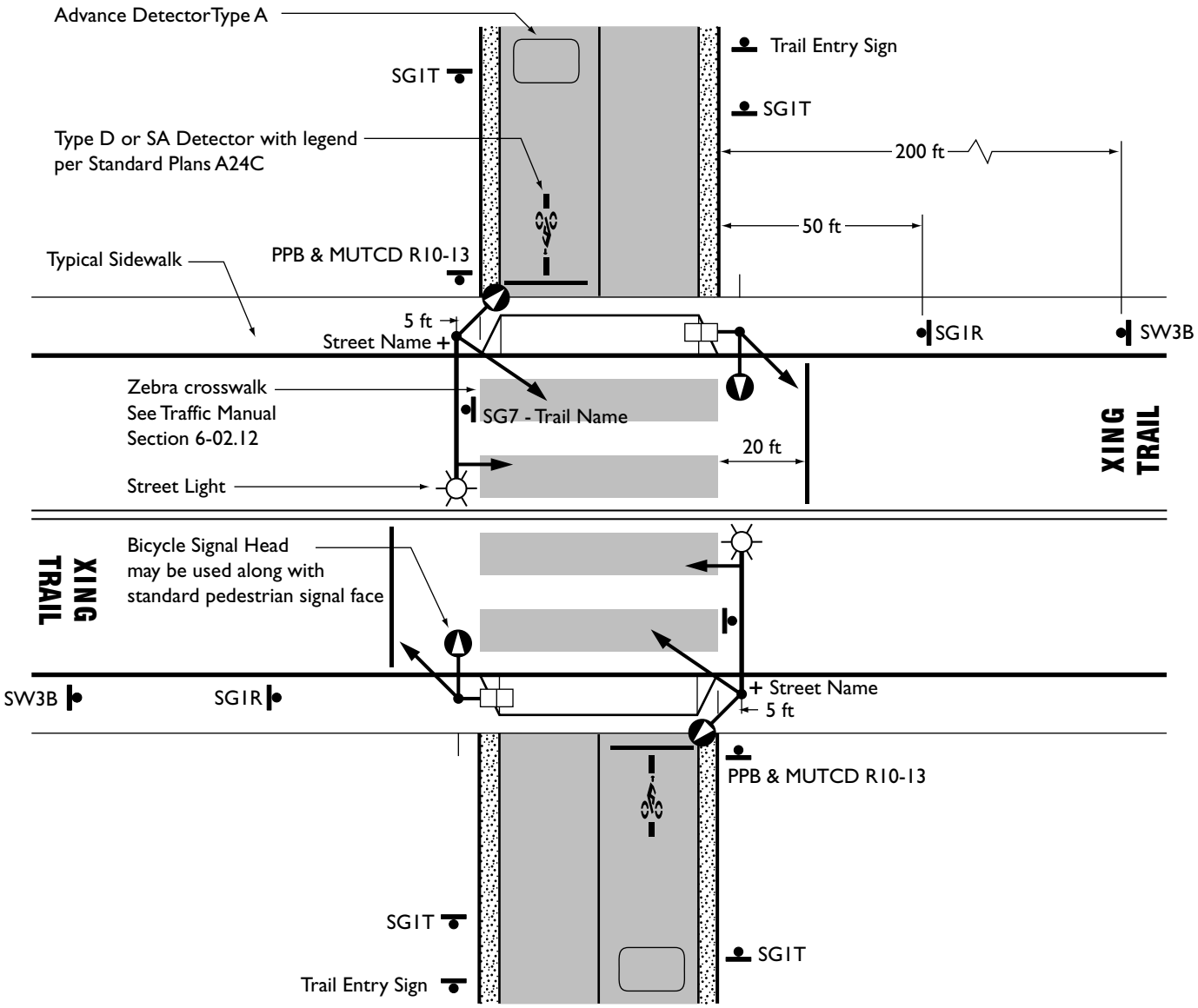
Speed is >= 30 mph
ADT is > 10,000 vpd (4-lane road)
or ADT is > 5,000 vpd (2-lane road)
Trail ADT is > 500

Notes:

1. Median refuge, bulbouts, and/or inpavement flashes may be considered in conjunction with this design.
2. If bollards are used, see Figure 5-1.
3. If slope of trail is > 5%, see Figure 10-1.
4. If passive detection for Flashing Yellow Beacon is used, provide hatched areas to indicate where trail users must wait to be detected and install SR3 sign.
5. Consider on-street parking restrictions to maintain adequate sight distance.
6. Refer to Figure 6-7 for details on traffic calming strategies

Figure 6-6

CONCEPTUAL INTERSECTION DESIGN
Condition I: Trail Crossing at Arterial/Major Collector with Traffic Signal



Consider where:

ADT is > 20,000 vpd (4-lane road)
or ADT is > 6,000 vpd (2-lane road)
Trail ADT is > 1,000

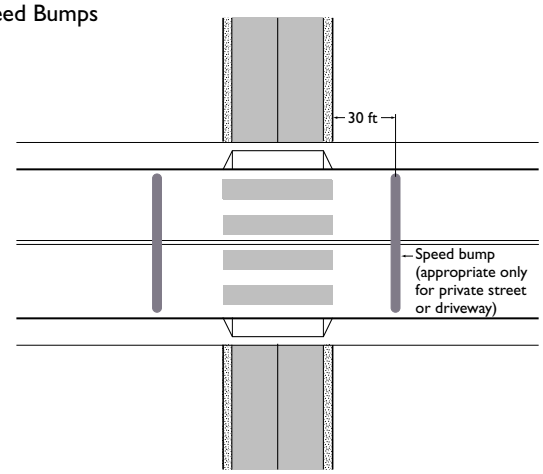
Notes:

1. During non-peak hours, response time for trail green phase should be short, 10 seconds if possible. Also, during non-peak hours, consider setting the signal operation to flashing yellow for roadway and flashing red for trail.
2. If bike detector is not provided, use push button with min. diameter of 3 inches located no more than 2 feet from edge of pathway and install MUTCD R9-5 sign.
3. PPB (pedestrian push button) should always be located to the right of the trail.
4. If bollards are used, see Figure 5-1.
5. Consult Caltrans *Traffic Manual* for signal design details.
6. Consider on-street parking restrictions to maintain adequate sight distance.
7. Refer to Figure 6-7 for details on traffic calming strategies

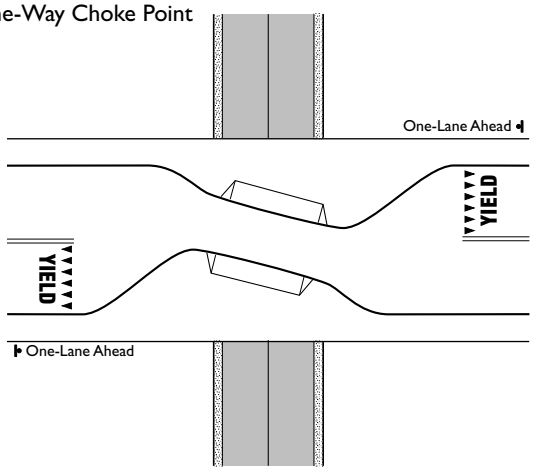
Figure 6-7

MENU OF TRAFFIC CALMING STRATEGIES

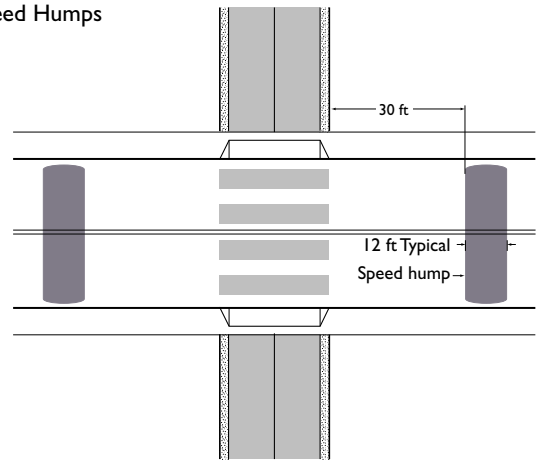
Speed Bumps



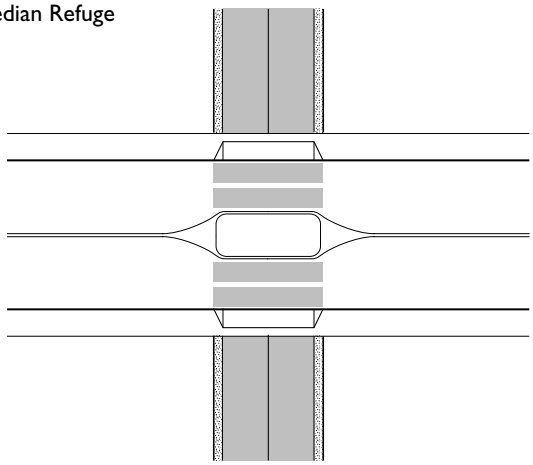
One-Way Choke Point



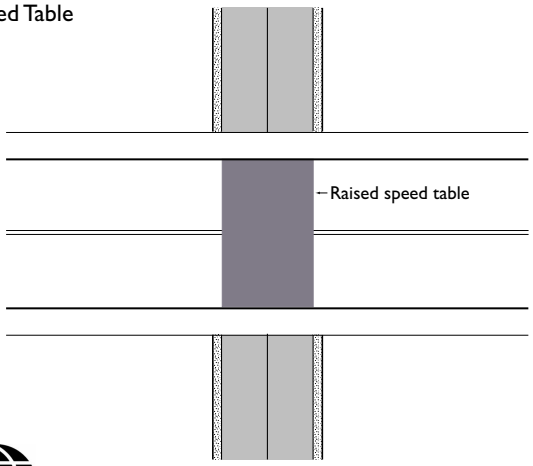
Speed Humps



Median Refuge



Speed Table



Bulbouts

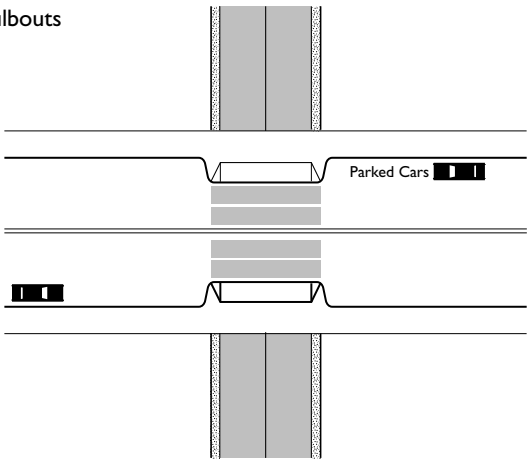


Figure 7-1

GRADED SHOULDERS

Width
- Minimum Width: 2 feet (0.6 m)
- Optimum Width: 3 feet (0.9 m)

Slope
- Maximum Slope: 1:6;
- Minimum slope: 1:50

Surface material
- Granular stone or natural surface

Distance to obstructions
- Distance to sharp drop-off: 5 feet (1.5 m)

Sprinkler Heads
- Sprinkler heads, if used to maintain landscaping in the trail corridor, should be located at the outside edge of the shoulder and should be designed so that the water does not land on the trail or shoulder.

To optimize the use of the graded shoulder by runners, pedestrians and equestrians, the following design guidelines are recommended:
- Optimum Width: 5 feet (1.5 m)
- Optimum Slope: 1:20
- Material: decomposed granite
- Sprinkler heads (if used) located at edge of shoulder

Figure 8-1

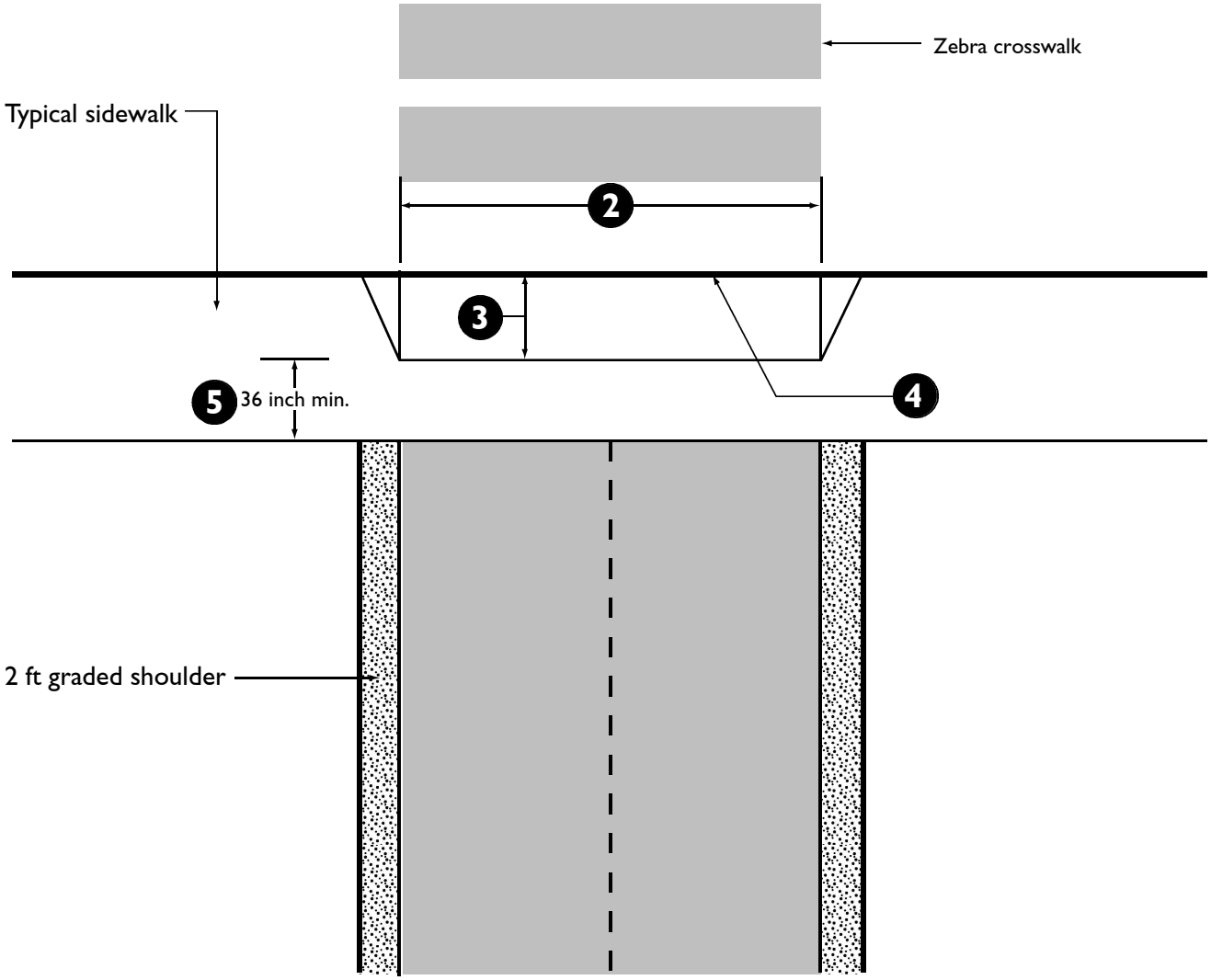
MAINTENANCE

The East Bay Regional Park District's Trail Manual for the Maintenance and Operation of Trails in the East Bay Regional Park District, November 1995 is hereby incorporated by reference. The following maintenance guidelines are intended to supplement those in the EBRPD Manual to maximize the utility of trails used for transportation purposes. These guidelines apply to all maintenance vehicles regardless of agency, i.e. the City, Contra Costa Water District, PG&E and/or the EBRPD.

- Trails should be inspected regularly and after heavy rains and wind.
- Shrubbery trimmings should be piled on the side of trail if possible.
- Blackberry bushes and other bushes with thorns should be eradicated.
- After maintenance work, trail should be swept clear of debris and mud.
- Trail should not be totally blocked by a maintenance vehicle unless it is unavoidable and a warning sign is posted at entrance to trail. (See Figure 3-3).
- Warning signs should be installed when spraying herbicides. These should be installed at the entrance to the trail segments.
- Hazard Report Forms (with the agency's phone and fax numbers) should be at locations where trail maps are distributed. A phone number should also be posted in the event forms have run out.

Figure 9-1

RAMPS



1. Ramp should align with trail and crosswalk.

2. Ramp width should be same as trail width.

3. Ramp slope should be 5% maximum.

4. Ramp lip should be flush with pavement (vertical difference of 0.25 inch maximum).

5. All applicable ADA or Title 24 guidelines should be met such as maintaining 36 inch clear space or design flair in accordance with ADA guidelines.