

Revised

January
2015

Bicycle Policy & Design Guidelines

Maryland State Highway Administration



RECORD OF CHANGES TO THE MAY 2013 BICYCLE POLICY & DESIGN GUIDELINES

Introduction

The 2013 Bicycle Policy & Design Guidelines have been revised and enhanced. Below is a description of some of the major changes to the document. **Bolded text** reflects changes or additions to the text from the previous version. ~~Strikeout text~~ reflects text removals from the previous version.

Chapter 2

Section	Page	Change
2.1	2.2	Table 2.1 - *Add 1 foot minimum to the shoulder/lane width if operating adjacent to traffic barrier, concrete barrier, a curb without a gutter pan, or on-street parking .
2.6	2.8	Section 2.6 – A through bicycle lane shall not be positioned to the right of a right turn only lane or to the left of a left turn only lane.
2.6	2.9	Figure 2.11 – NEW!
2.6	2.10	Figure 2.12 – NEW!
2.6	2.13	Table 2.2 – NEW! The pocket lane is an extension of the bicycle lane; therefore, the width of the bicycle lane must be maintained through the pocket lane. However, the pocket lane shall be a minimum width of 5 ft. It is desirable to give bicyclists enough space in the pocket lane to feel comfortable being passed by motorists on both sides. See Table 2.2 for further guidance on minimum pocket lane widths.
2.10	2.14	The bike lane shall be placed to the left of the deceleration lane as shown in Figure 2.15.
2.10	2.14	Figure 2.15 – Changed sign from R3-17 to R4-4.
2.10	2.15	Figure 2.16 – NEW!
2.11	2.16	<ul style="list-style-type: none"> • For roadways with auxiliary lanes that extend over a quarter of a mile, the bike lane may be kept adjacent to the curb line. At the last intersection where vehicular turning traffic must turn right, the bike lane shall be placed to the left of the right turn only lane; • For roadways with auxiliary lanes that extend less than one quarter mile, the bike lane should be placed to the left of the auxiliary lane.
2.12	2.18	Figure 2.18 – NEW!

Chapter 3

Section	Page	Change
3.1	3.1	In Maryland, bicycles are permitted on all roadways except where they are specifically prohibited with signs, i.e., most controlled access highways. However, on roads where the posted speed limit is more than 50 mph , bicycles may use the shoulder adjacent to a roadway and enter the roadway only if making or attempting to make a left turn; crossing through an intersection; or the shoulder is overlaid with a right turn lane, a merge lane, a bypass lane, or any other marking that breaks the continuity of the shoulder.
3.2	3.2	Sharrows should be placed: A minimum of 4 ft. from the edge of the parking edge line to the center of the sharrow marking when used adjacent to a parking lane. (Reflected change in Figure 3.3)
3.2	3.3	Figure 3.4 – NEW!
3.3	3.4	A SHARE THE ROAD assembly should be used for the following conditions: <ul style="list-style-type: none">• Where the rightmost travel lane is greater than or equal to 13 feet or less than 15 feet wide, and there is insufficient shoulder width or the shoulder is otherwise un-rideable.

Chapter 5

Section	Page	Change
Intro	5.1	When deciding upon where to transition between bicycle facilities near an intersection, the intersection is the preferred breaking point. One facility should end prior to the intersection and one should start after the intersection.
5.2	5.4	Figure 5.3 – 4 ft. minimum distance from the edge of the parking edge line to the center of the sharrow marking.
5.2	5.5	Figure 5.4 – Changed sign from W16-1(3) to R4-11.
5.2	5.9	Figure 5.8 – Changed sign from W16-1(3) to R4-11.
5.2	5.12	Figure 5.11 – 4 ft. minimum distance from the edge of the parking edge line to the center of the sharrow marking.
5.2	5.13	Figure 5.12 – Changed sign from W16-1(3) to R4-11.

5.2	5.14	Figure 5.13 – 4 ft. minimum distance from the edge of the parking edge line to the center of the sharrow marking.
5.2	5.15	Figure 5.14 – 4 ft. minimum distance from the edge of the parking edge line to the center of the sharrow marking.
5.2	5.16	Figure 5.15 – 4 ft. minimum distance from the edge of the parking edge line to the center of the sharrow marking.
5.2	5.17	Figure 5.16 – 4 ft. minimum distance from the edge of the parking edge line to the center of the sharrow marking and changed sign from W16-1(3) to R4-11.
5.2	5.21	Figure 5.20 – 4 ft. minimum distance from the edge of the parking edge line to the center of the sharrow marking.

Chapter 6

Section	Page	Change
6.2	6.1 – 6.2	A more thorough description of bike route types is provided.

Chapter 7

Section	Page	Change
7.13	7.8	Figure 7.6 – NEW!

Chapter 10 – NEW!

Section	Page	Change
10.1	10.1 – 10.3	Guidance on One-Way Cycle Tracks
10.2	10.3 – 10.4	Guidance on Buffered Bike Lanes
10.3	10.5 – 10.6	Guidance on Bike Boxes

Appendix C

Section	Page	Change
21-1205.1	C.11	Revised bicycle law for roadways posted more than 50 mph.

TABLE OF CONTENTS

	Chapter 1: Introduction.....	1.1
	Chapter 2: Bike Lane Design.....	2.1
	Chapter 3: Shared Lane Design.....	3.1
	Chapter 4: Riding Surface and Roadside Features.....	4.1
	Chapter 5: Bicycle Facility Transitions.....	5.1
	Chapter 6: Bicycle Routes.....	6.1
	Chapter 7: Shared Use Paths.....	7.1
	Chapter 8: Bicycle Access at Interchanges and Bridges.....	8.1
	Chapter 9: Accommodating Bicyclists through Work Zones.....	9.1
	Chapter 10: Innovative Bicycle Design Features.....	10.1
	Appendix A: Bibliography.....	A.1
	Appendix B: Definitions.....	B.1
	Appendix C: Annotated Code of Maryland Related to Bicycles.....	C.1

LIST OF TABLES

TABLE NUMBER	TITLE	PAGE
2.1	Marked Bike Lanes	2.2, 2.5, 2.6, 5.1, 8.2
2.2	Minimum Pocket Lane Width	2.13
2.3	Pocket Lane – Bicycle Pavement Marking Placement	2.13
5.1	Bikeway Transitions	5.1
7.1	Friction Factor on Pavement	7.6

LIST OF FIGURES

FIGURE NUMBER	TITLE	PAGE
1.1	MD 237 Bike Lane	1.4
1.2	MD 26 Bike Route	1.5
1.3	Shared Lane – Baltimore City	1.5
1.4	Shared-Use Path	1.5
2.1	Signed and Marked Bike Lane	2.1
2.2	Bike Lane Marking	2.2
2.3	BIKE LANE sign	2.3
2.4	BIKE LANE sign with AHEAD plaque	2.3
2.5	BIKE LANE sign with ENDS plaque	2.3
2.6	BEGIN RIGHT TURN LANE, YIELD TO BIKES sign	2.4

FIGURE NUMBER	TITLE	PAGE
2.7	Designated Bicycle Lane: Closed Section – With Parking	2.4
2.8	Designated Bicycle Lane: Closed Section Midblock - No Parking	2.5
2.9	Designated Bicycle Lane: Open Section Midblock – No Parking	2.6
2.10	Example of Bicycle Lane Treatment at Right Turn Only Lane or Deceleration Lane	2.8
2.11	Pocket Lanes Through Intersection	2.9
2.12	Pocket Lanes with Pork Chop Islands	2.10
2.13	Examples of Intersection Pavement Markings - Designated Bicycle Lane with Left-Turn Area, Heavy Turn Volumes, Parking, One-Way Traffic, or Divided Highway	2.11
2.14	Example of Pavement Markings for Bicycle Lanes at Intersections	2.12
2.15	Example of Bicycle Lane Placed to Left of Deceleration Lane	2.14
2.16	Bike Lane with Free Right Movement	2.15
2.17	Example of Bicycle Lane Placed to Right of Acceleration Lane	2.16
2.18	Bicycle Lane Adjacent to Shoulder Bypass Lane	2.18
3.1	Shared Lane Marking (Sharrow)	3.1
3.2	Shared Lane Marking (Sharrow) US 113 in Salisbury	3.1
3.3	Example Shared Lane Marking Placement	3.2
3.4	Sharrows Approaching Intersection	3.3
3.5	SHARE THE ROAD assembly	3.4
3.6a	BICYCLES MAY USE FULL LANE regulatory sign	3.5
3.6b	BICYCLES MAY USE FULL LANE with “NOTICE” sign	3.5
3.7	BICYCLES MAY USE FULL LANE warning sign	3.5

FIGURE NUMBER	TITLE	PAGE
4.1	Railroad Crossings	4.1
4.2	Skewed Crossing sign	4.1
4.3	Poor Concrete Seam Placement	4.2
4.4	Rumble Strip Gap Spacing to Accommodate Bicyclists	4.2
4.5	Shoulder Drop Off	4.3
4.6	Non-compliant Inlet Grate	4.3
5.1	Example of Typical Transition from BIKE LANE without Parking to BIKE LANE with Parking	5.2
5.2	Example of Typical Transition from BIKE LANE without Parking to Shared Lane without Parking	5.3
5.3	Example of Typical Transition from BIKE LANE without Parking to Shared Lane with Parking	5.4
5.4	Example of Typical Transition from BIKE LANE without Parking to Narrow or No Shoulder	5.5
5.5	Example of Typical Transition from BIKE LANE with Parking to BIKE LANE without Parking	5.6
5.6	Example of Typical Transition from BIKE LANE with Parking to Shared Lane without Parking	5.7
5.7	Example of Typical Transition from BIKE LANE with Parking to Shared Lane with Parking	5.8
5.8	Example of Typical Transition from BIKE LANE with Parking to Narrow or No Shoulder	5.9
5.9	Example of Typical Transition from Shared Lane without Parking to BIKE LANE without Parking	5.10
5.10	Example of Typical Transition from Shared Lane without Parking to BIKE LANE with Parking	5.11
5.11	Example of Typical Transition from Shared Lane without Parking to Shared Lane with Parking	5.12
5.12	Example of Typical Transition from Shared Lane without Parking to Narrow or No Shoulder	5.13
5.13	Example of Typical Transition from Shared Lane with Parking to BIKE LANE without Parking	5.14
5.14	Example of Typical Transition from Shared Lane with Parking to BIKE LANE with Parking	5.15

FIGURE NUMBER	TITLE	PAGE
5.15	Example of Typical Transition from Shared Lane with Parking to Shared Lane without Parking	5.16
5.16	Example of Typical Transition from Shared Lane with Parking to Narrow or No Shoulder	5.17
5.17	Example of Typical Transition from Narrow or No Shoulder to BIKE LANE without Parking	5.18
5.18	Example of Typical Transition from Narrow or No Shoulder to BIKE LANE with Parking	5.19
5.19	Example of Typical Transition from Narrow or No Shoulder to Shared Lane without Parking	5.20
5.20	Example of Typical Transition from Narrow or No Shoulder to Shared Lane with Parking	5.21
6.1	Bike Guide Sign	6.3
6.2	Destination Signs	6.4
6.3	U.S. Bicycle Route Sign	6.4
7.1	Typical Shared Use Path Cross Section	7.2
7.2	MD 450 Sidepath	7.3
7.3	Poorly Designed Trail Surface	7.4
7.4	Thickened Pavement Edge	7.5
7.5	Minimum Sight Distance Triangle at an Intersection with a Sidewalk	7.7
7.6	Shared Use Path Crosswalk Markings	7.8
7.7	Shared Use Path at Midblock Intersection	7.9
7.8	Median Refuge Design at Path Crossing	7.10
7.9	Bollards at an Intersection	7.10
7.10	Path Widening at an Intersection	7.11
7.11	Intersection Warning Rumble Strips	7.12

FIGURE NUMBER	TITLE	PAGE
8.1	Bicycle Lane at On-Ramp	8.1
8.2	Woodrow Wilson Bridge Trail	8.2
10.1	One-Way Cycle Tracks	10.1
10.2	One-Way Cycle Tracks with Raised Curb	10.2
10.3	Buffered Bike Lane	10.4
10.4	Bike Box	10.6

CHAPTER 1: INTRODUCTION

1.1 Purpose

The purpose of this Bicycle Policy & Design Guidelines is to provide transportation planners and engineers guidance for accommodations that improve bicycling in Maryland. Creating a regional bicycle network that connects both on-road and off-road facilities to transit stops, key community destinations, and other traffic generators and destinations is critical to moving Maryland towards a complete multi-modal transportation system. As SHA develops this system, it is imperative that we make our facilities as safe and efficient as possible for all roadway users. To this end, recognizing the potential safety concerns of mixing bicycles with motor vehicle traffic, SHA supports the creation of a statewide bikeway network to increase motorist awareness and acceptance of bicyclists as legitimate roadway users and to actively promote safe bicycling along our highways.

This Bicycle Policy & Design Guidelines provide uniform criteria for bicycle facilities in order to achieve a consistent statewide approach to bicycle design. It is the intent that this policy and design guideline apply to all state roadways in Maryland, incorporating current SHA road design practices, accepted national guidelines and standards and best practices used by state and local governments.

1.2 Policy

The Maryland Department of Transportation's (MDOT) principal mission is "to enhance the quality of life for Maryland's citizens by providing a balanced and sustainable multimodal transportation system..." Bicycling and walking are important modes of transportation that support this goal. In 2014, the Department developed the [Twenty-Year Bicycle and Pedestrian Master Plan](#) that serves as a blueprint for achieving the vision of Maryland becoming the best state in the nation for bicycling and walking. In support of the Master Plan, the State Highway Administration (SHA) issued its *Policy for Accommodating Bicycles and Pedestrians on State Highways*. The policy is stated below:

"The State Highway Administration (SHA) shall make accommodations for bicycling and walking a routine and integral element of planning, design, construction, operations and maintenance activities as appropriate."

MDOT's and SHA's mission and policy are in agreement with the United States Department of Transportation's (USDOT) Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations announced on March 15, 2010. It supports developing a fully integrated active transportation system that includes well-connected walking and bicycling networks. The goal of the USDOT policy provides direction to improve conditions and opportunities for walking and bicycling and integrate walking and bicycling into transportation systems by exceeding minimum standards to provide safe and convenient facilities for these modes. To meet this goal in relation to bicycles, SHA has updated the attached guidance, developed Maryland statewide statistical measures to improve bicycle facilities throughout the state, and added additional measures in the SHA Business Plan to demonstrate the state's commitment to enhancing the multi-modal network across Maryland. This Policy supports SHA's Complete Streets Policy and MDOT's overarching mission to "Enhance the quality of life for Maryland's citizens by providing a balanced...multimodal transportation system..." The American Association of State Highway Transportation Officials (AASHTO) *Guide for the Development of Bicycle Facilities*, 2012 is also used by engineers for the design of bicycle facilities. SHA has ensured that the Bicycle Policy & Design Guidelines are consistent with this document.

All projects shall evaluate opportunities to improve bicycle accommodations. Bicycle accommodations refer to both on-road (including marked bicycle lanes and shared lane

applications) and off-road facilities. It is SHA's policy to provide these accommodations as part of all roadway projects to the maximum extent feasible based upon design guidance provided in this document. In addition:

1. No project shall reduce an existing shoulder width to less than the mandatory conditions of these guidelines on roadways where bicycle are permitted without an approved bicycle design waiver.
2. No project or action shall reduce existing bicycle accommodations below the mandatory conditions of these guidelines without an approved bicycle design waiver.

The following definitions of "shall," "should" and "may" apply to guidance in this document (ITE Traffic Engineering Handbook, 413):

1. SHALL – A *mandatory* condition. Where certain requirements in the design or application of the device or treatment are described with the "shall" stipulation, it is mandatory when an installation is made that these requirements be met.
2. SHOULD – An *advisory* condition. Where the word "should" is used, it is considered to be advisable usage, recommended but not mandatory.
3. MAY – A *permissive* condition. No requirement for design or application is intended.

"Shall" conditions refer to a mandatory condition that must be met or a design waiver is required. "Should" and "may" conditions do not carry a requirement and will be reviewed and instituted through engineering judgment of the Assistant District Engineer for Traffic (ADE-T) and the Office of Traffic and Safety (OOTS).

While certain traffic control devices (signs, markings, and traffic signals) may be shown in this guide, such depictions should be considered as "typical applications" subject to the provisions of the Maryland Manual on Uniform Traffic Control Devices (MdMUTCD) 2011. MdMUTCD standards and guidelines are promulgated and interpreted by OOTS under the provisions of a Memorandum of Action, signed by the Administrator.

1.3 Compliance Certification

All proposed activities which disturb the paved roadway area, disturb the adjacent curblin, or adjust the line striping shall be reviewed for bicycle accommodations. These proposed activities include, but are not limited to, replacing and/or modifying lane widths or shoulder widths. Every effort shall be made to narrow the travel lanes in order to provide marked bicycle lanes or to widen the shoulder to improve bicycle compatibility. Prior to construction, the ADE-T will approve the activities and verify that bicycle accommodations have been met as outlined in this policy.

For projects going through the project development process, the appropriate strategy shall be documented in the Preliminary Investigation and Final Review Reports. At each milestone, the project shall be reviewed by the Office of Highway Development (OHD) Americans with Disabilities Act (ADA)/Bicycle Compliance Team to ensure that the mandatory conditions as outlined in these guidelines are met. The ADE-T will also evaluate the project at each milestone to ensure that the appropriate engineering solutions as outlined in these guidelines to provide bicycle accommodations are being instituted. Prior to advertisement, the lead design office shall request the ADE-T to certify that the bicycle accommodations meet the mandatory conditions or any necessary waivers have been approved and that the appropriate engineering solutions, as outlined in this policy, have been provided as part of the project. The ADE-T shall provide a signed

Compliance Certification form that shall accompany the Plans, Specifications, and Estimate (PS & E) Checklist in preparation of advertisement.

All proposed activities and projects outlined above that do not meet the mandatory conditions set forth in these guidelines will require an approved design waiver. The design waiver request shall be prepared by the lead design office. The following items should be considered prior to requesting a design waiver:

- Ability to acquire right of way
- Ability to relocate utilities
- Impact to existing structures
- Impact to environmentally or historically sensitive features

However, it is not the intent that right of way be acquired or utilities be relocated if they are not already in the project scope, for example on resurfacing projects. Resurfacing projects shall be examined to determine if the existing lane or shoulder widths may be modified to provide additional space for bicycle accommodations, or if additional signing or markings are appropriate to increase driver awareness of cyclists.

1.4 Design Waivers

It is SHA's intent to provide bicycle accommodations on all roadways under its jurisdiction where bicycles are allowed. However, if it is determined that the mandatory conditions cannot be provided, a design waiver shall be requested. A project can only proceed to advertisement or construction (construction includes maintenance activities) if the project meets the mandatory conditions set forth in these guidelines or has been granted a design waiver. **No blanket design waivers will be granted on a project-wide or program-wide basis.** To avoid schedule disruptions late in a project's development, the need for a design waiver should be identified in a Project Impact Review Report or equivalent process, and the documentation should be submitted by the Preliminary Investigation. If during construction, it is found that a project element cannot be constructed to meet the mandatory conditions (due to an unforeseen field condition, for instance), a design waiver shall be obtained prior to completing work of that element.

A design waiver may be considered for such things as impacts to right of way, utilities, structures (such as bridges and drainage structures), environmentally or historically sensitive areas, or due to excessive cost. Cost shall not be the sole consideration unless the inclusion of bicycle accommodations increases the project budget (ROW, utilities, and construction) and cause adverse impacts to the overall project funding. A waiver shall not be requested until all reasonable alternatives to meet the mandatory conditions have been exhausted and documented. The significance of additional impact created by these alternatives over and above the basic project will be considered in the waiver decision. The documentation of these alternatives will be required to support the design waiver request.

Design waivers are not intended to exclude the implementation of bicycle facilities as part of a project. Even with the design waiver, a project shall still be designed to the maximum extent practicable to provide bicycle accommodations.

Every effort shall be made to submit design waivers by the first milestone review. Documentation within the first milestone report and subsequent reports shall note the status of proposed design waivers, as well as coordination efforts with the OHD ADA/Bicycle Compliance Team; however, milestone reports will not be considered a substitute for a written waiver request.

1.5 Design Waiver Process

1. The Lead Project Manager, with input from all support divisions, determines the mandatory conditions outlined within this policy cannot be met. The ADE-T reviews the project and concurs in the recommendations of the project team.
2. The Lead Project Manager reviews the project with the OHD ADA/Bicycle Compliance Team. This Team will coordinate with the Office of Planning and Preliminary Engineering (OPPE) Bicycle/Pedestrian Coordinator to determine if the waiver will significantly impact established or proposed bicycle routes or master plans. The team will also coordinate with the ADE-T to determine if the design element requiring a waiver would significantly impact travel patterns and to ensure the appropriate engineering solution is proposed to mitigate the waiver condition. A summary of existing facilities and the potential impact of a waiver will be attached to the waiver request.
3. If it is determined that there will be no significant effect upon established or proposed bicycle routes, master plans or travel patterns, the Lead Project Manager shall make a formal request in writing to the Director of OHD, through the ADE-T, for consideration. The formal waiver request shall include, at a minimum, the following information:
 - Project description and typical sections (existing and proposed);
 - Length/Scope/Cost of the project;
 - Description of the design required to meet the mandatory conditions;
 - Written findings regarding the inability to meet the mandatory conditions. This written assessment shall evaluate all available data in reaching a recommendation, for example:
 - existing and proposed posted speed limit;
 - percentage of truck traffic;
 - details of cost exposure;
 - collision data for the project area including incident data involving bicyclists.
 - Description of any mitigating strategies to provide the appropriate engineering solution for the accommodation of bicyclists; and
 - Existing and proposed *Bicycle Level of Comfort* (BLOC)

1.6 Bicycle Terminology

Bikeway – General term denoting any trail, path, part of a highway, surfaced or smooth shoulder or any other travel way specifically signed, marked, or otherwise designated for bicycle travel. Bikeways include bike lanes, shared lanes, shared-use paths, trails, and bike routes.

Bike Lane – Any portion of a roadway or shoulder which has been designated for single directional flow and includes pavement markings for the preferential or exclusive use of bicyclists. Bike lanes shall be supplemented with signage.



Figure 1.1
MD 237 Bike Lane



Figure 1.2
MD 26 Bike Route

Bike Route – A system of bikeways connecting two or more points that is deemed most desirable for bicycling. A bike route is designated with guide signs, pavement markings, maps or other means. A bike route may include any of the various types of bikeways or a combination thereof. With regard to the use and application of traffic control devices, reference should also be made to the MdmUTCDC, Section 1A.13, for definitions that may apply.

Shared Lane – A roadway lane which is open to both bicycle and motor vehicle travel, without assigned space for each. Specific pavement markings and/or signs may be used to provide positive guidance for drivers and bicyclists allowing them to share the same lane. With regard to the use and application of traffic control devices, reference should also be made to the MdmUTCDC, Section 1A.13, for definitions that may apply.



Figure 1.3
Shared Lane – Baltimore City



Figure 1.4
Shared-Use Path

Shared-Use Path – A paved or unpaved bikeway outside the motor vehicle traveled way and physically separated from motorized vehicular traffic by an open space, curb, curb and gutter, or barrier and either within the highway right-of-way or within an independent alignment. Shared-use paths are open to use by pedestrians and other authorized non-motorized users. A shared-use path typically allows two-way travel and is therefore wider than an on-road bikeway.

For a complete list of definitions, see Appendix B.

CHAPTER 2: BIKE LANE DESIGN

2.1 General Notes

Bicycle lanes (or bike lanes) have been shown to increase the comfort level of bicyclists. Various studies have found that bike lanes have some distinct advantages over paved shoulders and wide outside lanes as they may:

- Provide dedicated space for bicyclists;
- Reduce wrong way bicycle riding;
- Encourage increased bicycle use;
- Increase motorist awareness of bicyclists;
- Encourage bicyclists to ride farther away from parked vehicles;
- Reduce motorist lane changes when passing bicyclists; and
- Provide visual guidance to bicyclists navigating intersections (Hunter et al, 2005).



Figure 2.1
Signed and Marked Bike Lane

Bike lanes have also been shown to have some of the following potentially negative characteristics, as they may:

- Give bicyclists the false impression that they are completely safe from collisions with motorized vehicles;
- Create an impression that bicyclists must always operate in the bike lane (even if there is debris or an obstruction present); and
- Place bicyclists within the path of a parked vehicle's opening door.

All proposed activities which disturb the paved roadway area, disturb the adjacent curblines, or adjust the line striping shall be reviewed for bicycle accommodations. These proposed activities include, but are not limited to, replacing and/or modifying lane widths or shoulder widths. Where there is continuous minimum shoulder width as stated in Table 2.1 for at least 2,500 ft inclusive of any intersection length, the shoulder shall be marked and signed as a designated bike lane, and in no case, shall a bicycle lane be marked as such when less than 4 feet. In instances where the bikeway connects key destinations, existing trails, recreational facilities or traverses conflict points such as intersections, a bike lane of less than 2,500 ft may be installed.

All projects that involve **widening or new construction** shall meet the mandatory conditions in Table 2.1 regardless of the presence of or the requirement to provide a marked bike lane as part of the project.

Table 2.1 – Marked Bike Lanes

MINIMUM SHOULDER WIDTHS FOR MARKED BIKE LANES		
POSTED SPEED LIMIT	TRUCK VOLUMES (%ADT)	SHOULDER/LANE WIDTH*
≤ 35 MPH	-----	4 FEET
> 35 MPH and ≤ 45 MPH	≤ 8% trucks	5 FEET
	> 8% trucks	6 FEET
> 45 MPH	-----	6 FEET

*The shoulder/lane width is measured excluding the gutter pan.

*Add 1 foot minimum to the shoulder/lane width if operating adjacent to traffic barrier, concrete barrier, a curb without a gutter pan, or on-street parking.

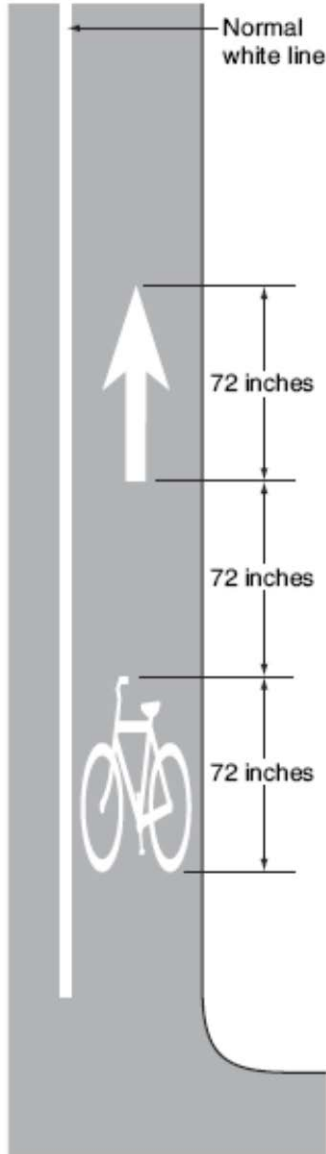


Figure 2.2
Bike Lane Marking

If parking lanes exist along the roadway, a minimum 5 ft bike lane is required between the through lane and parking lane. When shoulders are converted to bike lanes with the appropriate signs and pavement markings, they shall be referred to as bike lanes and not as shoulders. In addition, parking may be prohibited on these facilities once a thorough review has been undertaken through an engineering study and Memorandum of Agreement with appropriate parties has been executed. However, it is important to note that the establishment of a bike lane on what was previously a shoulder does not prohibit its use by emergency vehicles or disabled motor vehicles for a short period of time.

2.2 Bike Lane Pavement Markings and Signs

Bike Lane Pavement Markings

The MdMUTCD Part 9 establishes standards and guidance on the use of pavement markings (a bicycle without a rider and an arrow) to designate bike lanes, and should be referenced in addition to the guidance provided herein.

While the MdMUTCD allows the use of several different bicycle symbols for designating bike lanes, all new installations shall be the *bicycle without a rider symbol*, as shown in Figure 2.2. The symbol should generally be placed in the center of the bike lane and shall be accompanied by a straight arrow pavement marking. Both the bicycle symbol and the arrow shall be a white, thermoplastic, preformed pavement marking. If the shoulder meets the required width and it is determined that it will be designated as a bike lane, the pavement markings shown in Figure 2.2 shall be installed immediately beyond each major intersection. In addition to being placed after major intersections, bicycle pavement markings shall be placed at about every ½ mile along the bike lane where there is a sufficiently long section with no intersections in rural areas; and at about every ¼ mile in urban areas.

Bike lane pavement markings shall only be used in conjunction with a solid and/or dashed white line that delineates the bike lane from the motor vehicle travel lane. The delineation striping shall be per the MdMUTCD. Dashed white lines with a minimum width of 5 in., may be used to guide bicyclists through intersections and other situations where such guidance would be desirable. Where on-street parking is permitted, a solid

white line should be used to delineate the right edge of the bike lane. A solid white line may be used to delineate the edge of the paving on either shoulders or bike lanes if their use is considered desirable.

BIKE LANE Signs

Part 9 of the MdMUTCD establishes standards and guidance on the use of signs to designate bike lanes, and should be referenced in addition to the guidance provided herein. The following discussion highlights the primary signs required in conjunction with bicycle pavement markings.

The BIKE LANE sign (R3-17, as shown in Figure 2.3) shall be used only in conjunction with, and placed adjacent to, the bicycle pavement markings. BIKE LANE signs should be placed immediately after each major intersection and driveway (not including alleys or minor driveways) to reinforce the correct direction of travel for bicyclists. Along the length of rural roadways, BIKE LANE signs should be installed every 1 mile and along suburban roadways, they should be placed every ½ mile at a minimum. In urban areas with on-street parking, BIKE LANE signs should be kept to a minimum to reduce sign clutter. Preference should be given to placing signs at locations where there are sight distance problems, where the bike lane is unexpected, or where there is a history of motorists using the bike lane for driving, and/or parking.



Figure 2.3
BIKE LANE sign (R3-17)



Figure 2.4
BIKE LANE sign (R3-17) with
AHEAD plaque (R3-17aP)

A BIKE LANE sign (R3-17) with an AHEAD plaque (R3-17aP, as shown in Figure 2.4) placed beneath may be installed at least 100 ft in front of the first pavement marking within the bike lane.

A BIKE LANE sign (R3-17) with a BEGINS plaque (R3-17cP) placed beneath may be installed as close as practicable to the point where a bike lane begins. A NO PARKING sign (R7-9(1)) may be used in conjunction with the R3-17 in areas where parking in the bicycle lane is problematic.

A BIKE LANE sign (R3-17) with an ENDS plaque (R3-17bP, as shown in Figure 2.5) placed beneath should be installed as close as practicable to the point where a bike lane ends.

In some locations it may be necessary to end the bike lane in advance of an intersection, and then regain the bike lane after the intersection. If the resulting gap exceeds 200 ft in length, not including the width of the intersection itself, the BIKE LANE ENDS assembly should be used.



Figure 2.5
BIKE LANE sign (R3-17) with
ENDS plaque (R3-17b)

In locations where vehicles entering an exclusive right turn lane must weave across the bike lane, the BEGIN RIGHT TURN LANE, YIELD TO BIKES sign (R4-4, as shown in Figure 2.6) should be used to inform both the motorist and bicyclist of the weaving maneuver. For further information on sign placement and typical uses, see Section 2.6.

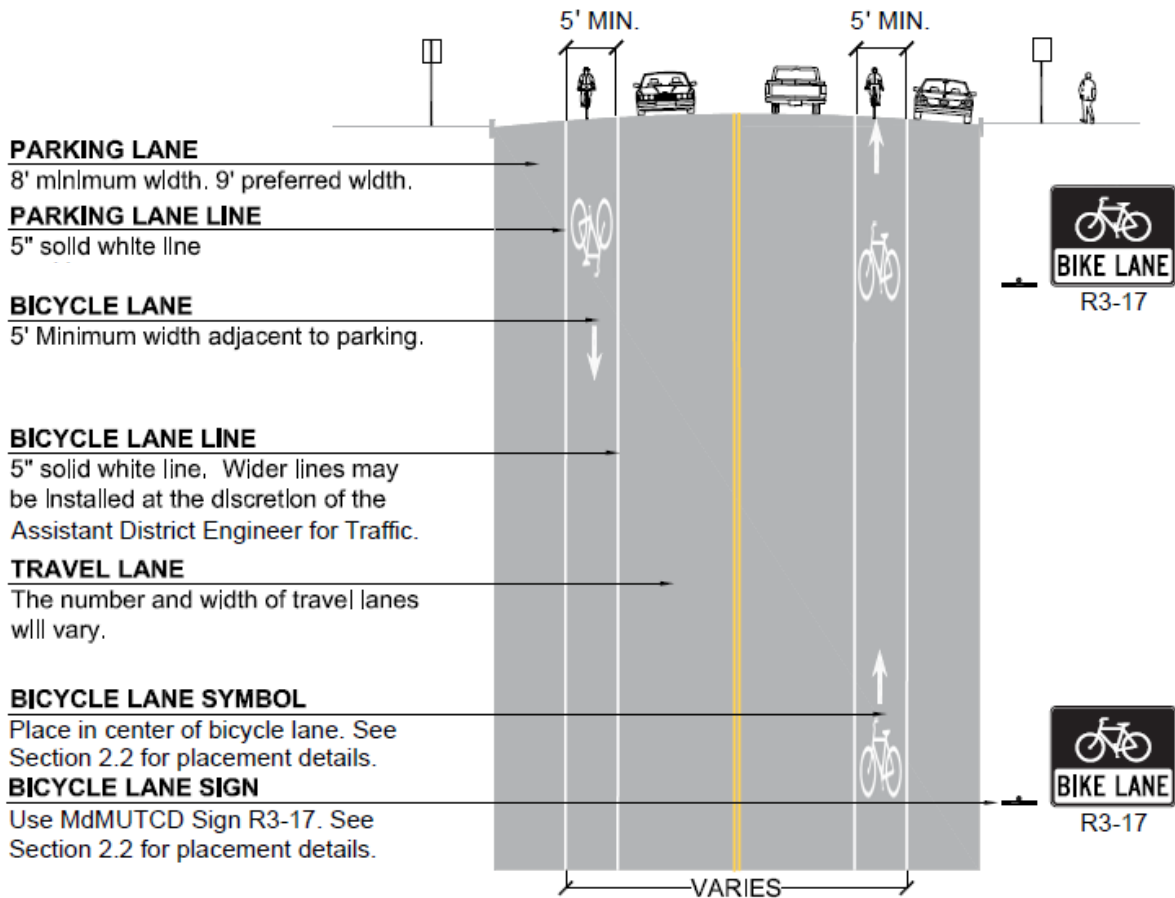


Figure 2.6
BEGIN RIGHT TURN LANE,
YIELD TO BIKES (R4-4)

2.3 Designated Bike Lanes at Midblock

Figure 2.7 illustrates an example of bicycle lanes on a closed section roadway with parking. Figure 2.8 illustrates an example of bicycle lanes on a closed section roadway without parking. Figure 2.9 illustrates an example of bicycle lanes on an open section roadway without parking.

Figure 2.7 - Designated Bicycle Lane: Closed Section - With Parking



DESIGN OF BICYCLE LANES ON CLOSED SECTION ROADWAYS WITH PARKING:

- In areas where parking violations frequently occur, the use of the R7-9(1) NO PARKING/BIKE LANE sign may be used in place of the NO PARKING sign (R7-1) or similar.

Figure 2.8 - Designated Bicycle Lane: Closed Section Midblock - No Parking

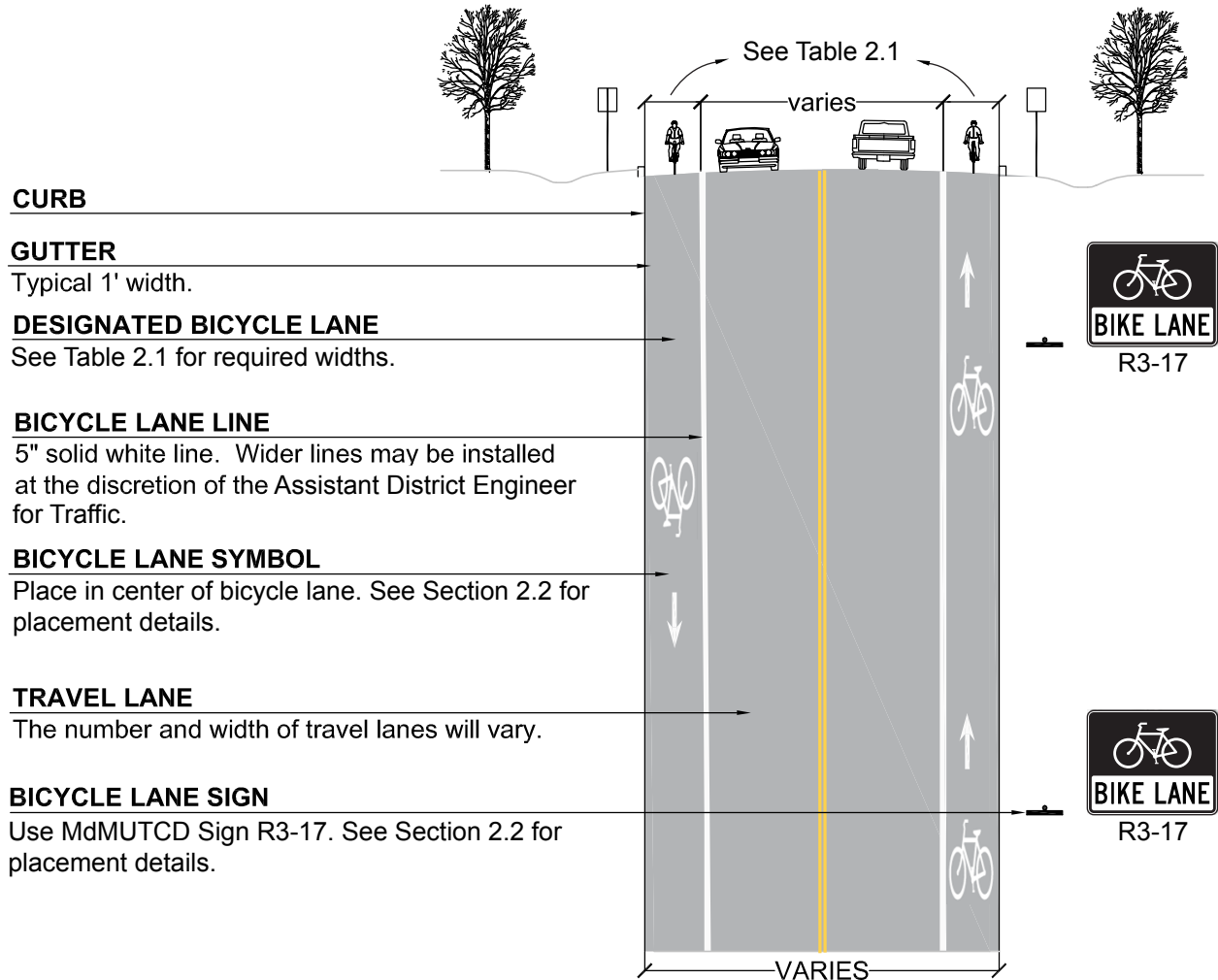


Table 2.1 – Marked Bicycle Lanes

MINIMUM SHOULDER WIDTHS FOR MARKED BIKE LANES		
POSTED SPEED LIMIT	TRUCK VOLUMES (%ADT)	SHOULDER/LANE WIDTH*
≤ 35 MPH	-----	4 FEET
> 35 MPH and ≤ 45 MPH	≤ 8% trucks	5 FEET
	> 8% trucks	6 FEET
> 45 MPH	-----	6 FEET

*The shoulder/lane width is measured excluding the gutter pan.

*Add 1 foot minimum to the shoulder/lane width if operating adjacent to traffic barrier, concrete barrier, a curb without a gutter pan, or on-street parking.

DESIGN OF BICYCLE LANES ON CLOSED SECTION ROADWAYS WITH NO PARKING:

- Bicycle lanes may be wider than the minimum widths.
- In areas where parking violations frequently occur, the use of the R7-9(1) NO PARKING/BIKE LANE sign may be used in place of the NO PARKING sign (R7-1) or similar.

Figure 2.9 - Designated Bicycle Lane: Open Section Midblock- No Parking

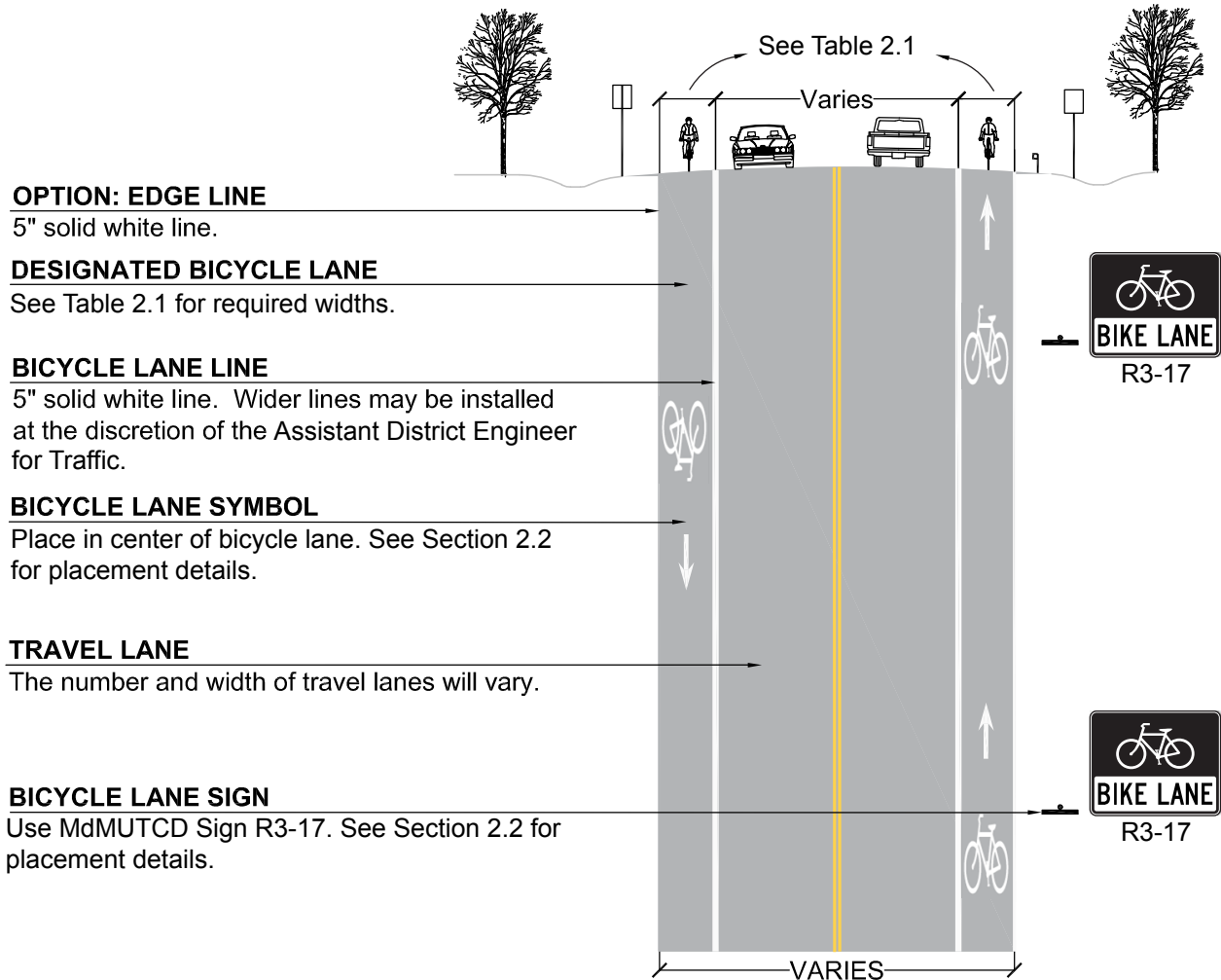


Table 2.1 – Marked Bicycle Lanes

MINIMUM SHOULDER WIDTHS FOR MARKED BIKE LANES		
POSTED SPEED LIMIT	TRUCK VOLUMES (%ADT)	SHOULDER/LANE WIDTH*
≤ 35 MPH	-----	4 FEET
> 35 MPH and ≤ 45 MPH	≤ 8% trucks	5 FEET
	> 8% trucks	6 FEET
> 45 MPH	-----	6 FEET

*The shoulder/lane width is measured excluding the gutter pan.

*Add 1 foot minimum to the shoulder/lane width if operating adjacent to traffic barrier, concrete barrier, a curb without a gutter pan, or on-street parking.

DESIGN OF BICYCLE LANES ON OPEN SECTION ROADWAYS WITH NO PARKING:

- Bicycle lanes may be wider than the minimum widths.
- In areas where parking violations frequently occur, the use of the R7-9(1) NO PARKING/BIKE LANE sign may be used in place of the NO PARKING sign (R7-1) or similar. If desired, a sign with “EMERGENCY STOPPING OK” or similar message may be placed below the R7-9(1) or on a separate post.

2.4 Bike Lanes in Areas with High Parking Turnover

In locations where a bike lane is adjacent to on-street parking, consideration should be given to the possibility that bicyclists may crash into car doors that suddenly swing open. This type of crash is more likely in locations with higher parking turnover, such as main streets, streets near restaurants and retail, etc., but it is not typically a concern on residential streets. Bicyclists encountering a suddenly opened door must either stop short of the door, swerve into an adjacent travel lane to go around it, or risk riding into the open door. Collisions of this type are commonly referred to as “dooring” by bicyclists.

Shared Lane Pavement Marking

In some locations with high parking turnover, it is preferable to use a wide outside lane with a shared lane marking placed a minimum of 11 ft from the curb in lieu of a bike lane. See Section 3.2 for further guidance on shared lane pavement markings.

Bike Lanes Adjacent to Angled Parking

Angled parking can be used to increase parking capacity and to reduce the width of travel lanes. Bike lanes may be considered between the travel lane and the parking area. When designing bike lanes adjacent to angled parking, the parking stall markings shall be of sufficient size to fully store the typical design vehicle for the jurisdiction. A 5 in. minimum white line shall be used to delineate the bike lane from the travel lane, but a second line shall not be used to separate the parking area from the bike lane. Bike lanes adjacent to angled parking shall be a minimum of 6 ft wide to allow space for cyclists to move laterally in the event of a backing vehicle.

2.5 Bike Lanes at Intersection Approaches

Various analyses of bicycle crash data have shown that more than 70 percent of these incidents occur at the intersection of a through route and a cross-street or driveway. The careful selection of traffic control devices can guide all vehicles to their preferred stopping position and through any necessary weaving or merging movements. The Maryland MUTCD gives general guidance on typical intersection configurations. In addition, human factors concepts must be taken into account to provide the most effective guidance.

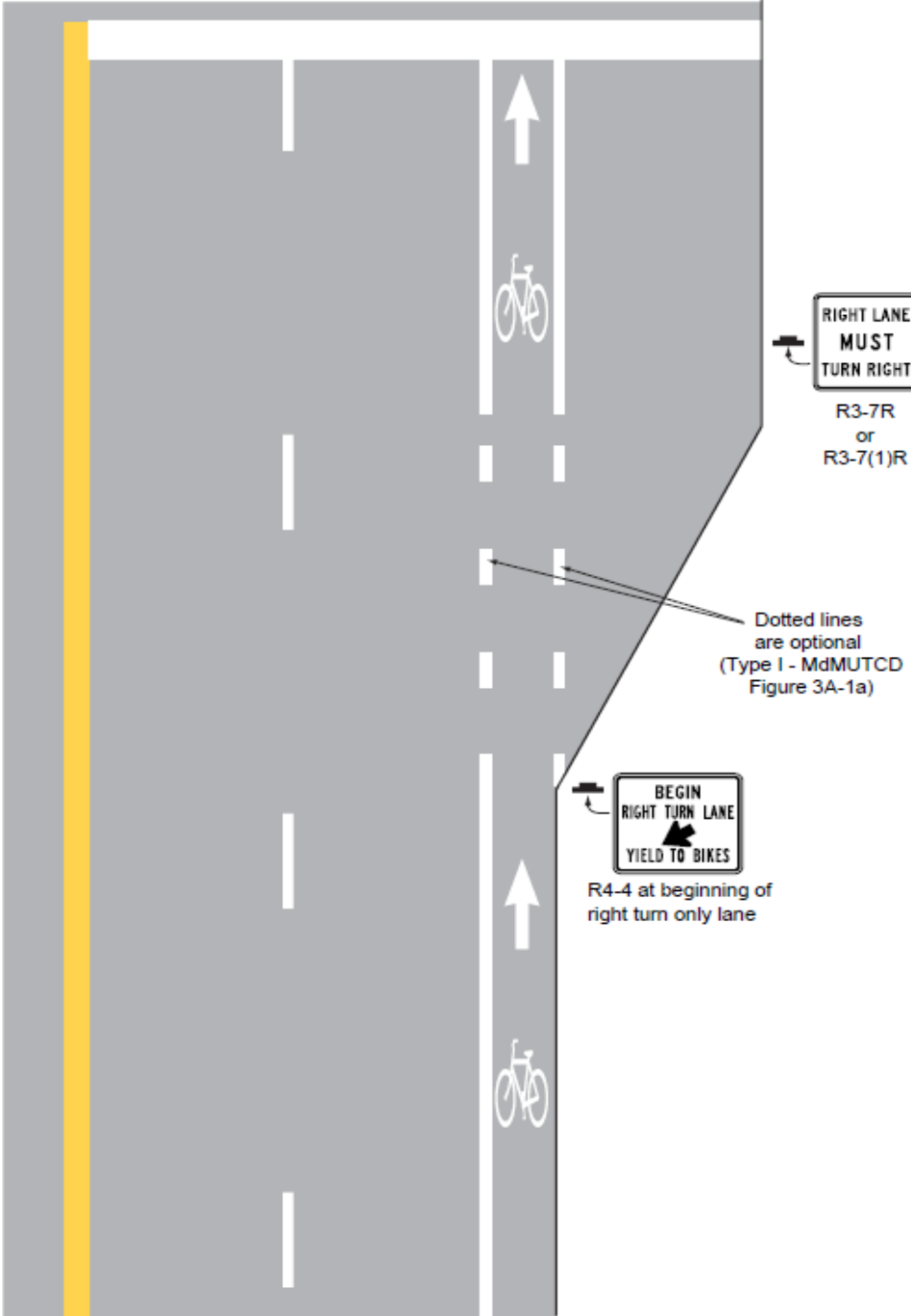
There are a variety of customized configurations for bike lanes at intersections, as shown in Figures 2.10 through 2.14. These figures depict intersections that are typical on Maryland roadways. For more complex intersection configurations that are not depicted in the drawings within the guidelines, the designer should consult with the ADE-T on the appropriate bicycle accommodations.

Often a portion of a bike lane, shoulder, or parking lane has to be taken to provide space for turning, bypass, acceleration, or deceleration lanes at intersections. Obviously, eliminating a bike lane for short section creates a number of problems. For this reason, designers should make every attempt to maintain the continuity of the bike lane through the intersection. This may require altering the turn lane configuration, reducing the through or turn lane width, or reducing the bike lane width. Elimination of a bike lane is not permitted by state law and SHA policy, and reduction of the width of the bike lane below the mandatory conditions in Table 2.1 is subject to the Design Waiver Process as outlined in Section 1.5. However, the elimination of a bike lane does not constitute the elimination of a bikeway.

2.6 Pocket Lanes

For locations that have a high volume of right turning motor vehicle movement, the preferred design is to insert a short, separate bike lane (commonly called a *pocket lane*) between the right turning and through traffic. A through bicycle lane shall not be positioned to the right of a right turn only lane or to the left of a left turn only lane. An example of a typical pocket lane is shown in Figure 2.10 below.

Figure 2.10 - Example of Bicycle Lane Treatment at Right Turn Only Lane or Deceleration Lane.



Source: Maryland MUTCD 2011 Edition, Section 9C.04

Figure 2.11 Pocket Lanes Through Intersection

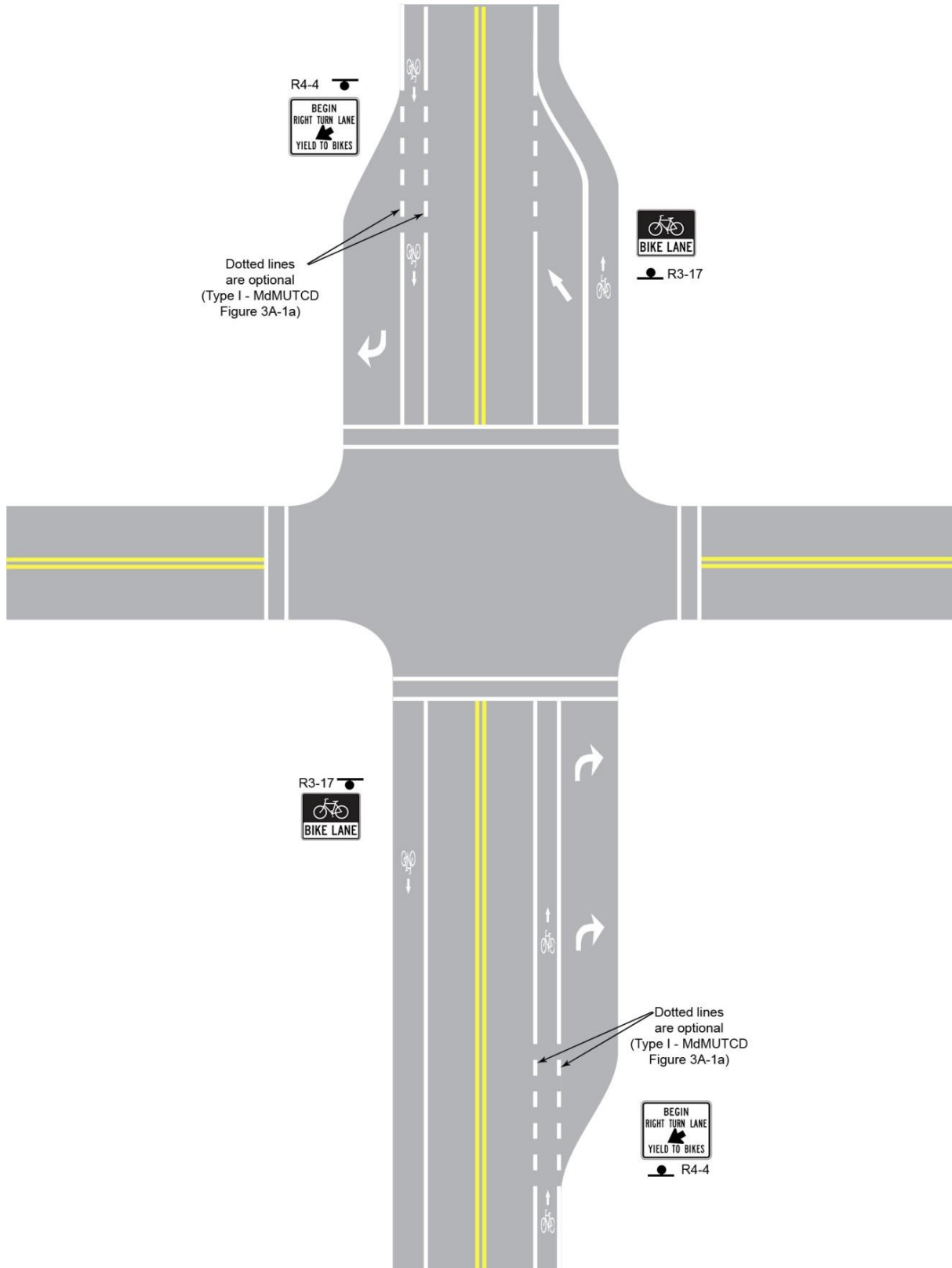


Figure 2.12 Pocket Lanes with Pork Chop Islands

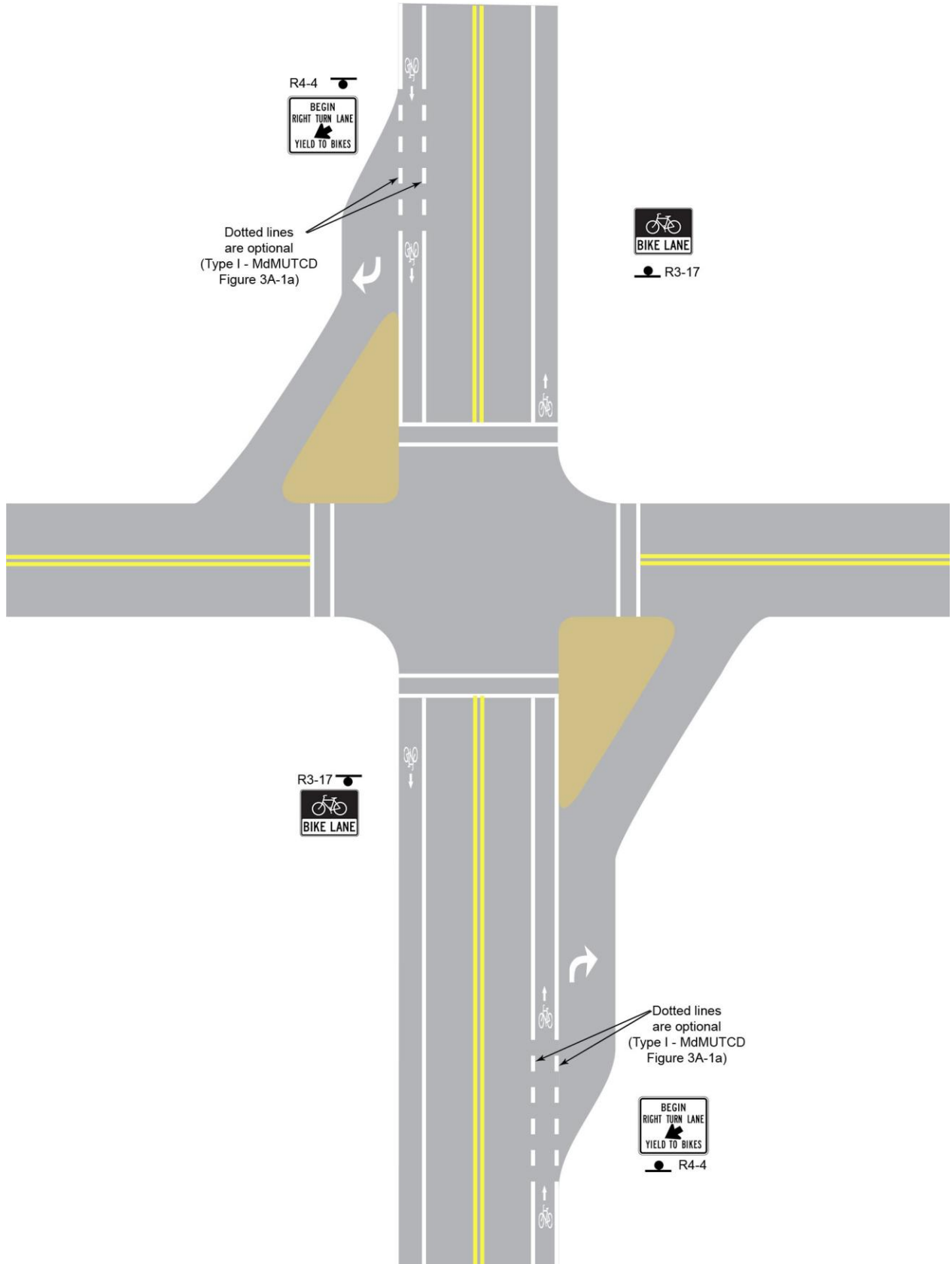
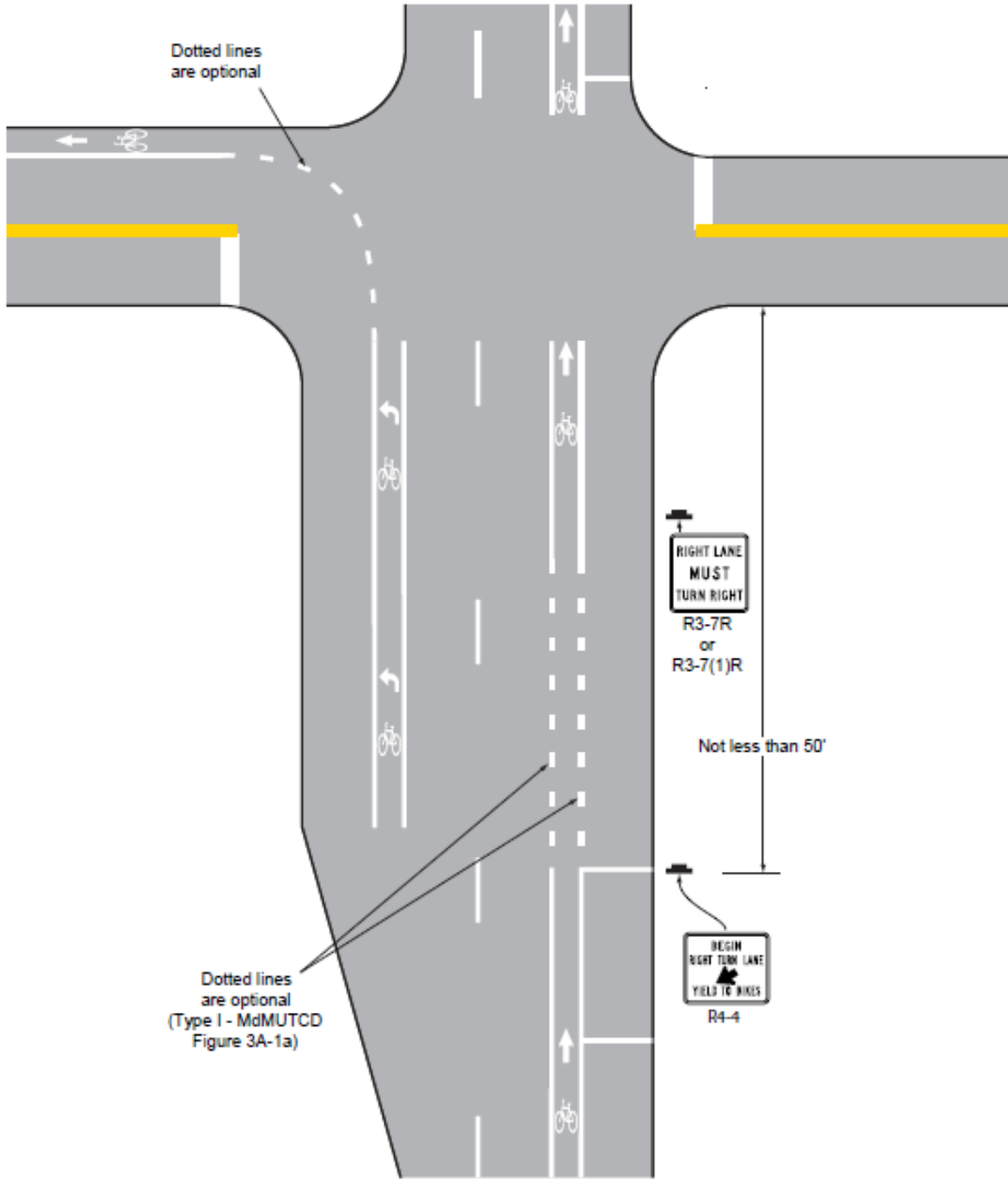
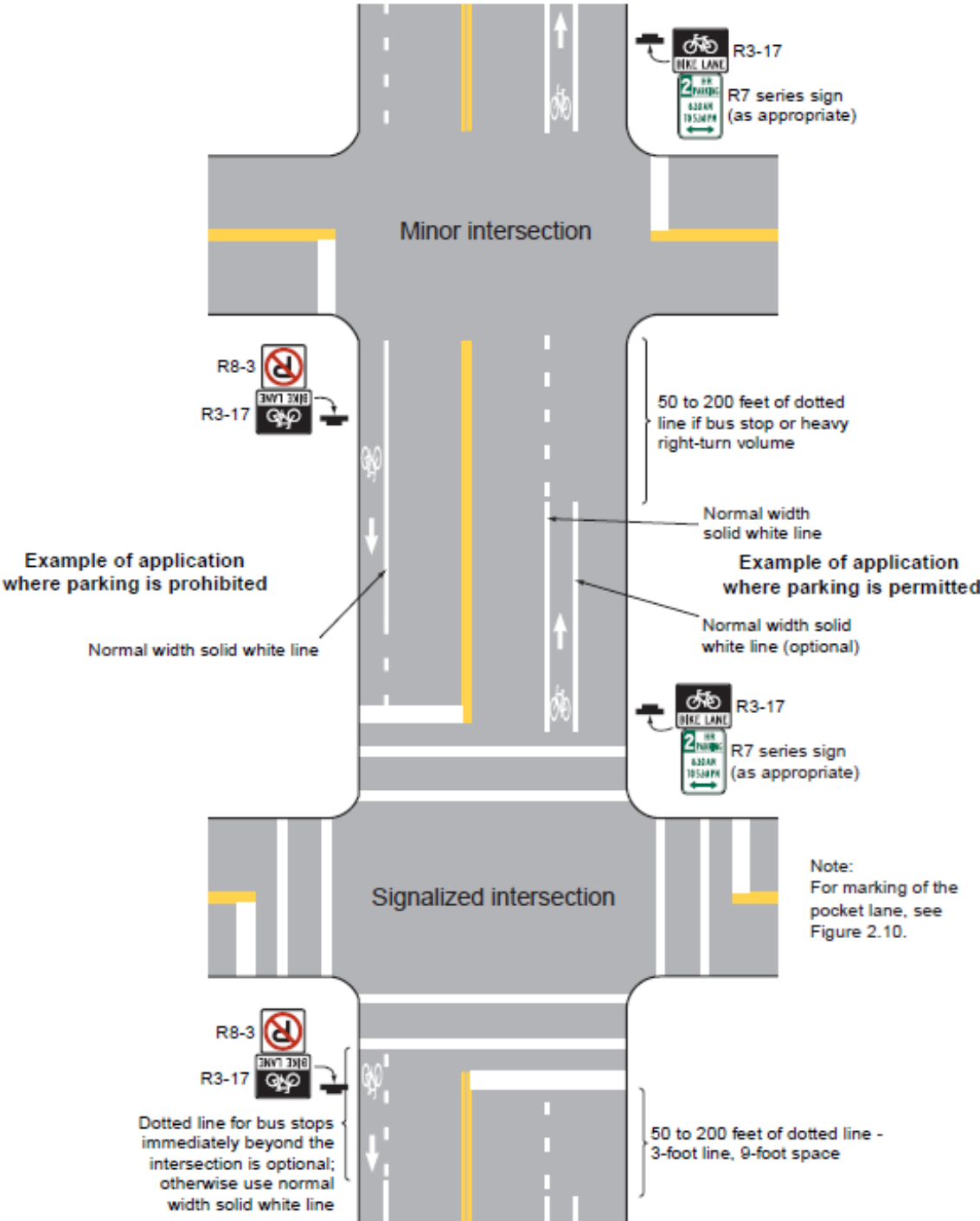


Figure 2.13 - Examples of Intersection Pavement Markings -- Designated Bicycle Lane with Left-Turn Area, Heavy Turn Volumes, Parking, One-Way Traffic, or Divided Highway



Source: Maryland MUTCD 2011 Edition, Section 9C.04

Figure 2.14 - Example of Pavement Markings for Bicycle Lanes at Intersections



The pocket lane is an extension of the bicycle lane; therefore, the width of the bicycle lane must be maintained through the pocket lane. However, the pocket lane shall be a minimum width of 5 ft. It is desirable to give bicyclists enough space in the pocket lane to feel comfortable being passed by motorists on both sides. See Table 2.2 below for further guidance on minimum pocket lane widths. The pocket lane widths should be maintained through the intersection to the receiving leg of the intersection.

Table 2.2

MINIMUM POCKET LANE WIDTH		
POSTED SPEED LIMIT	TRUCK VOLUMES (%ADT)	POCKET LANE WIDTH
≤ 35 MPH	-----	5 FEET
> 35 MPH and ≤ 45 MPH	≤ 8% trucks	5 FEET
	> 8% trucks	6 FEET
> 45 MPH	-----	6 FEET

Pocket lanes are delineated by solid white lines on both sides and a bicycle pavement marking (see Figure 2.10) One pavement marking should be placed per pocket lane. See Table 2.3 for bicycle pavement marking placement within pocket lanes.

Table 2.3

Pocket Lane – Bicycle Pavement Marking Placement	
Pocket lane approaching an intersection	Approximately 2/3 distance of the pocket lane back from the stop bar
Pocket lane after an intersection	Approximately 1/4 distance of the pocket lane from the stop bar

Left-turn pocket lanes are not regularly used in Maryland; however, if they are an option, the same widths shall apply as for the pocket lanes described above. Left-turn pocket lanes require approval from the ADE-T.

2.7 Roundabouts

No bicycle related traffic control devices shall be installed in the roundabout. All bikeway treatments should end at least 100 ft prior to entering a roundabout or at an appropriate distance to afford the bicyclist time to merge with traffic and resume approximately 100 ft after exiting it.

If the desirable design is to direct bicyclists who may not be comfortable blending with traffic outside of the roundabout, exit ramps should be provided onto an adjacent shared-use path. Particular attention should be given to upgrading the crosswalks to accommodate crossing bicyclists.

2.8 Shared Bus/Bike lanes

Shared Bus/Bike lanes are typically wider than the standard 11 ft lane; usually wide enough for a bicycle to safely pass a bus when stopped to drop off its passengers. These lanes are also typically shared with right turning traffic creating many conflict points for bicyclists. The minimum width for this shared lane is 14 ft. Bus/bike lanes are used in Maryland (in Ocean City and on U.S. 29 in Montgomery County), the District of Columbia, and other parts of the country; however, due to the conflicts inherent in this type of facility, it shall only be considered after consultation with the ADE-T.

2.9 Bicycle Climbing Lanes

Bicycle climbing lanes are a hybrid bicycle facility that includes a 5 ft bike lane on one side of the roadway (in the uphill direction) and a shared lane on the other side of the roadway.

Climbing lanes allow slower-moving, uphill bicyclists to have a designated bicycle space, allowing easier passing by motor vehicles. A separate bike lane is not necessary on the downhill side (although it is desirable) because bicycles are moving at a speed closer to that of the motorized vehicle with which they may be sharing the lane. A shared lane marking may be installed on the downhill slope, if all criteria is fulfilled in Section 3.2. This marking helps make motorists aware that bicyclists are likely to merge into the travel lane. However, this treatment shall only be used if the downhill direction of the roadway, where the shared lane marking is intended, is posted at 35 mph or less. The bike lane and shared lane pavement markings also indicate the proper direction for bicyclists to travel on either side of the roadway. This type of facility may be particularly useful on roadways where the existing lanes are not wide enough to accommodate full width bike lanes on both sides.

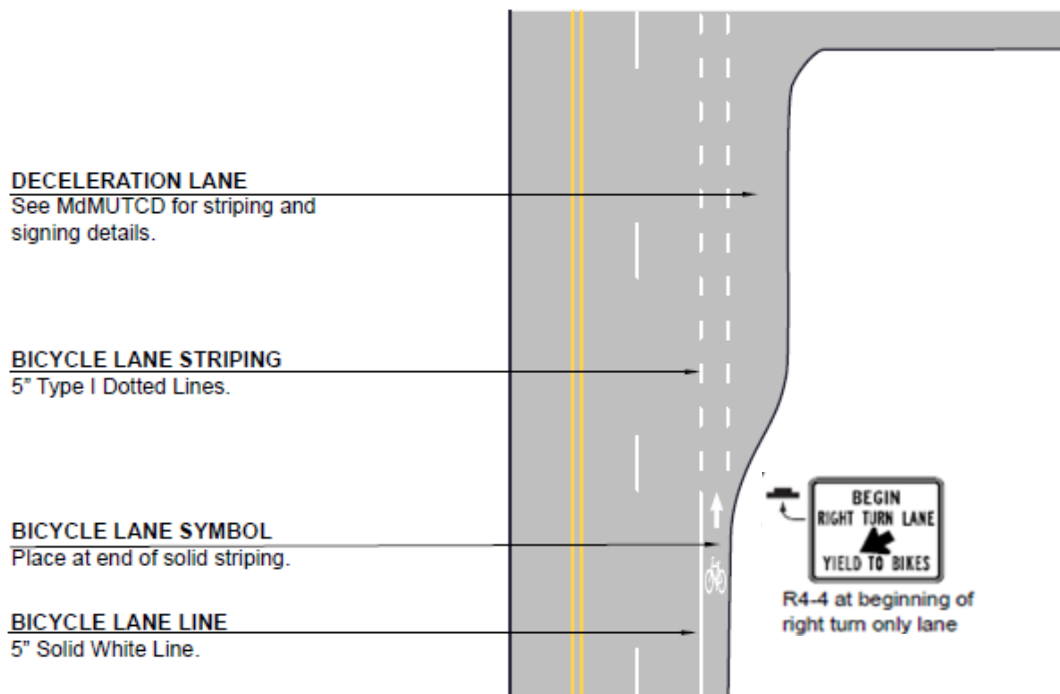
2.10 Bike Lane Treatments with Acceleration/Deceleration Lanes

The use of acceleration and deceleration lanes on State roadways at individual intersections can be beneficial to reducing motor vehicle crashes by providing a separate lane for motorists to change speeds to exit or enter the roadway. They are, however, generally incompatible with bicycle use and pose challenges for designers. If acceleration or deceleration lanes must be installed where bicycle use exists, careful attention needs to be given to safely accommodate bicyclists. The following sections provide guidance for locations where acceleration/deceleration lanes are constructed in conjunction with bike lanes.

Bike Lane Placement Adjacent to Vehicular Deceleration Lanes

The bike lane shall be placed to the left of the deceleration lane as shown in Figure 2.15.

Figure 2.15 - Example of Bicycle Lane Placed to Left of Deceleration Lane



Bike Lane Placement Adjacent to Vehicular Acceleration Lanes

Generally, the bike lane should be placed to the right of the acceleration lane as shown in Figure 2.16 and Figure 2.17.

Figure 2.16 Bike Lane with Free Right Movement

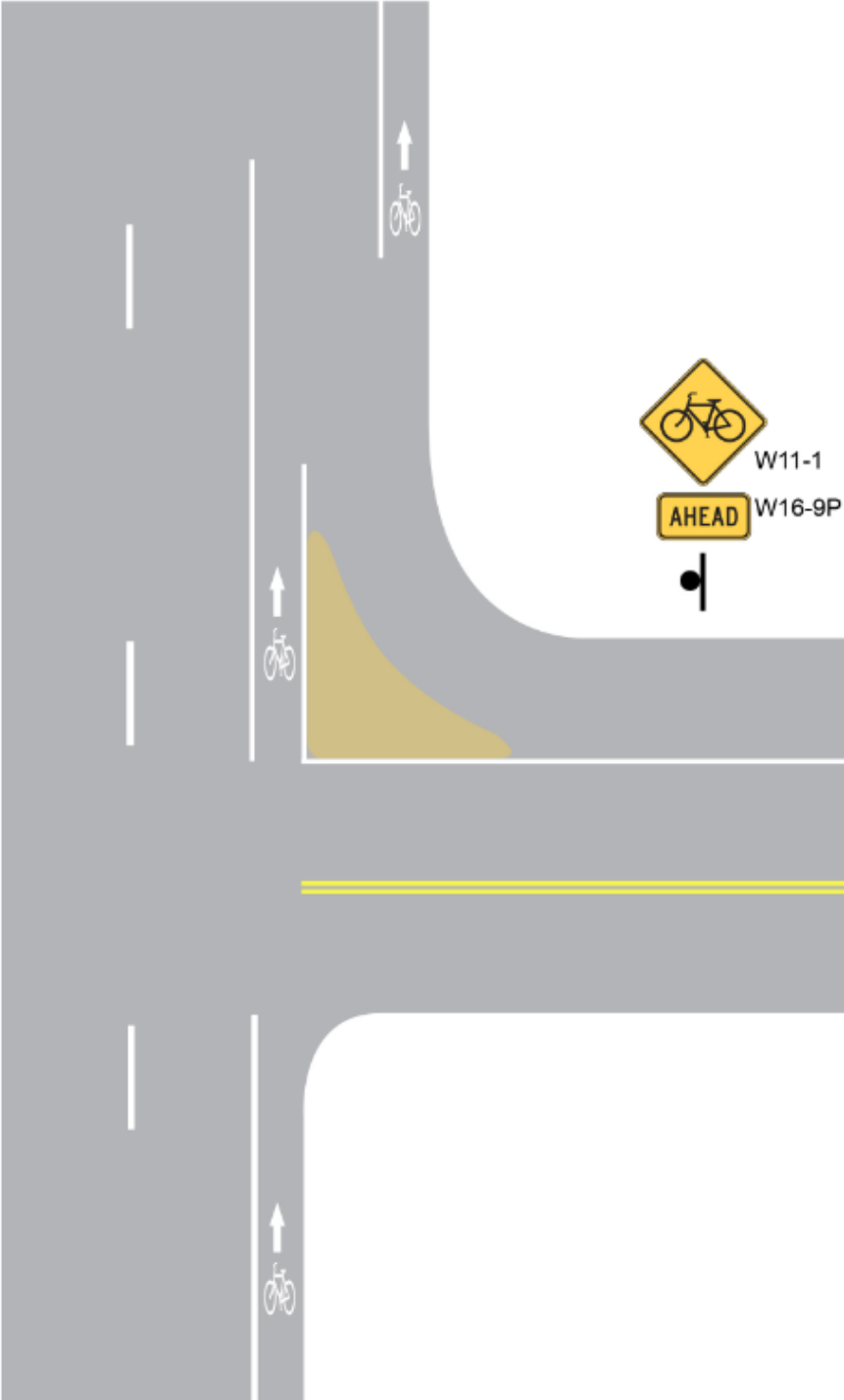
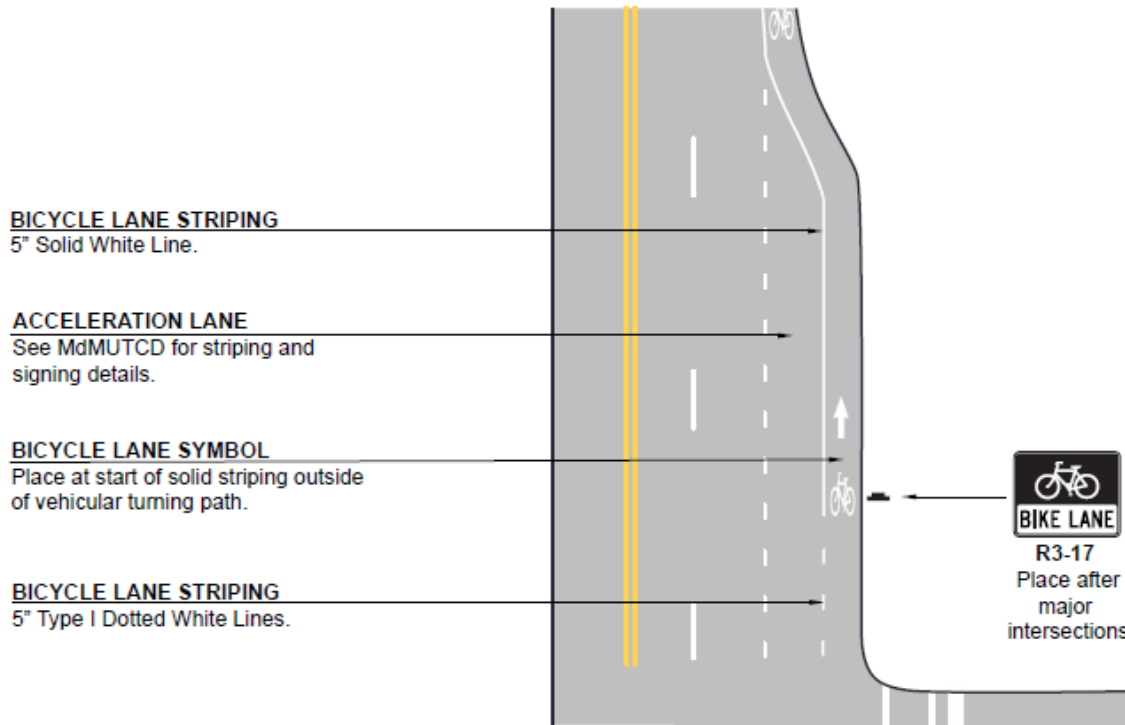


Figure 2.17 - Example of Bicycle Lane Placed to Right of Acceleration Lane

2.11 Bike Lane Treatments with Auxiliary Lanes or Continuous Right Turn Lanes

Auxiliary lanes or continuous right turn lanes are commonly used in locations where there are frequent driveways or access points. Due to conflict points at each driveway intersection, these lanes can cause problems for both pedestrians and bicyclists.

It is recommended that the use of continuous right-turn lanes or auxiliary lanes be limited in length and that basic access management principles be employed during the design to limit driveways and to reduce conflict points. It is preferable to increase the spacing between driveways and to provide dedicated right turn lanes.

One common cause of bicycle collisions is a right turning vehicle traveling across the path of a bicyclist proceeding straight on the driver's right at an intersection. For this reason, through bike lanes should be located to the left of continuous right-turn lanes. However, local conditions may make it preferable to locate the bike lanes to the right of the continuous right-turn lane, or to combine the right-turn and bike lanes.

The designer should consider the following bicycle accommodation options:

- For roadways with auxiliary lanes that extend over a quarter of a mile, the bike lane may be kept adjacent to the curb line. At the last intersection where vehicular turning traffic must turn right, the bike lane shall be placed to the left of the right turn only lane;
- For roadways with auxiliary lanes that extend less than one quarter mile, the bike lane should be placed to the left of the auxiliary lane; and

- If motorists operating speeds are below 35 mph in the auxiliary lane and a separate bike lane is not possible, shared lane pavement markings may be considered with consultation with the ADE-T.

2.12 Bike Lane Treatments with Bypass Lanes

At a T-intersection where motorists frequently drive in a bike lane to bypass left turning vehicles, it is preferable to create a bypass lane adjacent to the bike lane. In order to provide the pavement width for a bypass lane, travel lanes may need to be narrowed or the paving may need to be widened. Consideration should be given to bike lanes when installing bypass lanes. Overlaying a bicycle-compatible shoulder with a bypass lane is not permitted by state law and SHA policy. In the event a bypass lane is needed, an adjacent bike lane meeting the criteria in Table 2.1 shall be provided. An example of a bike lane striped with a bypass lane is shown on Figure 2.18.

At locations where it is not possible to widen the roadway and it is not possible to prevent motorists from driving in the bike lane to pass left-turning vehicles, proper warning should be provided.

2.13 J-Turn Intersections

J-Turn intersections, also called “superstreet” intersections, present a challenge for both bicyclists and pedestrians. If a bicyclist wishes to proceed straight across or make a left turn from a side road, they must merge across several lanes of traffic and make a U-turn a significant distance away from the intersection to do so.

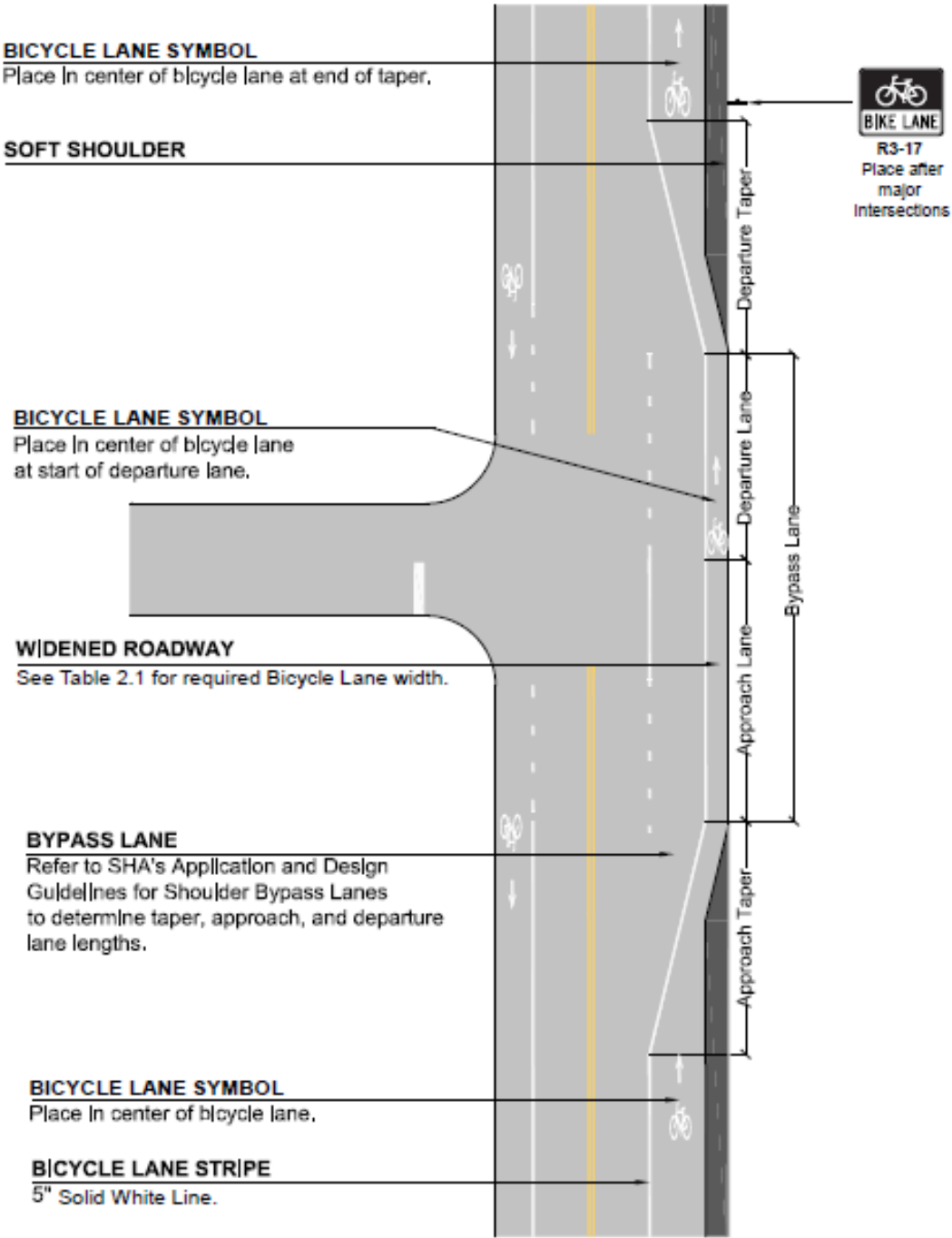
All intersections that use J-turns should consider providing a cut-through in the median if appropriate, and if one is provided, the cut-through shall be ADA compliant. The width of the crossing shall be as wide as the widest path approach, i.e., if a shared use path that is 10 feet wide is constructed on any leg of the intersection, the crossing shall also be 10 feet wide.

2.14 Bicycle Detection and Signal Timing at Intersections

At signalized intersections where bicycle traffic exists or is anticipated (i.e. it is designated in a bicycle route plan as an existing or proposed bicycle facility), consideration should be given to bicyclists in the timing of the traffic signal.

The 2012 *AASHTO Guide for the Development of Bicycle Facilities, fourth edition*, provides guidance on how to determine the clearance interval needed to accommodate bicyclists.

Figure 2.18 - Bicycle Lane Adjacent to Shoulder Bypass Lane



CHAPTER 3: SHARED LANE DESIGN

3.1 Shared Roadways

In Maryland, bicycles are permitted on all roadways except on expressways, unless on adjacent bicycle paths or way approved by the State Highway Administration, or on any other controlled access highway specifically prohibited with signs. However, on roads where the posted speed limit is more than 50 mph, bicycles may use the shoulder adjacent to a roadway and enter the roadway only if making or attempting to make a left turn; crossing through an intersection; or the shoulder is overlaid with a right turn lane, a merge lane, a bypass lane, or any other marking that breaks the continuity of the shoulder. On roadways with low motor vehicle volumes and/or speeds, bicycles can easily share the travelled-way with other traffic and usually do not need special treatments, such as bicycle lanes. These roadways operate well in their current condition for shared use. However, State-maintained roadways typically carry higher volumes of motor vehicle traffic at higher speeds and are therefore less compatible to bicycles and motorized vehicles sharing the same space. At the Preliminary Investigation, discuss all Shared Lane design elements included within this chapter with the ADE-T. Shared Lane design is a possible mitigation strategy to provide appropriate engineering solutions for the accommodation of bicyclists.

3.2 Shared Lane Pavement Markings

Along urban and suburban roadways where it is not possible to stripe a separate bicycle lane due to width constraints, consideration should be given to providing Shared Lane pavement markings, commonly referred to as Sharrows.

Sharrows may be used to:

1. Help bicyclists position themselves in lanes that are between 13 and 15 feet wide, resulting in a lane too narrow for a motor vehicle and a bicycle to travel side by side within the same traffic lane;
2. Encourage safe passing of bicyclists by motorists;
3. Alert road users of the lateral location bicyclists will likely occupy; and
4. Reduce the incidence of wrong-way bicycling.

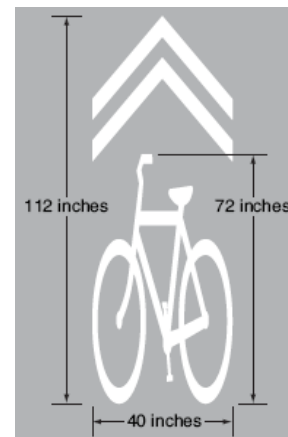


Figure 3.1
Shared Lane Marking (Sharrow)

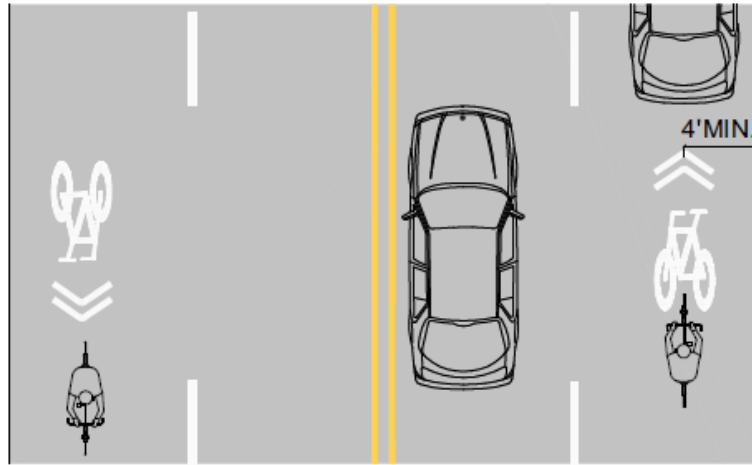


Figure 3.2
Shared Lane Marking (Sharrow)
U.S. 113 in Salisbury

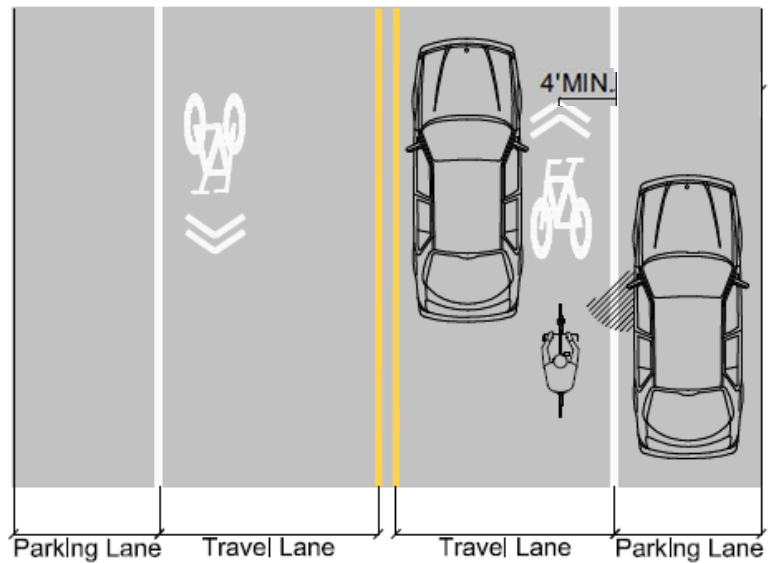
Sharrows may be used where the rightmost motor vehicle lane is wider than normal, but too narrow to be divided into a travel-lane and a bicycle lane or shoulder (i.e. lane widths equal to or greater than 13 ft and less than 15 ft). Sharrows shall not be installed on roadways where the speed limit is higher than 35 mph.

Figure 3.3 – Example Shared Lane Marking Placement

SYMBOL PLACEMENT - NO PARKING:



SYMBOL PLACEMENT - PARKING:

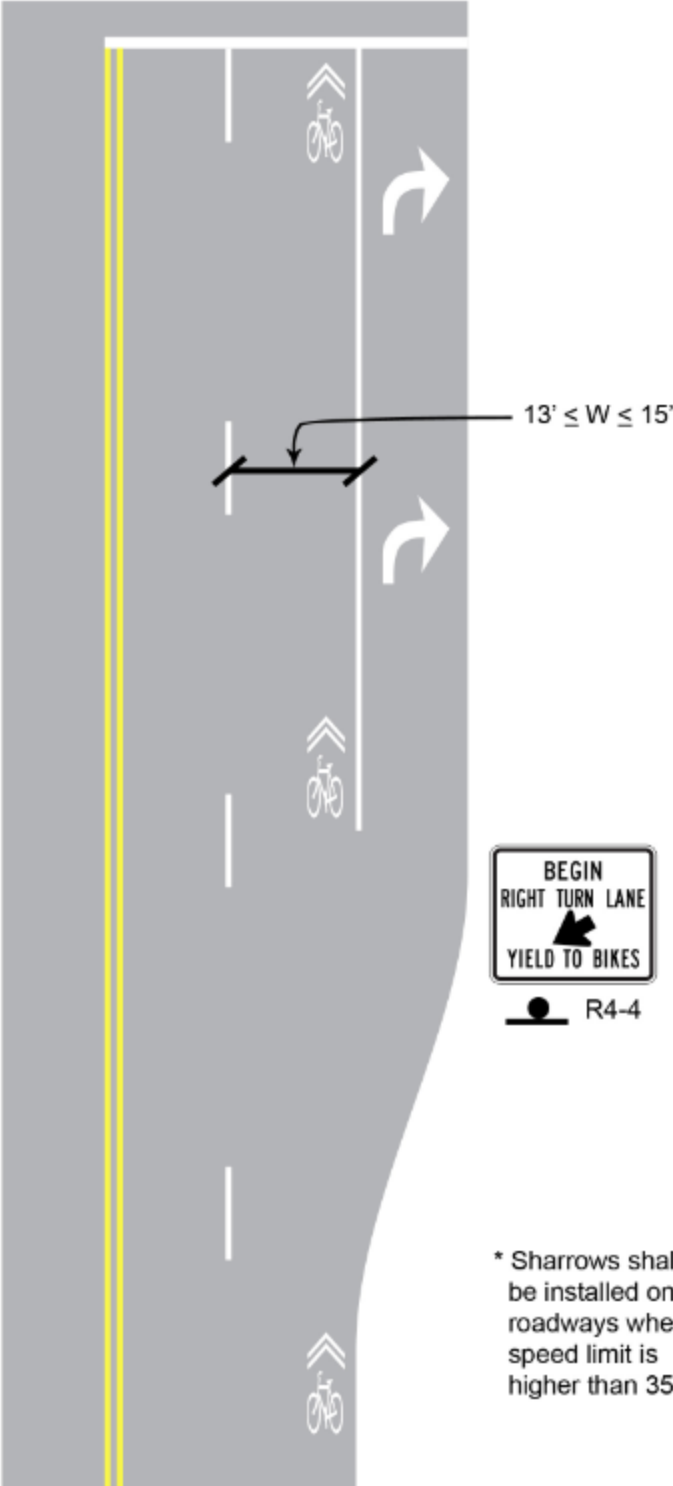


Sharrows should be placed:

- A minimum of 4 ft from the face of curb or roadway edge to the center of the sharrow marking when not used adjacent to a parking lane; or
- A minimum of 4 ft from the edge of the parking edge line to the center of the sharrow marking when used adjacent to a parking lane.

For spacing and further information on Shared Lane Markings, refer to Section 9C.07 in the MdMUTCD. Sharrows shall not be placed in bicycle lanes. See Figure 3.3 for typical placement locations of the shared lane marking.

Figure 3.4 Sharrows Approaching Intersection



3.3 Share the Road Assembly

A SHARE THE ROAD assembly may be used to alert motorists of the presence of bicyclists in locations where bicyclists are forced to leave a shoulder, Bicycle Lane, or other bikeway and use the motor vehicle lanes because of either an obstruction or the end of the bikeway. The SHARE THE ROAD assembly consists of a standard Bicycle Warning Sign (W11-1) with a SHARE THE ROAD plaque (W16-1).

A SHARE THE ROAD assembly should be used for the following conditions:

- where the rightmost travel lane is less than 15 feet wide, and there is insufficient shoulder width or the shoulder is otherwise un-rideable;
- where there are obstacles (i.e. trees, traffic barrier, bridge piers, etc.) that impinge on an otherwise rideable shoulder.



Figure 3.5
SHARE THE ROAD assembly
W11-1 and W16-1

In general, SHARE THE ROAD signs should not be used in locations with good bicycling conditions, such as roadways with low traffic volumes or roads with wide paved shoulders or bicycle lanes. SHARE THE ROAD signs should not be used in combination with sharrows.

3.4 Bicycles May Use Full Lane

There are areas where road users may need to be informed of the State Law provisions covering bicycle use of the full travel lane width where necessary for the safety and comfort of the bicyclist; and the fact that along certain narrow roadways, bicycles may be within the roadway travel lane. This information may be provided through either regulatory or warning signs. The purpose of these signs is two-fold: to provide information to other road users that bicyclists are entitled by law to utilize the full width of the travel lane where the lane is too narrow for a bicycle and another vehicle to safely travel side-by-side and; secondly to provide a warning message to alert other road users of the possibility of such full travel lane usage by bicyclists in areas where such use may not be expected. These signs provide options for the highway operating agencies to be flexible in selecting the sign application that best meets the needs of the traveling public.

BICYCLES MAY USE FULL LANE sign (R4-11, see Figure 3.6a)

This Regulatory/Informational sign is intended to be used at locations where it is deemed desirable to remind motorists of the legal right of bicyclists to occupy any space within the travel lane when conditions warrant doing so. This sign should be used in the following circumstances:

- At the entry points onto the State highway system as information about Maryland law;
- At the beginning of a section of roadway where the lane is 13 feet or less wide (i.e. where motorists are forced to cross a double yellow line in order to pass a bicyclist with the mandated 3 foot clearance);
- At the beginning of a section of roadway where the curbside parking or other encroachments narrow the usable width of travel to 13 feet or less;
- Additional signs may be placed at intervals of ½ mile through the length of a lane effectively 13 feet or less wide in urban areas;

- At the point where an existing bike lane or other bicycle facility ends and bicyclists are forced to share a lane with motorized vehicles;
- In advance of locations where significant number of left turning bicycles are expected (i.e. along Bike Routes);
- Where major routes cross major jurisdictional boundaries; such as the state line, Baltimore City, or Washington D.C. city limits, a modified R4-11 with a black NOTICE legend on a yellow background may be added to the top of a standard R4-11 sign (see Figure 3.6b).



Figure 3.6a
BICYCLES MAY USE FULL LANE
R4-11



Figure 3.6b
BICYCLES MAY USE FULL LANE
with "NOTICE"
R4-11(1)

BICYCLES MAY USE FULL LANE warning sign (W16-1(3))

The BICYCLES MAY USE FULL LANE sign should be installed at locations where lane widths and/or other conditions create an extraordinary hazard for bicyclists sharing a lane with motorized vehicles on roadways where no specific bicycle facility such as bicycle lanes, shared lanes, or adjacent shoulders exists. This sign, as shown in Figure 3.7, shall be used only where "substandard width" lanes could make it particularly unsafe for a bicyclist to travel along the right curb or edge of the roadway. The W16-1(3) sign is not currently in the MD MUTCD; however, it is approved and available for use. It is within the Maryland Standard Sign book and is also in the Federal Standard Sign book. It will be added to the next version of the MD MUTCD.



Figure 3.7
BICYCLES MAY USE FULL LANE
W16-1(3)

The signs described in this section should only be installed after approval from the ADE-T.

CHAPTER 4: RIDING SURFACE AND ROADSIDE FEATURES

4.1 Railroad Crossings

At highway-rail crossings, bicycle tires, particularly on-road bikes, can become stuck in the gap between the rail and the adjacent crossing surface material; possibly causing the bicyclist to fall. This is generally a concern only in locations where the rails intersect with the roadway at an angle of less than 45 degrees to the direction of travel.

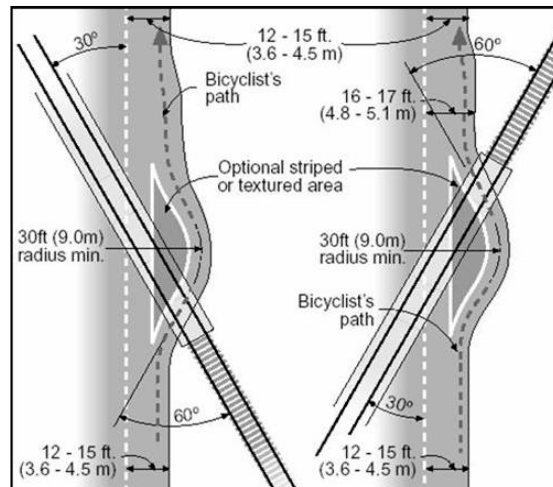


Figure 4.1

Railroad Crossings

Source: Oregon DOT

In locations where this condition is present, the bicycle lane or shoulder should be designed so that the bicyclist can approach the track at an angle between 60 and 90 degrees, without having to utilize the motor vehicle travel lanes. The dimensions of the widened area will be dependent upon the angle of the intersection of the tracks and the roadway. The crossing surface should extend a minimum of 3 ft beyond the right edge of the roadway paving. Sufficient paved space must be provided on each side of the tracks for bicyclists to safely leave and return to the normal path of the bikeway. An example of this widening treatment is shown in Figure 4.1.

In locations where a retrofit may not be feasible or where the retrofit may not occur for a period of time, W10-12 warning signs should be installed to warn bicyclists of this skewed crossing, as shown in Figure 4.2. Any stop bars or warning gates that are provided for highway traffic will be provided for bikeway facilities.



Figure 4.2

Skewed Crossing

W10-12

4.2 Pavement Quality - Asphalt and Concrete Joint Lines

Careful consideration should be given to the placement of asphalt joint lines and concrete expansion joints. This is typically a problem on roadways where a concrete joint is located at or near the most appropriate place for bicyclists to ride (typically on the right side of the outside travel lane near on-street parking). The bicycle tire can become trapped within the joint, causing the bicyclist to crash. The placement of concrete joints should be considered during design to locate it away from the portion of the roadway where bicyclists are most likely to travel. Existing joints should be filled with an appropriate filler to reduce the chance of a bicycle crash.

Concrete joints should not be placed in locations with parking between 6 ft and 9 ft from the curb or roadway edge. See Figure 4.3 for an example location where the concrete expansion joint is placed within the bicycle riding area. Concrete pads at bus stops in roadways with parking often overlap into the bike lane. Care should be taken to ensure that joints are smooth between the asphalt and concrete surfaces.



Figure 4.3
Poor Concrete Seam Placement

Unpaved Driveways

When appropriate as part of a project, unpaved driveways should be paved up to the right of way line or 20 ft from the roadway edge, whichever is less, to reduce gravel and dirt debris deposited onto shoulders and bike lanes.

4.3 Shoulder Area Rumble Strips

Rumble strips provide a safe, inexpensive and efficient way to reduce run-off-road crashes for motorists on higher speed roadways. However, rumble strips can also impede bicycle travel if installed incorrectly.

If rumble strips are located along the right edge of a roadway with a narrow shoulder or no shoulder space, bicyclists will be forced into the roadway requiring them to share the travel lane with motorists. If rumble strips are used on wider shoulders or Bike Lanes, their placement should be such that a minimum width of smooth paving remains to their right throughout the corridor to accommodate bicycle access, as directed in Table 2.1.

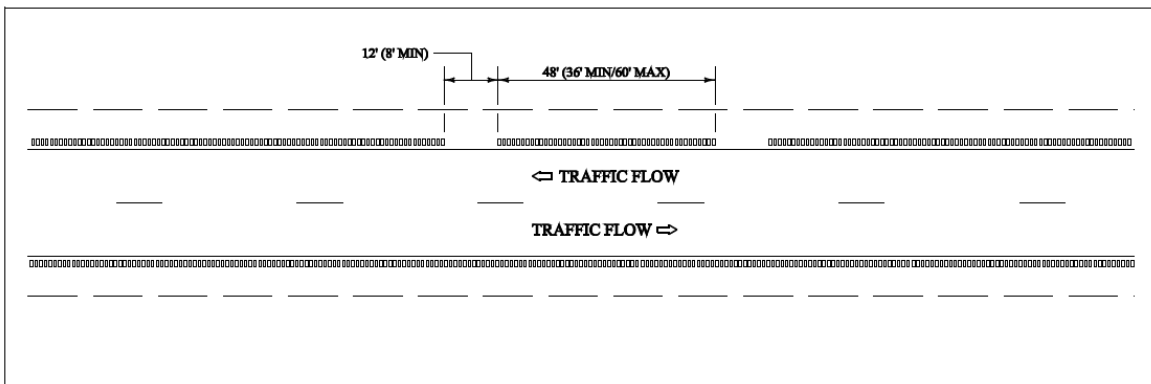


Figure 4.4
Rumble Strip Gap Spacing to Accommodate Bicyclists

Where appropriate, periodic gaps should be provided in the rumble strips to accommodate left turning or merging movements and to enable bicyclists to leave the bikeway if necessary or to pass slower moving bicyclists. Initial research indicates that an opening of 12 ft should be provided to allow bicyclists to cross, without riding on, the rumble strip, as shown in Figure 4.4. To allow for sufficient opportunities for bicyclists to leave the bikeway, these gaps should be provided at regular intervals. For more information on bicycle compatible rumble strips, refer to SHA’s *Guidelines for Application of Rumble Strips and Rumble Stripes*, August 2011.

The ADE-T should be consulted prior to the installation of rumble strips on roadways where bicyclists are permitted.

4.4 Shoulder Edge Treatment

It is important to avoid sudden drop-offs at the edge of existing open sections of roadway (Figure 4.5) as they represent a hazard to both bicyclists and motorists. The graded shoulder should have a smooth transition with the paved shoulder.

When roads are resurfaced, the new pavement should extend to the edge of the existing pavement to prevent the creation of a lip which is also a hazard to motorists and bicyclists. If erosion problems and/or a soft shoulder are anticipated, the edge of the pavement should be milled to a maximum 30 degree angle. In areas where there is a transition from an open to a closed drainage system, taper the paved bicycle lane or compatible shoulder into the gutter pan edge at the face of the curb to minimize erosion.



Figure 4.5
Shoulder Drop Off
Source: FHWA "Safety Edge" Brochure

4.5 Traffic Barrier

The location of traffic barrier along roadside edges should follow the requirements established within the *Roadside Design Guide*. For further guidance on the width of a bicycle lane adjacent to traffic barrier, refer to Table 2.1.

4.6 Storm Drain Grates

Non-reticular inlet grates pose a hazard for bicyclists when the openings are parallel to the bicyclists' direction of travel. Bicycle tires can get caught between the bars of these grates, and cause bicyclists to crash. Per Section 8-648 of the Maryland Transportation Code, non-bicycle friendly drain grates shall be replaced with one of the types listed below. The following commonly found Maryland standard inlet grates are considered bicycle friendly:

- Reticular inlets/grates such as:
 - WR
 - NR
 - WRM
 - NRM
- Curved Vane grates such as:
 - S-CV, fits Type S inlet
 - E-CV, fits Type E inlet
- Curb opening inlets such as:
 - COG*
 - COS*
- ADA-compliant grates

*Note that these type inlets use a depressed pavement area that may cause some problems especially if the pavement is overlaid.



Figure 4.6
Non-Compliant Inlet Grate

CHAPTER 5: BICYCLE FACILITY TRANSITIONS

The transition from one type of bikeway to another is just as important as the selection of the type of bikeway to be installed along a specific section of roadway. Most roadways have several different typical sections over their length. This results in the need for different types of bikeways within a corridor to fit within the existing conditions. The transitions between these bikeways must be signed and marked so that both the motorists and bicyclists know what to expect as they travel along the roadway. When deciding upon where to transition between bicycle facilities near an intersection, the intersection is the preferred breaking point. One facility should end prior to the intersection and one should start after the intersection.

5.1 Transitions Table

In Table 5.1 below, each type of bikeway is listed on each axis. The Figures listed at each intersecting square are typical illustrations of the proper signing and marking for the transition selected.

Table 5.1 Bikeway Transitions

F R O M	T O	Bike Lane without Parking	Bike Lane with Parking	Shared Lane without Parking	Shared Lane with Parking	Narrow or No Shoulder
Bike Lane without Parking			Figure 5.1	Figure 5.2	Figure 5.3	Figure 5.4
Bike Lane with Parking		Figure 5.5		Figure 5.6	Figure 5.7	Figure 5.8
Shared Lane without Parking		Figure 5.9	Figure 5.10		Figure 5.11	Figure 5.12
Shared Lane with Parking		Figure 5.13	Figure 5.14	Figure 5.15		Figure 5.16
Narrow or No Shoulder		Figure 5.17	Figure 5.18	Figure 5.19	Figure 5.20	

5.2 General Notes

Listed below are general notes corresponding to all the diagrams listed in Table 5.1.

1. Refer to Table 2.1 for preferred bike lane widths:

Table 2.1 Marked Bike Lanes

MINIMUM SHOULDER WIDTHS FOR MARKED BIKE LANES		
POSTED SPEED LIMIT	TRUCK VOLUMES (%ADT)	SHOULDER/LANE WIDTH*
≤ 35 MPH	-----	4 FEET
> 35 MPH and ≤ 45 MPH	≤ 8% trucks	5 FEET
	> 8% trucks	6 FEET
> 45 MPH	-----	6 FEET

*The shoulder/lane width is measured excluding the gutter pan.

*Add 1 foot to the shoulder/lane width if operating adjacent to traffic barrier, concrete barrier, a curb without a gutter pan, or on-street parking.

2. If $W < 13$ ft, shared lane markings shall not be used. Where appropriate, Bicycle May Use Full Lane signs may be used.
3. If $13 \text{ ft} \leq W < 15$ ft, either shared lane markings or share the road assemblies may be used, but not both. Shared lane markings shall not be installed on roadways where the speed limit is higher than 35 mph.
4. If $W \geq 15$ ft, an 11 ft motor vehicle travel lane and bike lane should be established with a solid white line delineating the lanes, making sure compliance is met in Table 2.1. For further bike lane guidance, see Chapter 2.

Figure 5.1 - Example of Typical Transition from BIKE LANE without Parking to BIKE LANE with Parking

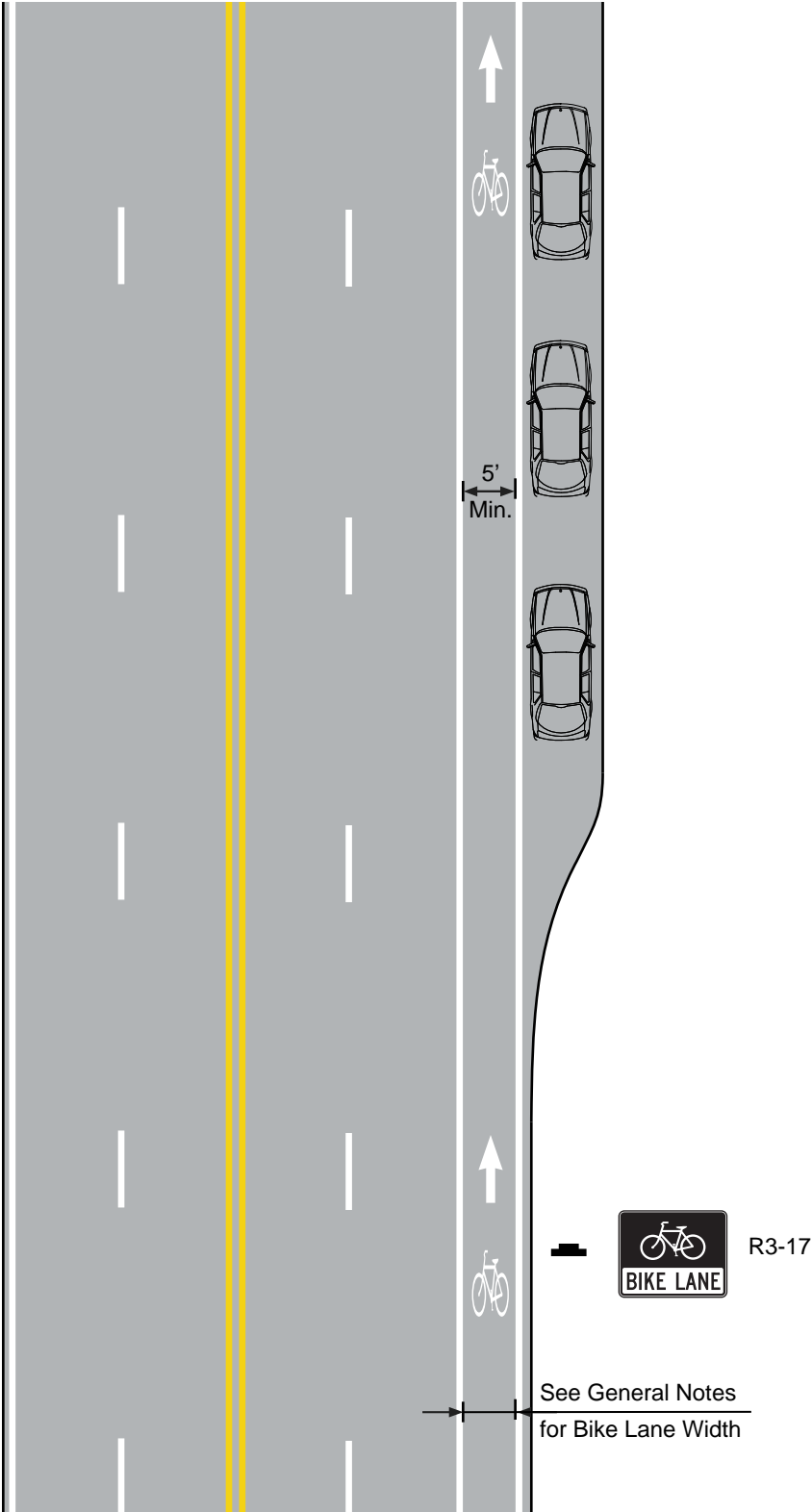


Figure 5.2 - Example of Typical Transition from BIKE LANE without Parking to Shared Lane without Parking

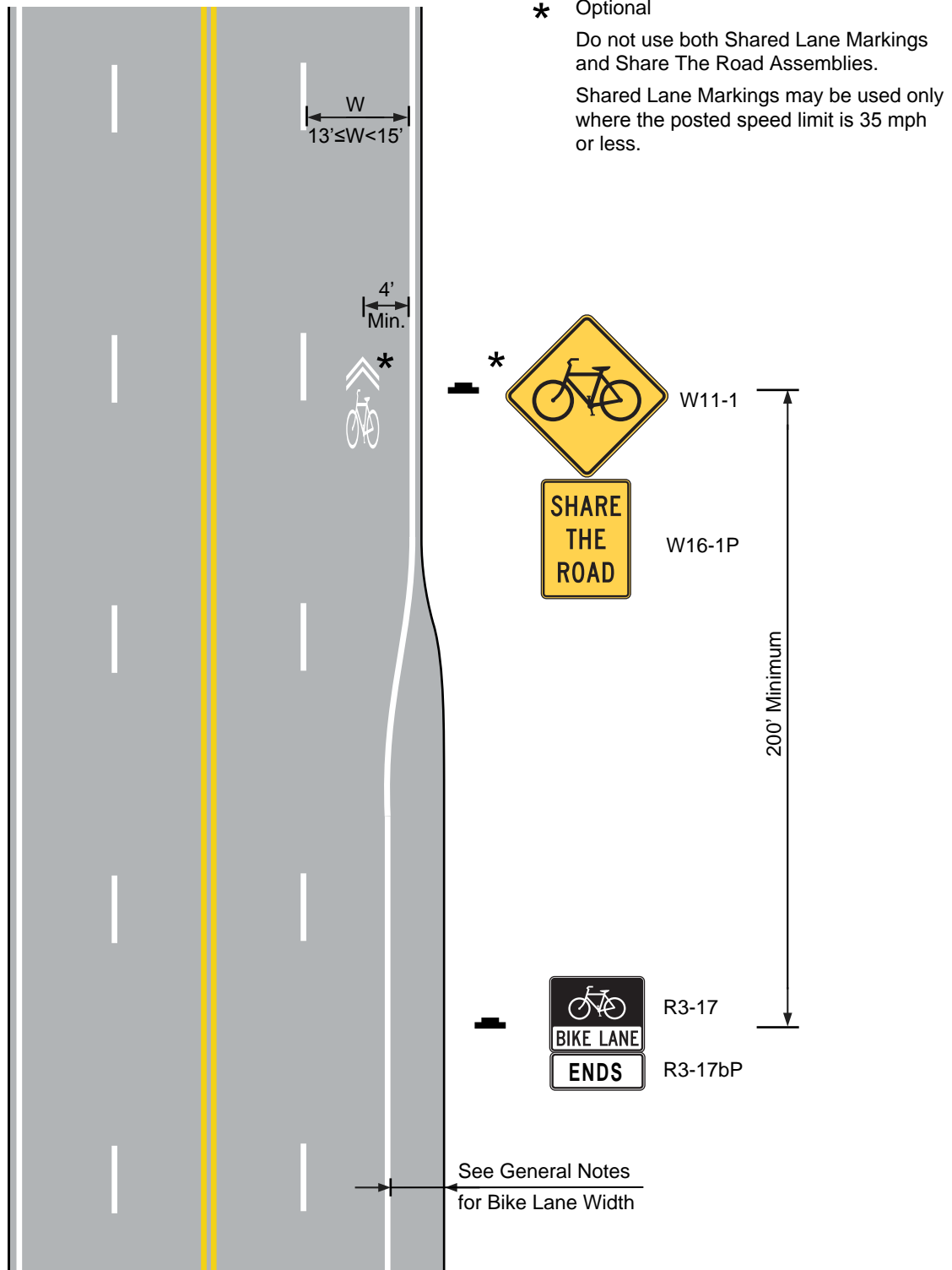


Figure 5.3 - Example of Typical Transition from BIKE LANE without Parking to Shared Lane with Parking

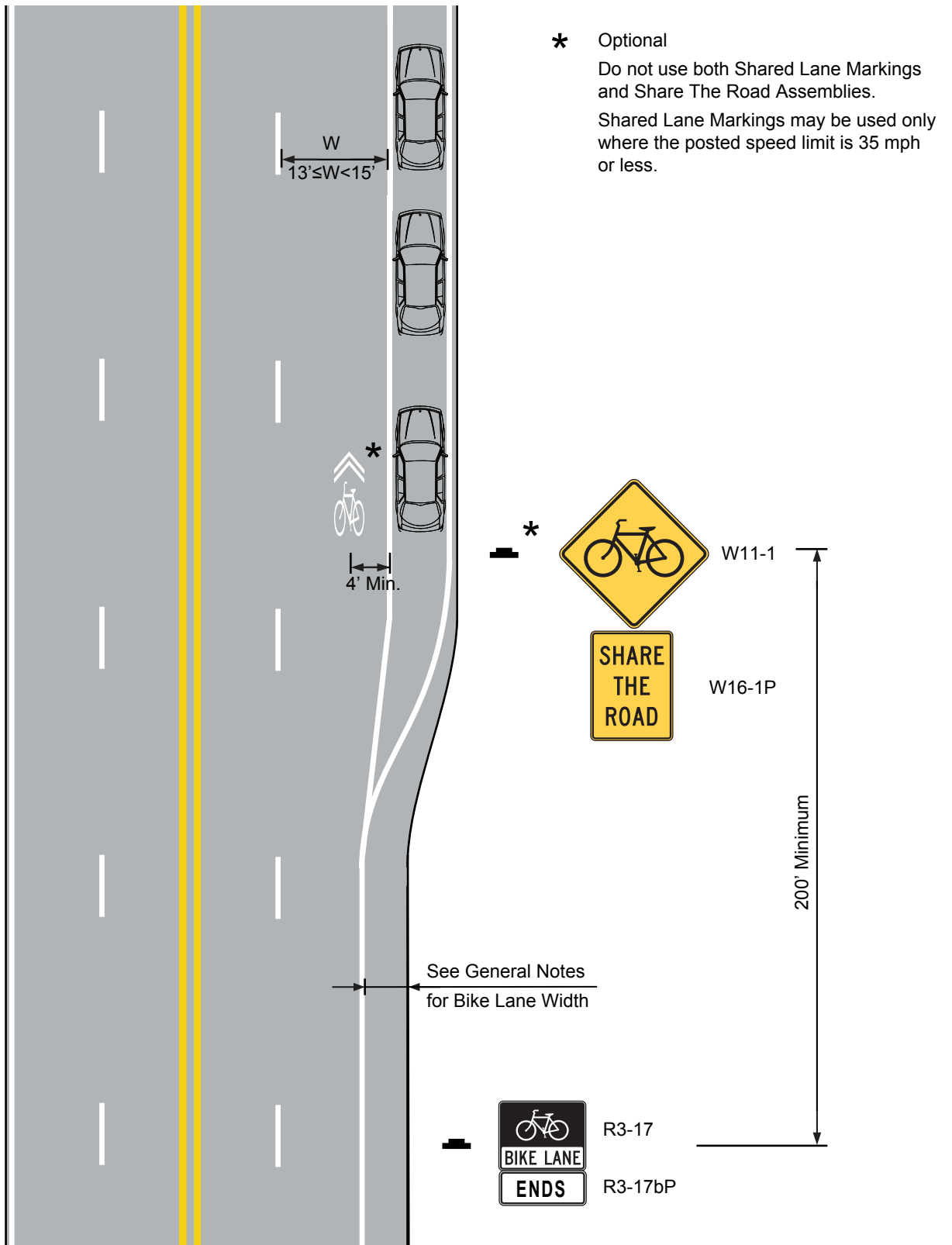


Figure 5.4 - Example of Typical Transition from BIKE LANE without Parking to Narrow or No Shoulder

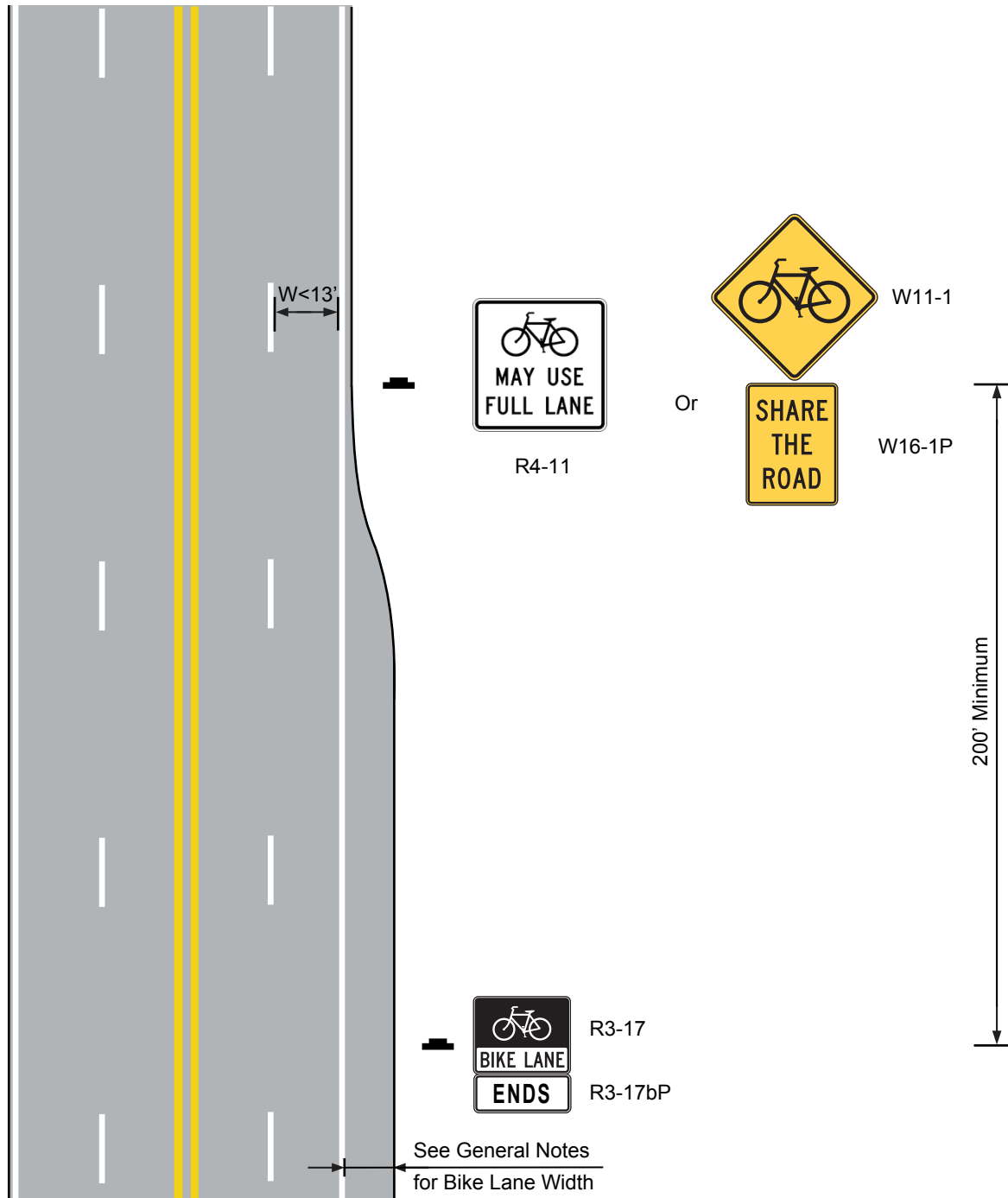


Figure 5.5 - Example of Typical Transition from BIKE LANE with Parking to BIKE LANE without Parking

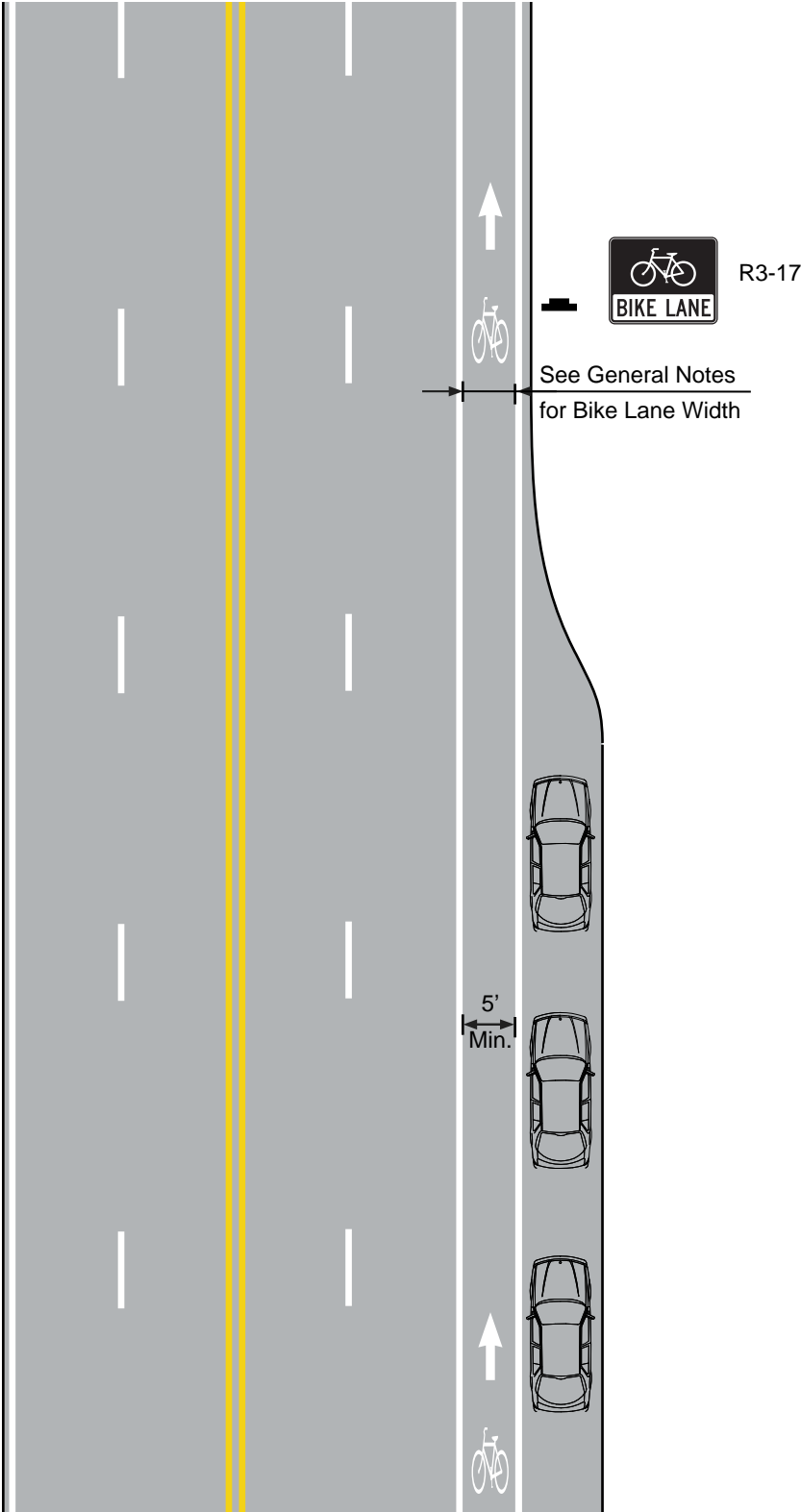


Figure 5.6 - Example of Typical Transition from BIKE LANE with Parking to Shared Lane without Parking

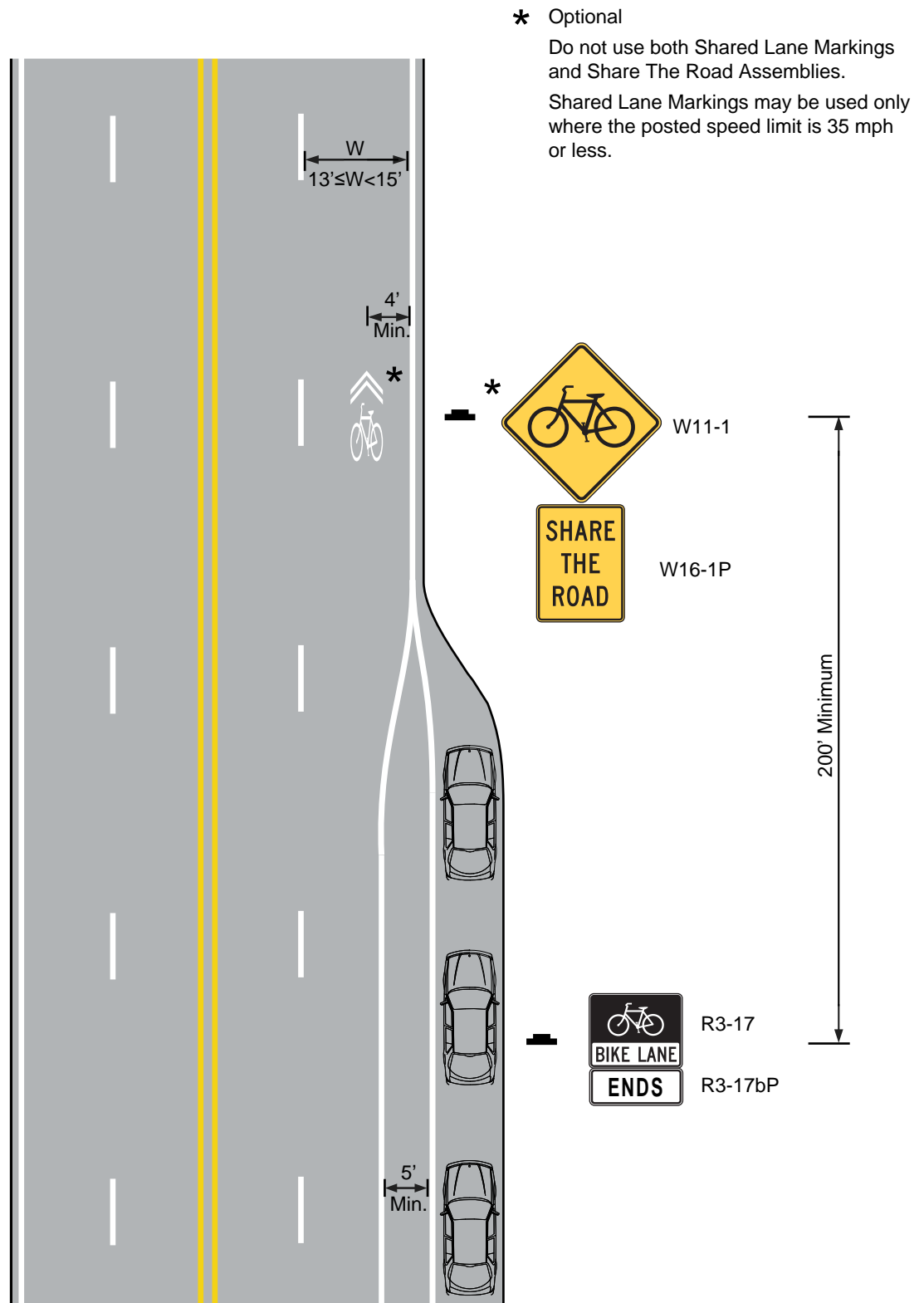


Figure 5.7 - Example of Typical Transition from BIKE LANE with Parking to Shared Lane with Parking

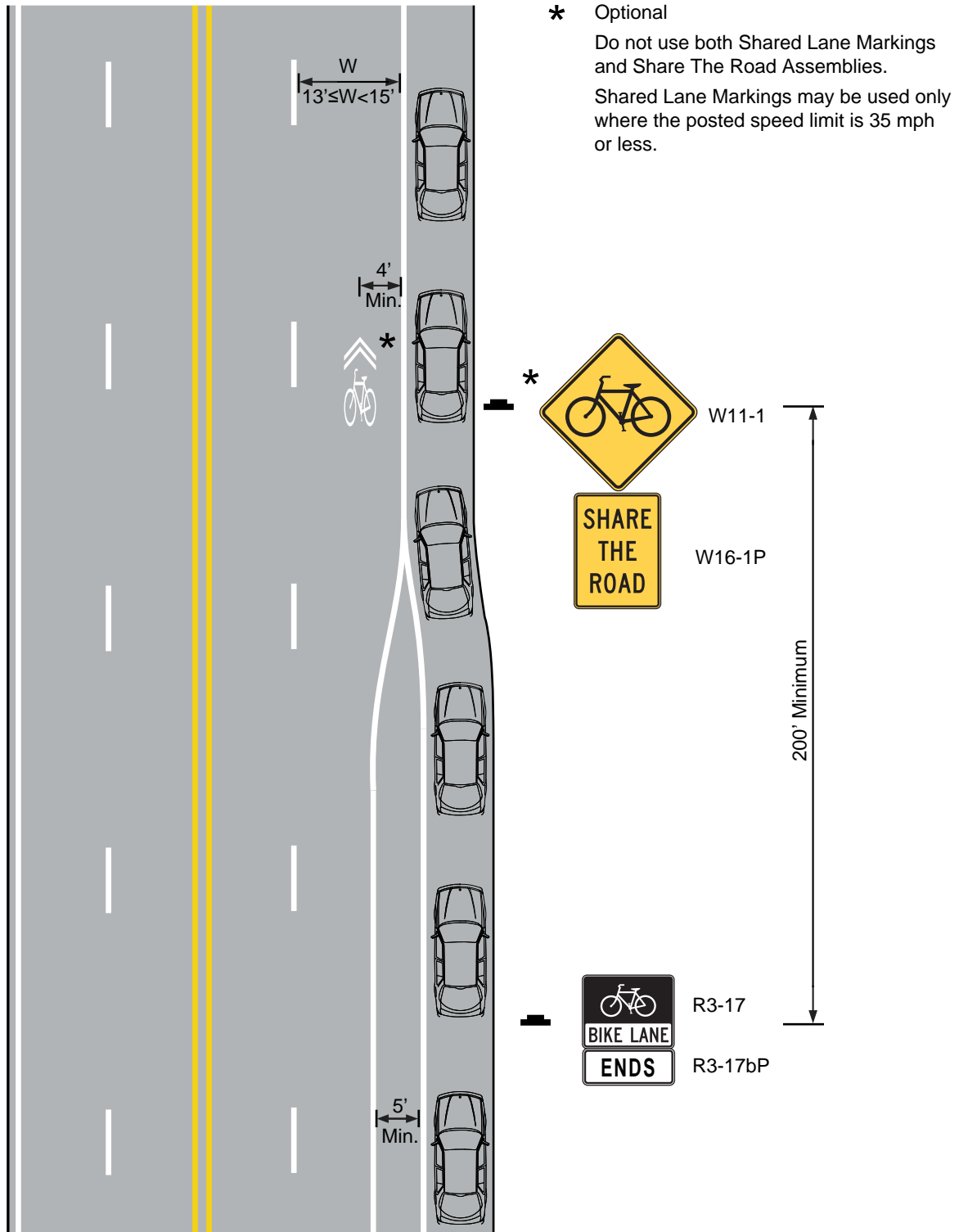


Figure 5.8- Example of Typical Transition from BIKE LANE with Parking to Narrow or No Shoulder

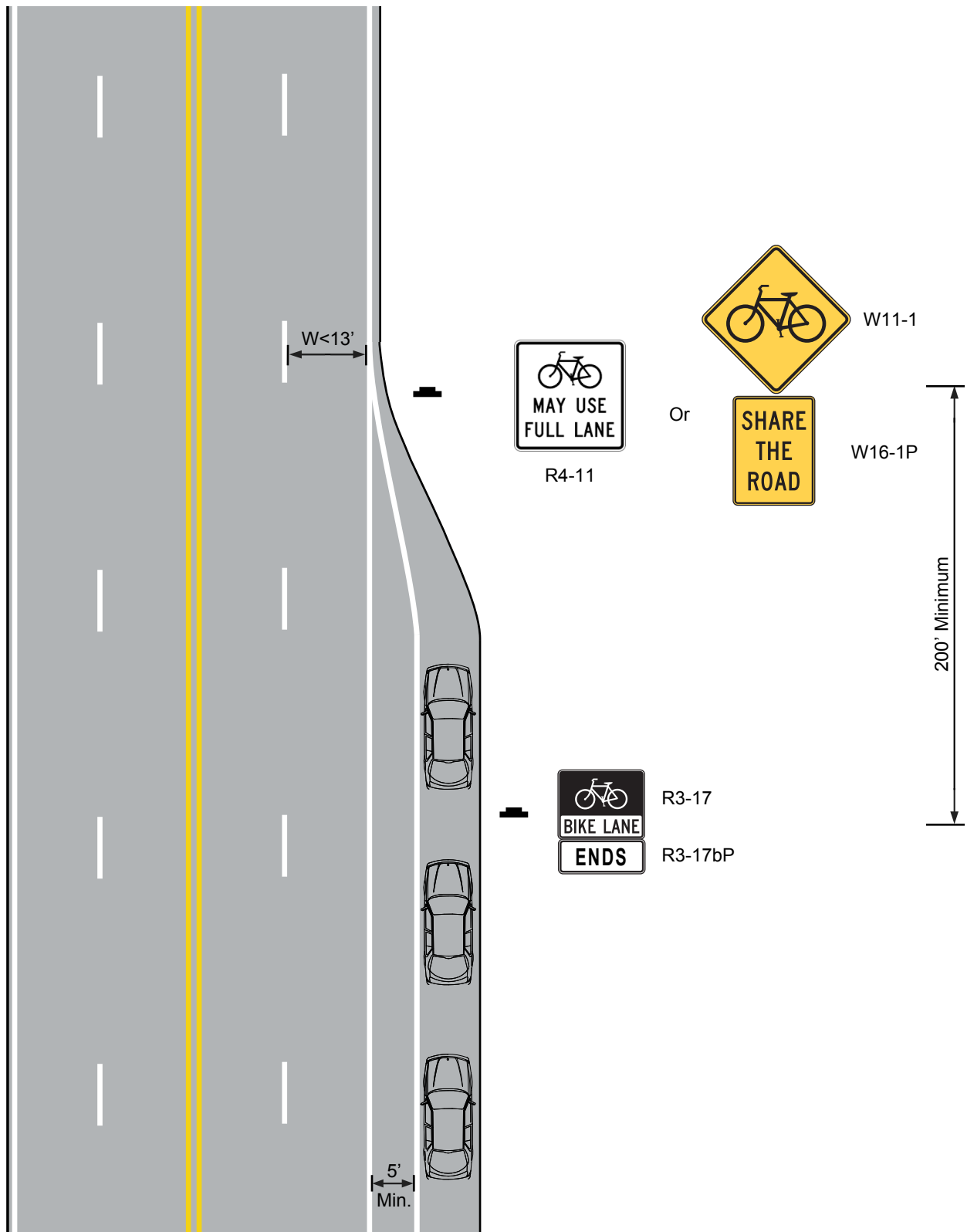


Figure 5.9 - Example of Typical Transition from Shared Lane without Parking to BIKE LANE without Parking

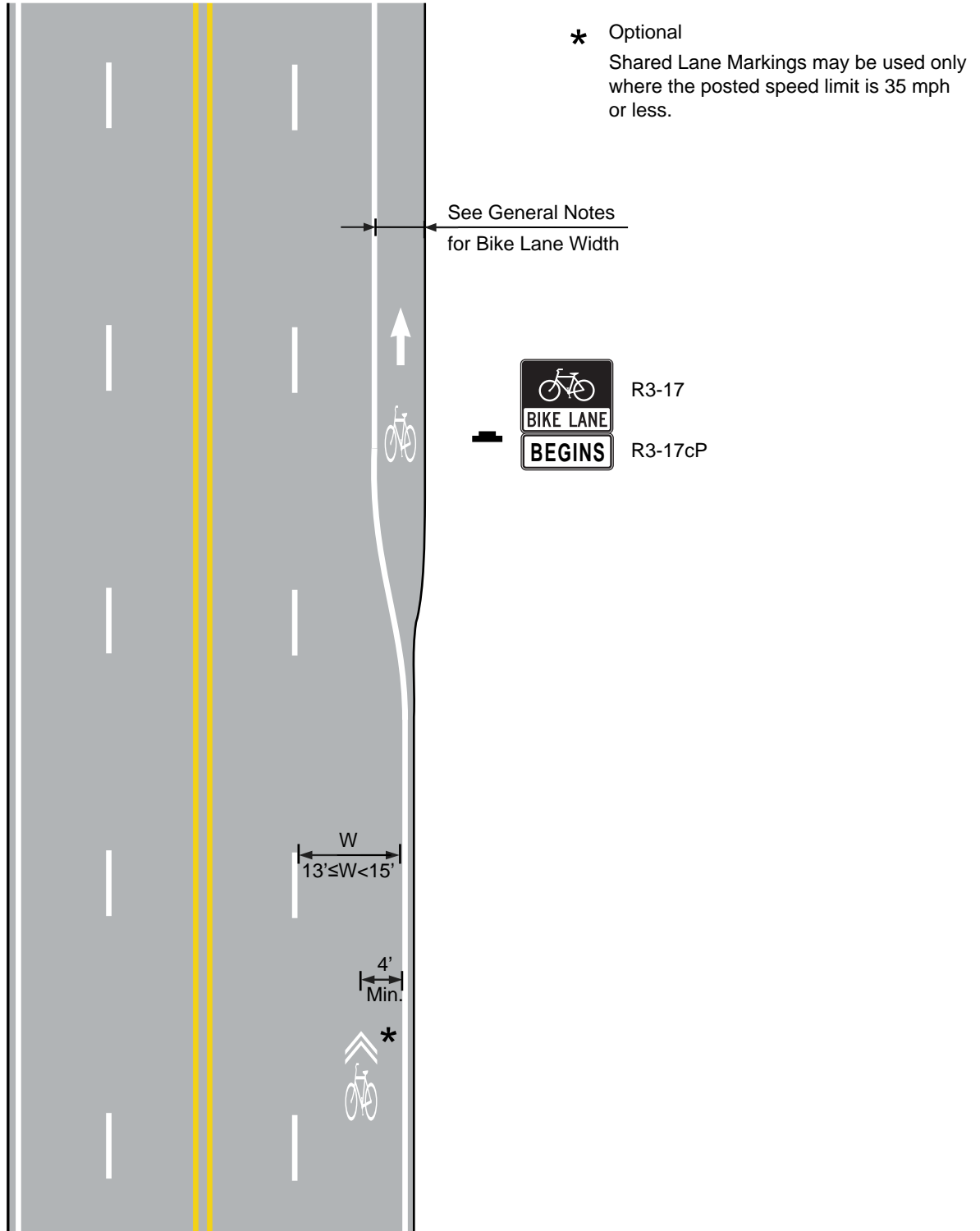


Figure 5.10 - Example of Typical Transition from Shared Lane without Parking to BIKE LANE with Parking

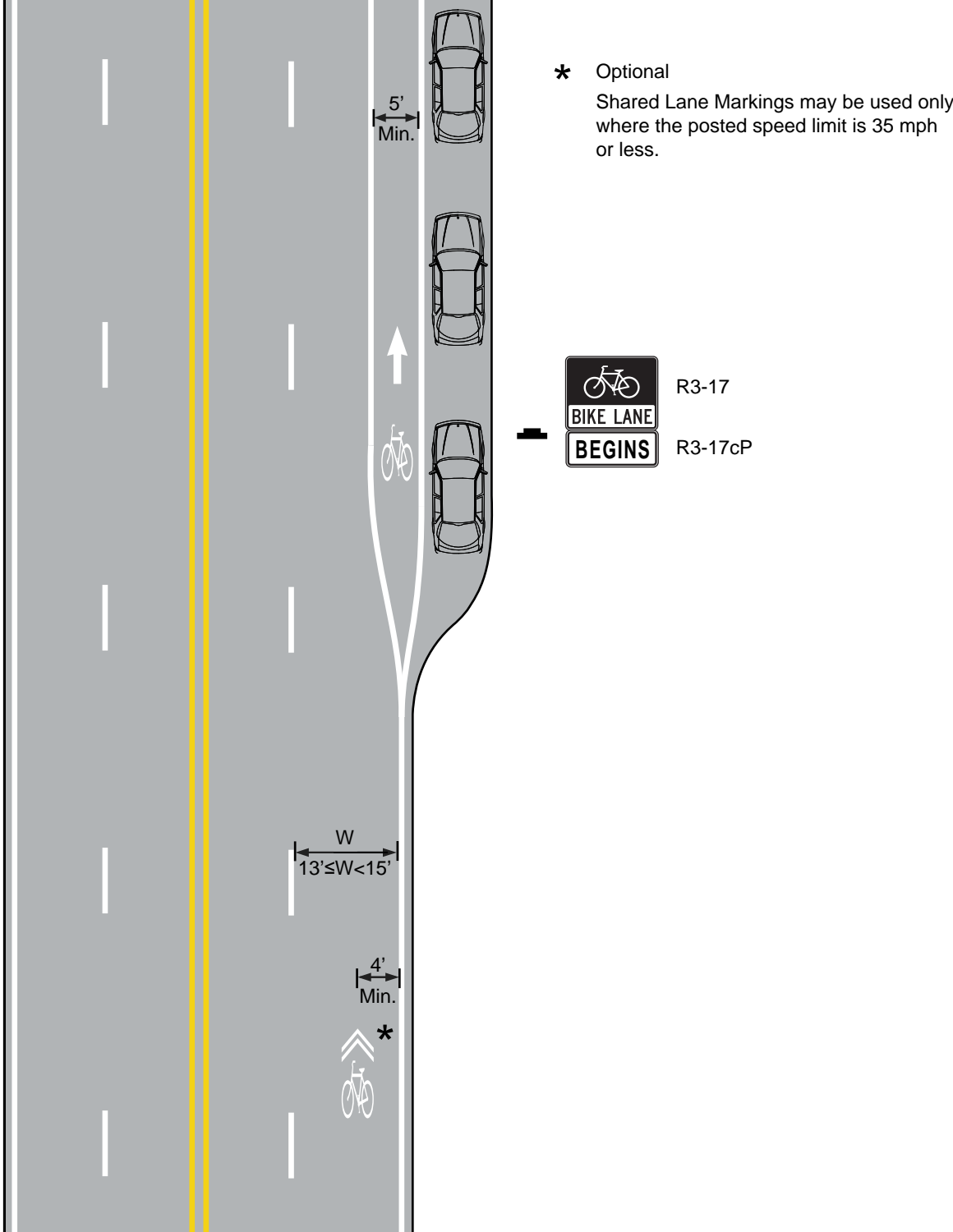


Figure 5.11 - Example of Typical Transition from Shared Lane without Parking to Shared Lane with Parking

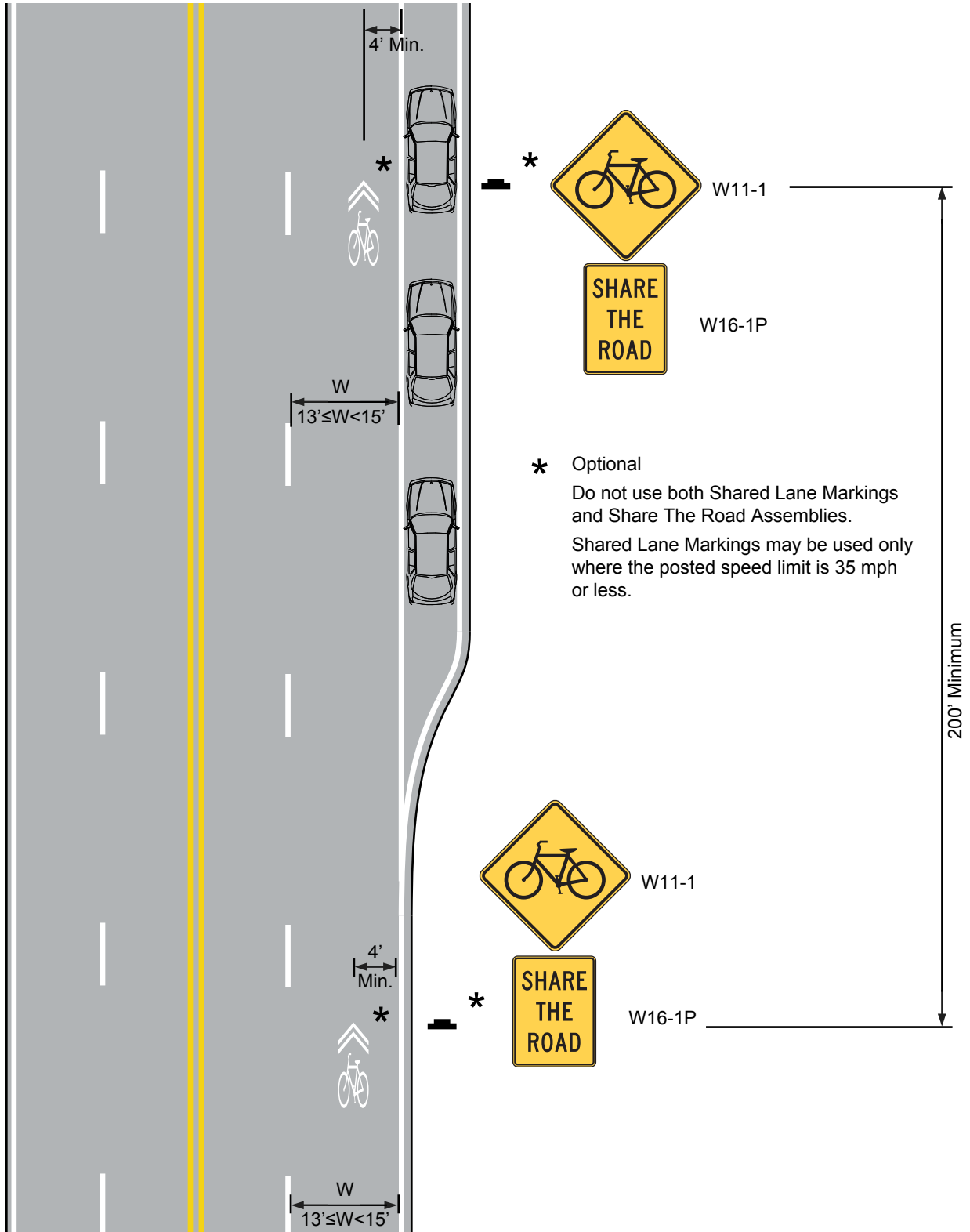


Figure 5.12 - Example of Typical Transition from Shared Lane without Parking to Narrow or No Shoulder

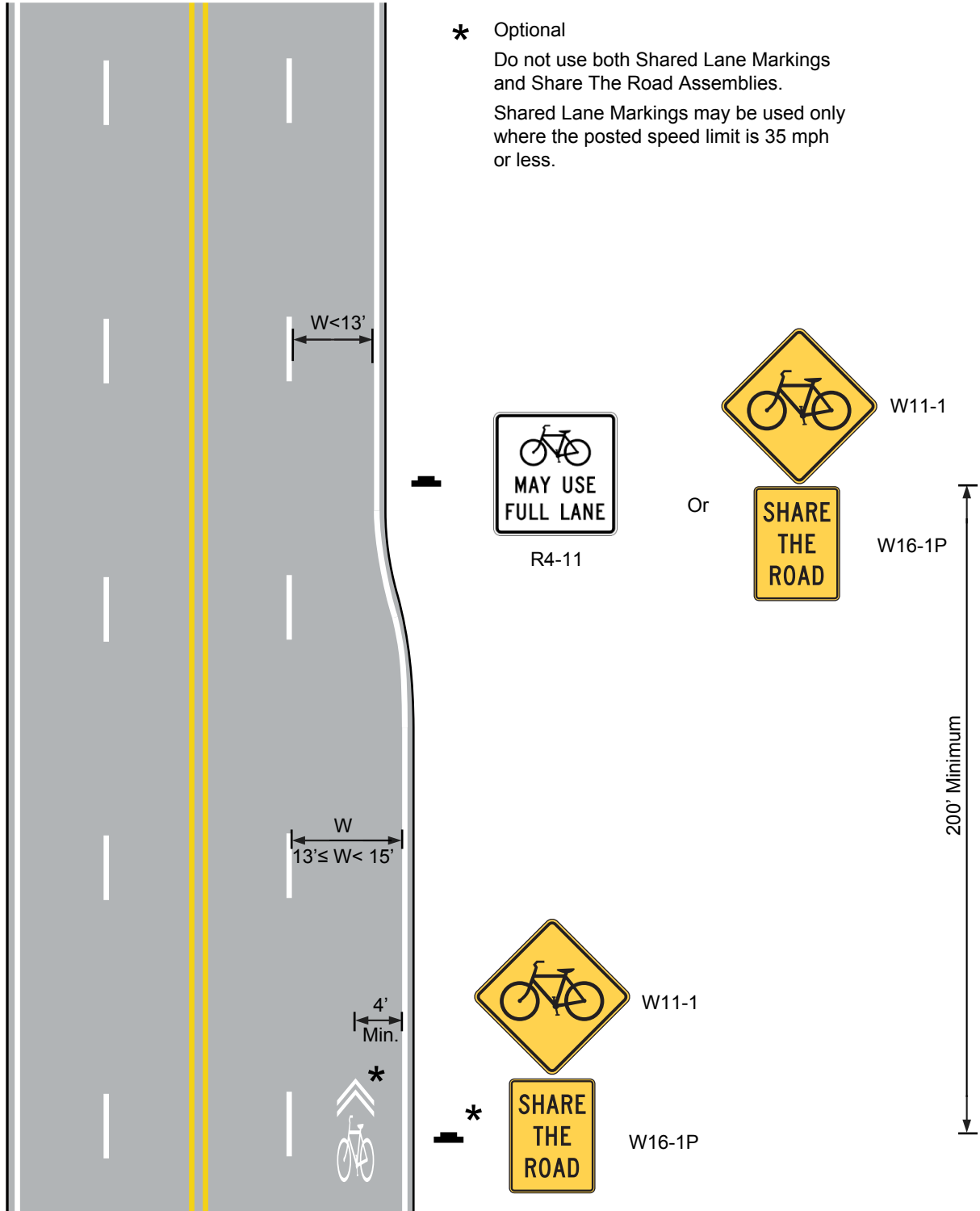


Figure 5.13 - Example of Typical Transition from Shared Lane with Parking to BIKE LANE without Parking

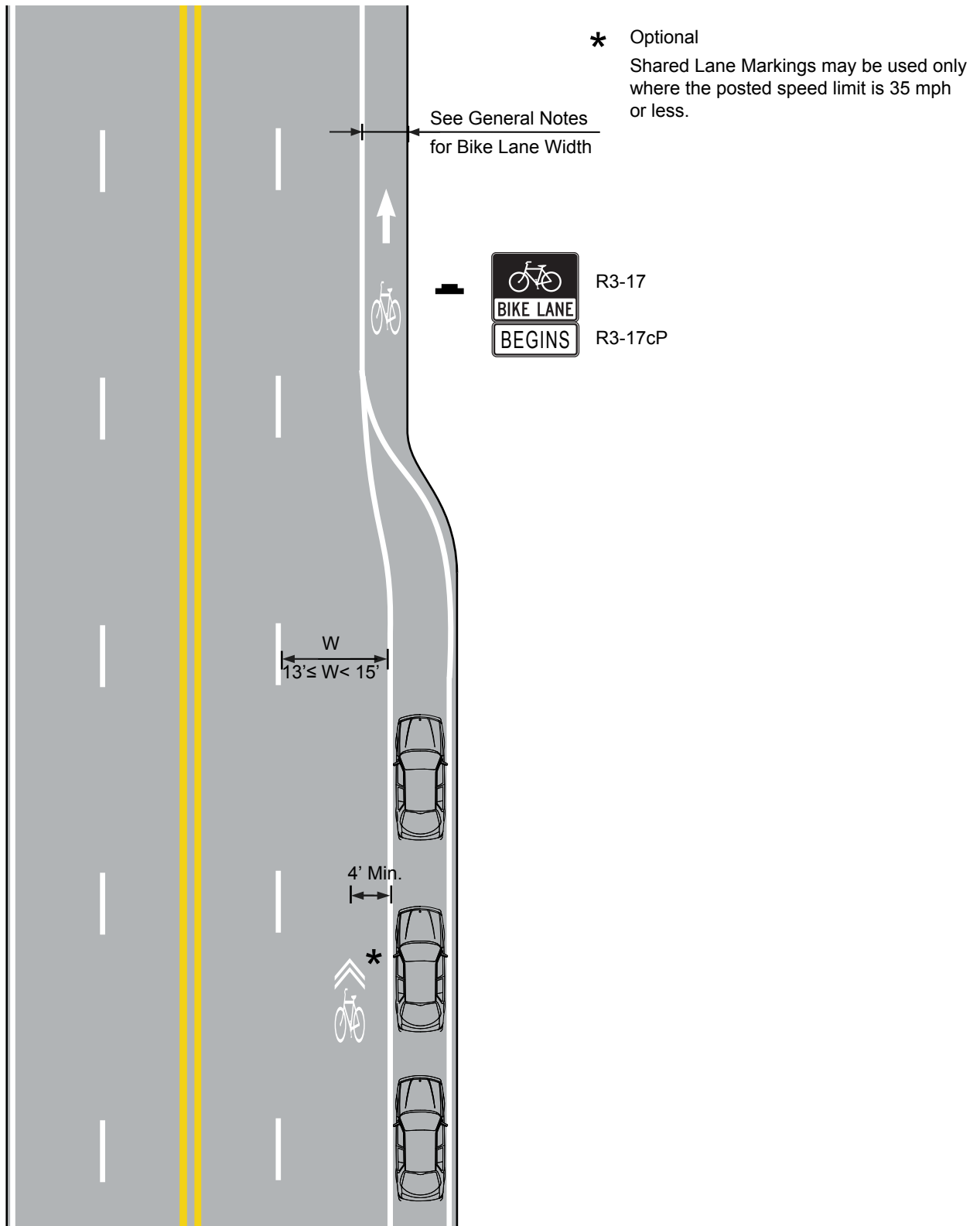


Figure 5.14 - Example of Typical Transition from Shared Lane with Parking to BIKE LANE with Parking

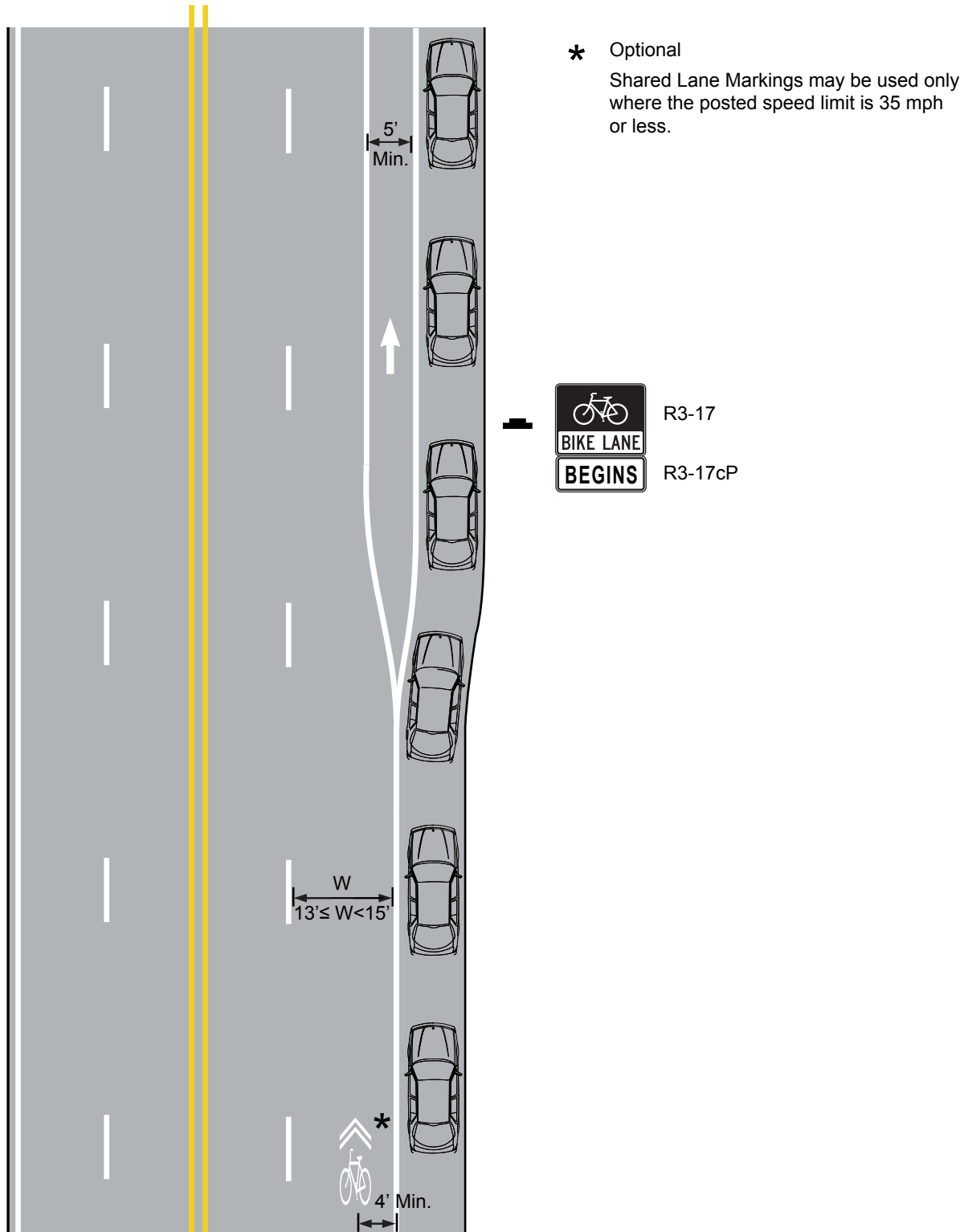


Figure 5.15 - Example of Typical Transition from Shared Lane with Parking to Shared Lane without Parking

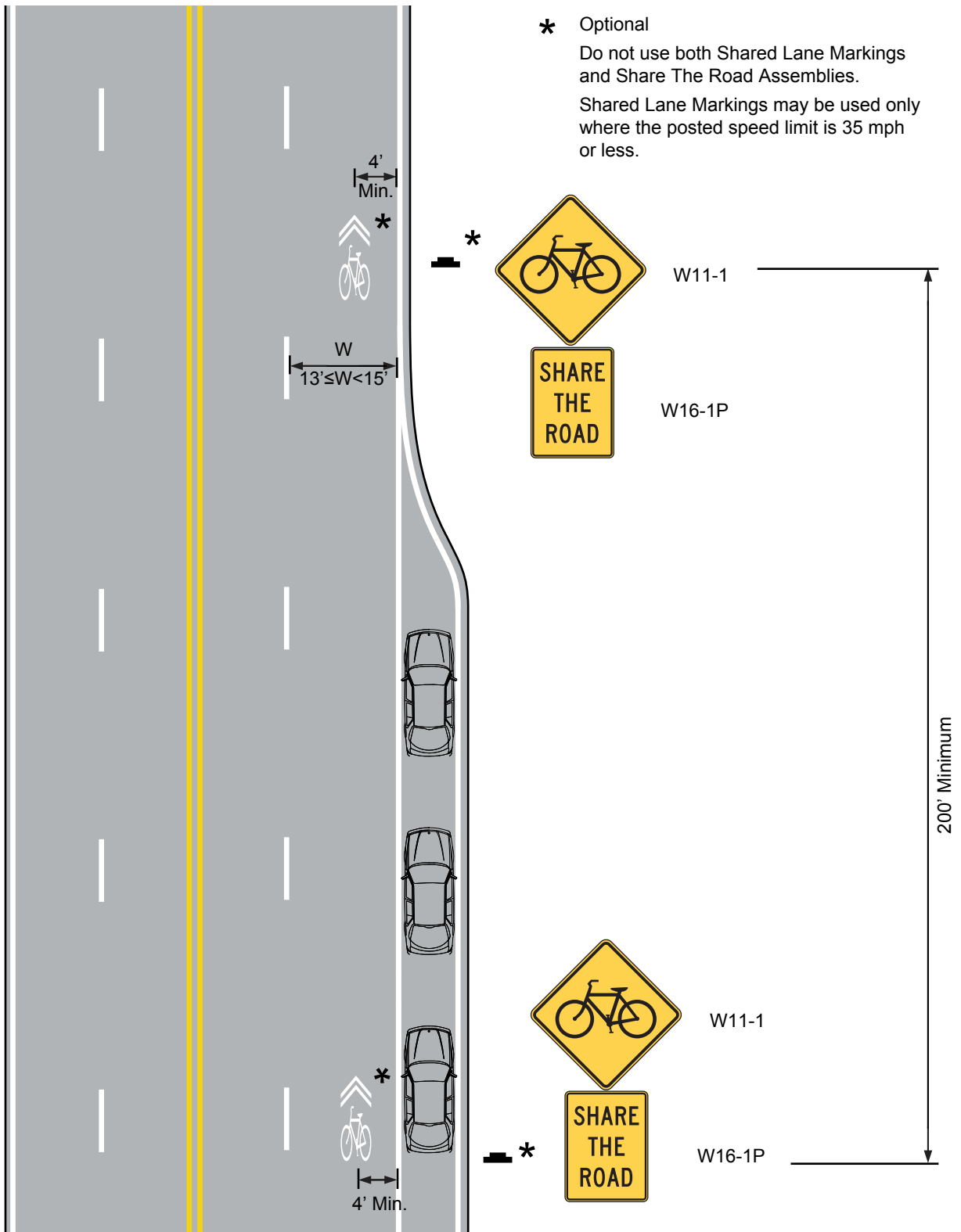


Figure 5.16 - Example of Typical Transition from Shared Lane with Parking to Narrow or No Shoulder

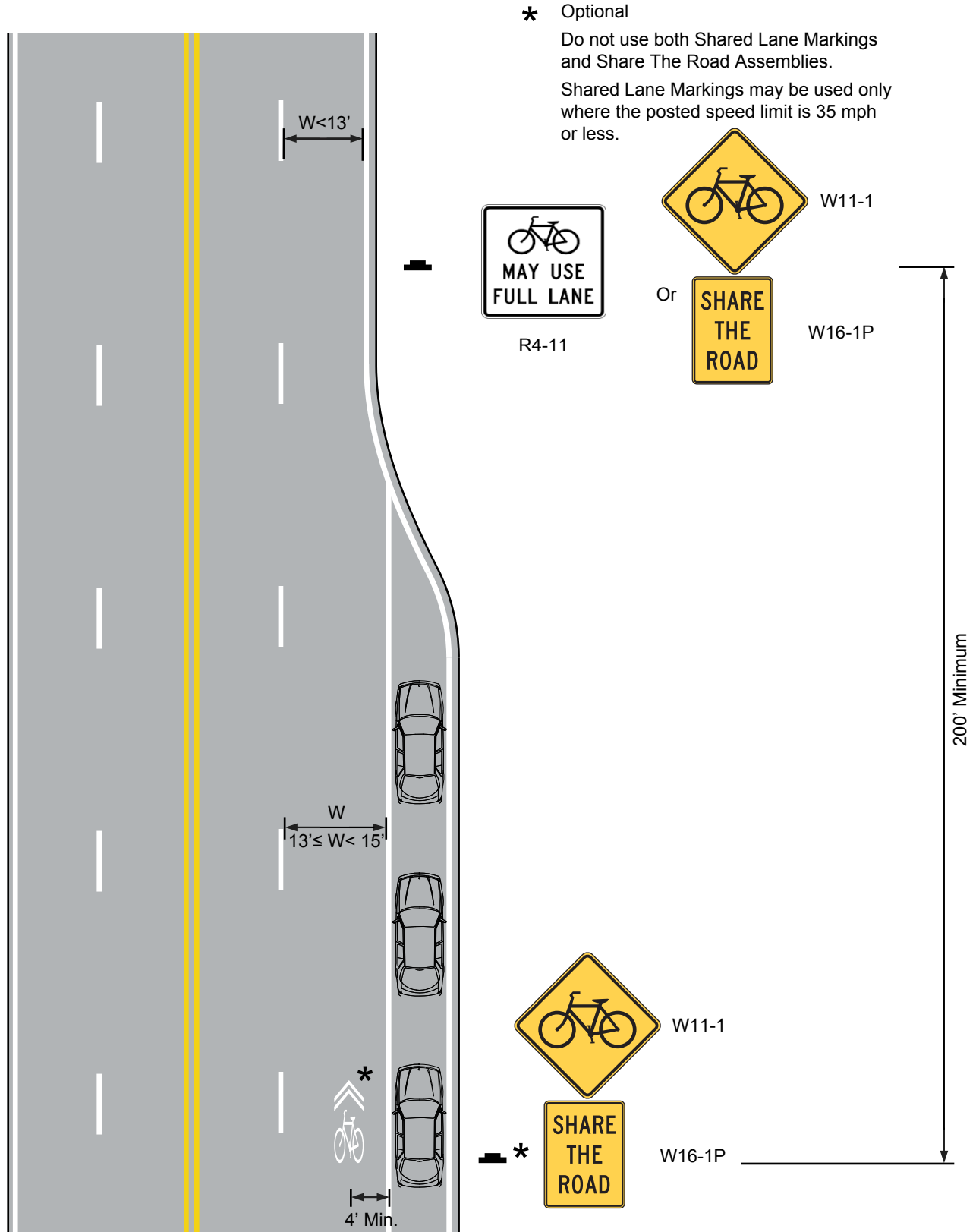


Figure 5.17 - Example of Typical Transition from Narrow or No Shoulder to BIKE LANE without Parking

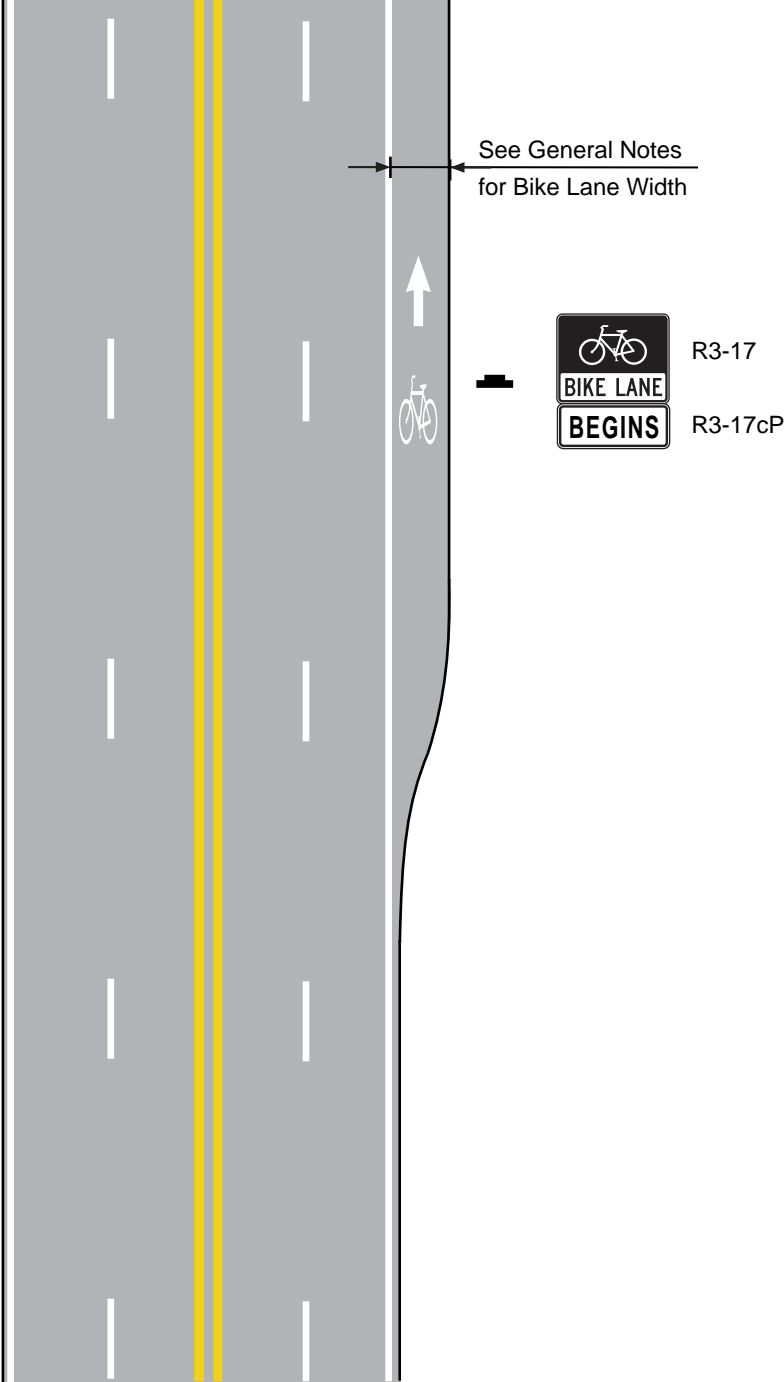


Figure 5.18 - Example of Typical Transition from Narrow or No Shoulder to BIKE LANE with Parking

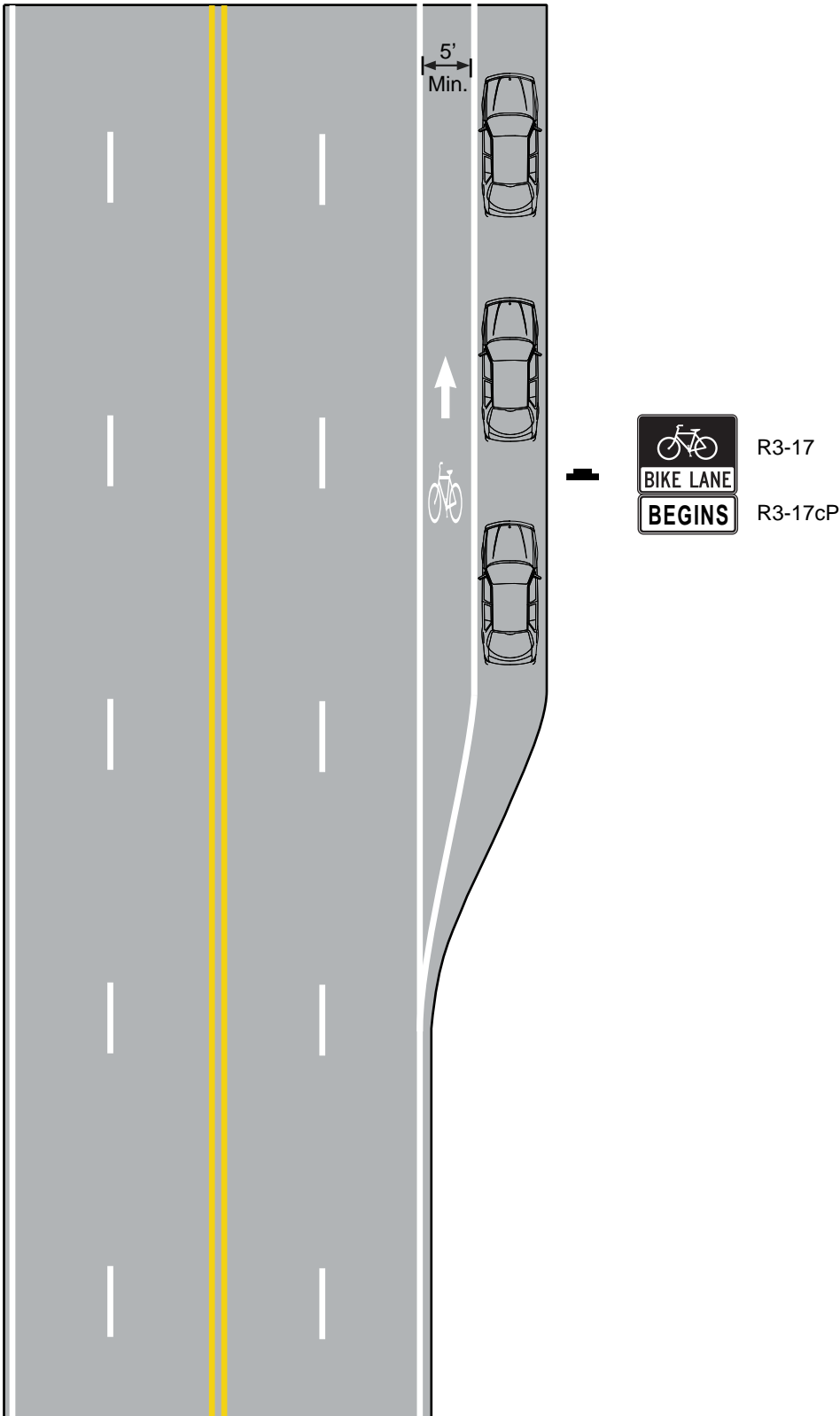
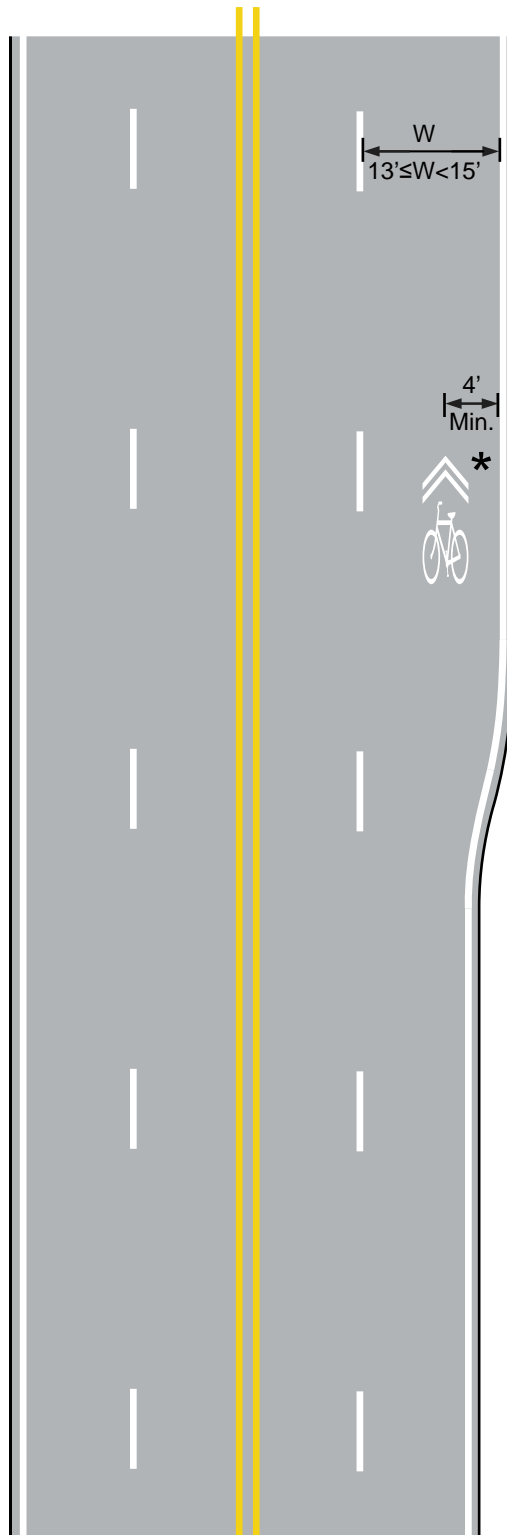


Figure 5.19 - Example of Typical Transition from Narrow or No Shoulder to Shared Lane without Parking



* Optional
Do not use both Shared Lane Markings and Share The Road Assemblies.
Shared Lane Markings may be used only where the posted speed limit is 35 mph or less.

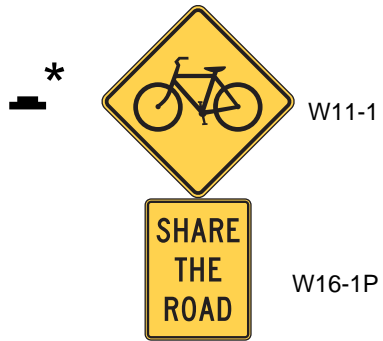
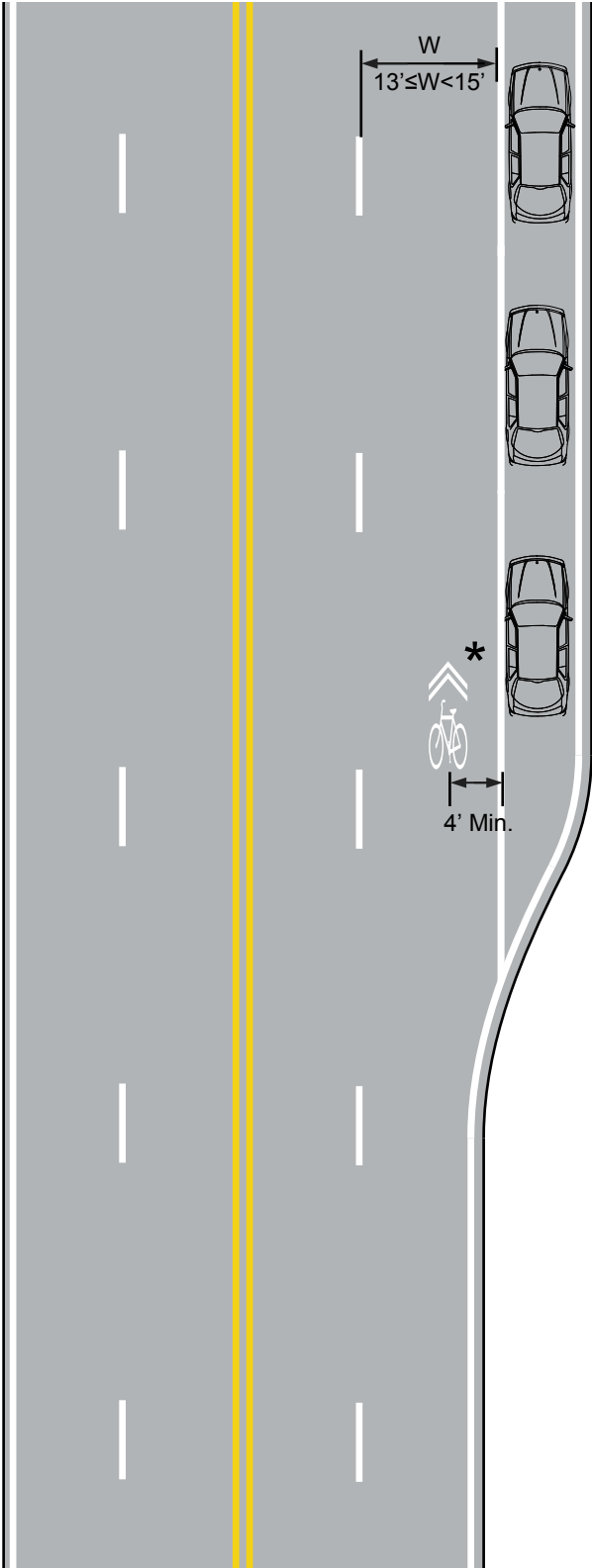
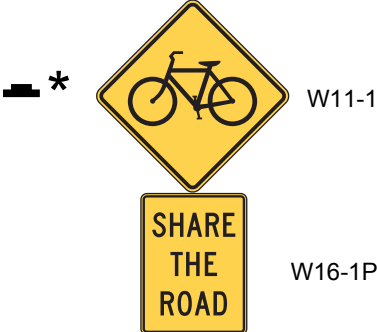


Figure 5.20 - Example of Typical Transition from Narrow or No Shoulder to Shared Lane with Parking



* Optional
Do not use both Shared Lane Markings and Share The Road Assemblies.
Shared Lane Markings may be used only where the posted speed limit is 35 mph or less.



CHAPTER 6: BICYCLE ROUTES

6.1 Purpose

Bicycle routes (or bike routes) are designated and signed routes of travel for bicyclists along roads and/or trails. The intent of a bicycle route is to guide bicyclists along the most favorable alignment between two or more points of interest. A bicycle route may be placed on any legally permitted type of bicycle facility; however, it should be selected to maximize the comfort of a bicyclist and enhance the connectivity of the bicycling network. Bicycle route signing is not a tool for enhancing the bicycling conditions on a road. Bicycle routes should only be used in circumstances when the most favorable bicycling alignment is difficult to navigate or not always the most logical choice.

Bike routes, although routinely designed one at a time, should be planned as part of a network of bikeways within an area ranging from a small community, an entire state, a region wholly within one state or spanning several states. Bicyclists, like motorists, travel for a variety of reasons. They may be developed with a specific type of trip in mind – mostly either recreation or commuting. Of course, these designs do not preclude the use of these routes by bicyclists for other purposes.

6.2 Bike Route Types

A bicycle route can serve many different types of users and serve multiple purposes. SHA recognizes three types of routes as candidates for designation and signing; Regional Bicycle Routes, Local Bicycle Routes, and Recreational Bicycle Loops. Physical roadway features should be independent of the route type, meaning all route types may be placed on a range of roadways and/or pathways. However, not all route types will be in the interest of SHA. Regional bicycle routes, intended to provide an alternative route to a state owned and/or maintained highway, will be SHA's main focus. SHA may be required to take the lead in designating and signing regional bicycle routes. All SHA bicycle routes will be signed appropriately, as explained in Section 6.4. All other routes may be left to the designation and design of a local jurisdiction or another state agency with coordination, guidance and approval of the route along a state highway.

All bike routes should be consistent with the local jurisdictional bike plan if it exists. The length of a state designated route may be extended beyond the limits of the local plan to make appropriate inter-jurisdictional connections. The placement of the route in a local plan may also be adjusted by the SHA route designer in coordination with the local entity that created the plan.

Regional Bicycle Routes

A regional route can be used to connect long distances within or between cities, counties, and across the state or potentially across state boundaries. The purpose of these regional routes is to connect bicyclists across multiple jurisdictions. Regional routes will serve the largest area and connect suburbs to downtowns or towns to towns. In order to make connections along long distances, often compromises may need to be made between the length of the route and the comfort level of the route to provide the most desirable route.

There are a few sub-sets of regional routes including state bicycle routes, US national bicycle routes and other regional routes. State bicycle routes are SHA approved routes that are primarily on MD and US numbered highways. US national bicycle routes are AASHTO designated routes that are provided to facilitate travel between states on facilities that have been identified as being more suitable than others for cycling. Other regional or national routes are those that may cross through the State of Maryland such as the East Coast Greenway and American Discovery Trail. State bicycle

routes may form sections of these larger regional and national routes. Each route sub-set will have unique signage.

Local Bicycle Routes

A local bicycle route can be used to connect destinations within areas such as towns, cities, or other local districts. The purpose of these local routes is to connect bicyclists to trip generators such as; schools, parks, employment centers, and public transit. Local routes should also provide connections to regional bicycle routes. In short distance trips the comfort level of the route is should be essential. These routes are designated by the county or local municipality.

Recreational Bicycle Loops

A recreational bicycle route can be used for connection to recreational destinations such as parks, lakes, or trails. The purpose of these routes is to provide bicyclists with satisfying ways to get exercise while enjoying the scenery. Recreational routes should begin and end at the same point of interest and may include on-road and off-road facilities.

6.3 Designing Bike Routes

When designing bike routes, they should have one or more of the following characteristics:

- a. Provide connectivity to and from other bicycle facilities such as bike lanes and shared use paths;
- b. Run along a series of streets that:
 - would be difficult to follow without guidance,
 - provide a somewhat less direct route between destinations, but one with more favorable conditions for bicycling,
 - include an off-street short cut between destinations,
 - lead to an internal neighborhood destination such as a park, school, path access point or commercial district, that would be hard to find otherwise.
- c. Provide a lower traffic, lower speed route that parallels a major arterial roadway or limited access highway;
- d. Includes specific amenities for the enhancement of bicycle safety and convenience;
- e. Avoid roadways with conditions that cause difficulty for bicyclists such as steep hills, complex intersections, narrow lanes, unfriendly storm grates, etc.;
- f. Provide the only access over, under or around an impediment such as a river, a railroad line, or a controlled access highway; and
- g. Is popular for recreational riding because of low motor vehicle traffic volumes, attractive scenery, and possibly destinations that are attractive to bicyclists.

Bike routes may include various types of bikeways. They should establish a continuous route. Bike route plans should be reviewed by SHA's Bicycle and Pedestrian Coordinator to ensure the route agrees with the statewide bicycle plan. They should also be reviewed by District Office staff to ensure that no undiscovered hazards are present.

6.4 Bicycle Guide Signs

Bike Route Guide signs may be installed along designated bike routes to inform bicyclists of route direction changes and to confirm route direction, distance, and destination, as shown in Figure 6.1. For bicycle guide signs to be effective, they must regularly and clearly indicate which direction to go to remain on the route. Signs should be installed at each turn along the route and periodic signs should be placed along long sections of the route using the same road (by name or number), to provide a sense of comfort to bicyclists that they have not strayed from the designated route. It is



Figure 6.1
Bicycle Guide Sign

highly recommended that bicyclist-oriented destination and distance information be included, if not already present.

To establish unique route identification for a bike route, the Bicycle Route (M1-8, M1-8a) sign may be used instead of the generic BIKE ROUTE (D11-1) sign. The M1-8 Bicycle Route sign shall contain a route designation and shall have a green background with a retroreflectorized white legend and border. The M1-8a Bicycle Route sign shall contain the same information as the M1-8 sign and in addition shall include a pictograph or wording that is associated with the route or with the agency that has jurisdiction over the route. If either of these signs is chosen, its

use shall be consistent over the entire route.

Destination (D1-1, D1-1a) signs as shown in Figure 6.2, Street Name (D3) signs, or Bicycle Destination (D1-1b, D1-1c, D1-2b, D1-2c, D1-3b, D1-3c) signs may be installed to provide direction, destination, and distance information as needed for bicycle travel. Destinations may include any of the following:

- Cities, towns, and other developed commercial or residential areas; and
- Parks, recreation areas, and trails; transit stations; schools; libraries; historic and cultural sites; and other sites of particular interest to bicyclists.



Figure 6.2 – Destination Signs

Guide signs should be installed at locations where the route turns, as a confirmation after turns and major intersections, and periodically on straight stretches of the route. Appropriate signs may also be used on route approaches.

More detailed guidance on bike route signing can be found in Sections 9B.20, 9B.21, and 9B.22 of the MUTCD.

6.5 Other Signs and Interstate Bicycle Routes

Shared Use Path Signing

The use of bicycle route guide signs on shared use paths is desirable. Park agencies within Maryland utilize a variety of sign types to mark shared use paths and provide destination and distance information. The use of standard bicycle route guide signs described above should be encouraged on shared use paths as appropriate. Standard bicycle route guide signs should be used if the path is a segment of a larger bicycle route that includes several different types of bikeways.

Interstate Routes & Trails

A variety of interstate routes and trails cross through Maryland, including US Bicycle Route 1 (USBR 1), the East Coast Greenway, and the American Discovery Trail.

- Interstate bikeways, such as USBR 1 should be signed with the U.S. Bicycle Route (M1-9) sign described in MdmUTCD Section 9B.21 as shown in Figure 6.3. Optional destinations information for bicyclists can be provided using the same bicycle route and destination signs previously described.
- The American Discovery Trail has its own sign. Additional information about it can be obtained from the trail sponsor, the American Discovery Trail Society, located in Washington, DC. www.discoverytrail.org.
- The East Coast Greenway (ECG) also has its own sign design as well as a MUTCD approved sign. Additional information can be obtained from the East Coast Greenway Alliance www.greenway.org.



Figure 6.3
U.S. Bicycle
Route Sign

CHAPTER 7: SHARED USE PATHS

7.1 Introduction

National guidelines for the design of shared use paths are provided in the 2012 AASHTO *Guide for the Development of Bicycle Facilities, fourth edition*. This guide offers a great deal of information to path designers, and should be referred to in addition to the guidance in this chapter.

Shared use paths are physically separated from motorized vehicular traffic by an open space, curb, curb and gutter, or barrier and are located either within the highway right-of-way or within an independent right-of-way. Shared use paths are open to use by pedestrians and other authorized non-motorized users. The presence of a shared use path shall not replace the requirement to provide bike lanes per Table 2.1. Paths provide a complement to the roadway transportation system, and are not a substitute for roadway access. However, shared use paths shall be considered if they are included in a local Master Plan, requested by the local jurisdiction or supported by the local community.

7.2 Design for Accessibility

The Americans with Disabilities Act (ADA) “prohibits public entities from designing new facilities or altering existing facilities, including sidewalks and trails, that are not accessible to people with disabilities (FHWA, 2001).” Shared use paths shall comply with the Office of Highway Development’s guidelines set forth in SHA’s *Accessibility Policy and Guidelines for Pedestrian Facilities along State Highways*. In addition, all connections to a shared use path shall also comply with the aforementioned policy and guidelines. Such connections include: parking lots, neighborhood connectors, adjoining sidewalks, and entrances to facilities such as rest areas, buildings, restrooms, etc.

7.3 Path Cross Section

The design of shared use paths must take into consideration that it will be (in most cases) a two-way facility with a variety of users, each with a different footprint and operating characteristics. Shared use paths shall have a minimum cross section of 10 ft with 2 ft shoulders on both sides (Figure 7.1), and any path less than 10 ft wide will require a design waiver. This is the narrowest design that will enable the path to operate as a two way facility. In areas where high volumes of users are anticipated (such as in urban areas near major origin and destination zones), 12-14 ft widths are recommended. In areas where pedestrian activity is expected to be light, an 8 ft wide path may be acceptable. However, in such areas, right-of-way costs are usually low, so the cost of an extra 2 ft of paving must be weighed against the advantages of a full width path.

Occasionally, conditions will dictate that having a short section of the path less than 8 ft wide is unavoidable. In such situations, warning signs and/or pavement markings should be provided far enough in advance to notify the fastest trail users (i.e. bicyclists) that the pathway narrows in time to slow to a safe speed appropriate for the narrowed section.

Trail users generally co-exist on shared use paths without requiring pavement marking delineating separate lanes for wheeled versus foot traffic. However, lane markings may be used when needed in heavily congested areas to prevent conflicts between users operating at different speeds. If such conflicts are extreme, separate parallel facilities for wheeled versus foot traffic may be considered. Other circumstances where pavement markings may be appropriate include:

- Solid center line around areas of limited (sight) distances such as horizontal and vertical curves where it is important for trail users to keep to the right;

- Approaches to intersections with railroad crossings;
- Dashed center lines to delineate the main alignment of a shared use path at junctions with connector paths; and
- Dashed or solid center lines along with bicycle symbol pavement markings and arrows at the departure legs of pathways at shared use path/roadway intersections.

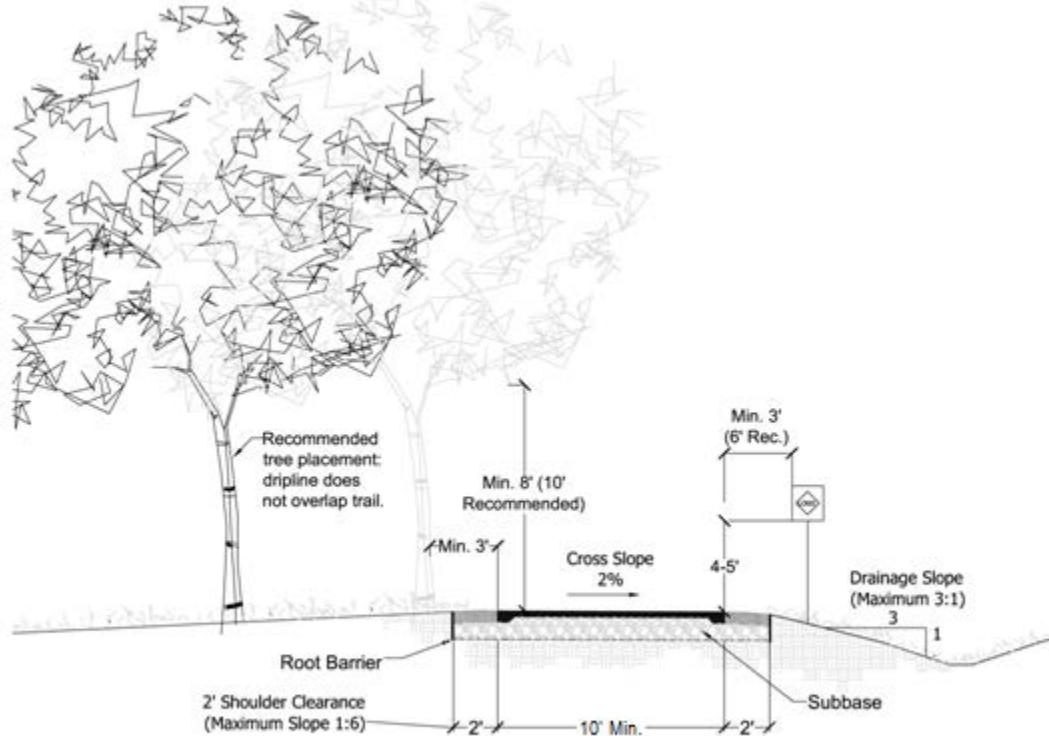


Figure 7.1 – Typical Shared Use Path Cross Section

Tree species selected for planting adjacent to path should be compatible with the surrounding environment and not conflict with the overhead clearance restrictions nor create a safety hazard to users. Consult with the Landscape Architecture Division for the design of landscape plantings and an evaluation of impacts to existing vegetation associated with the alignment in conjunction with the planning and development of pathways. When appropriate, tree preservation plans should be developed to reduce adverse impacts to desirable existing vegetation.

7.4 Shared Use Paths Adjacent to Roadways (aka Sidepaths)

The 2012 AASHTO *Guide for the Development of Bicycle Facilities*, fourth edition, makes a number of specific statements that recommend against providing shared use paths directly adjacent to the road. These facilities are often called sidepaths (Figure 7.2). Despite this guidance, sidepaths are typically identified on local master plans and are widely used throughout Maryland and in other states. Where no other solution exists, new sidepaths may be constructed and existing ones maintained. However, they must be carefully designed to ensure the safety of all users.

Sidewalks are different from sidepaths in that they are intended for use by pedestrians and mobility devices only. Bicycle use is prohibited except where allowed by local ordinance (Maryland Code, Title 21, Section 21-1103).

A conflict between path users and motor vehicles at intersections and driveways is an endemic aspect of sidepaths. Studies have shown a higher crash risk among bicyclists using sidepaths. A 1994 study compared crash statistics with riding location and exposure (based on bicycle volume counts). The study determined that riding on a sidepath, even in the same direction as motor vehicle traffic, puts the bicyclist at nearly twice the risk of a crash compared to riding with the motor vehicles on the roadway. This same study showed that a bicyclist riding against the flow of traffic, regardless of riding in the roadway or on a sidepath, has a 3.6 times greater risk of crashing (Wachtel and Lewiston, 1994). Frequent driveways and intersections increase these risks, making sidepaths even less desirable.

Sidepaths are strongly recommended at major bridge crossings, especially if no other bicycle connections exist. Sidepaths are also appropriate adjacent to freeways where bicyclists are prohibited from using the facilities. The presence of an existing or proposed sidepath should be considered in the design of interchanges, as these sidepaths must be carefully routed around highway entrance and exit ramps.



Figure 7.2
MD 450 Sidepath
Source: Visidata

The most critical design issues for sidepaths are the following:

- Reduced speeds at intersections and driveways: geometric design measures (such as tighter corner radii) should be employed to ensure that motor vehicle speeds are at or below 10 mph at the point of intersection with the path. Bicycle speeds should also be slowed at intersections and driveways (to 8 mph or less).
- Clear sight distances: per Figure 7.5, both motorists and path users should have a clear and unobstructed view of each other at intersections and driveways.
- Adequate warning signs at intersections for roadway and path users: motorists and path users should be adequately warned of upcoming conflict zones.

- Clear assignment of right-of-way: it is very important to ensure that path users and motorists are not given conflicting messages about which mode has the right-of-way at intersections. For example, if a traffic signal is used to indicate the right-of-way, STOP signs shall not be installed in any direction.

7.5 Surface

Path surfaces are typically made of some form of asphalt. Permeable mixes are desirable to lessen the effect of stormwater runoff; however, the positive effects of these materials must be balanced against their higher initial and maintenance costs as well as the underlying soil permeability.

Where the primary uses are mountain biking, horseback riding or running; it may be appropriate to use an unconsolidated surface. Unconsolidated surfaces shall not be used in areas prone to flooding or where steep grades would cause the erosion of the path surface.

The surface must be constructed to withstand use by the heaviest maintenance vehicle intended to travel along the path (Figure 7.3).

7.6 Shoulders

Two-foot wide graded shoulders should be provided along the entire length of the path. The turf shoulders should typically be constructed with 2-3 ft wide turfgrass sod placed adjacent to the paved path to provide an alternative to the harder path surface for walkers and runners.



Figure 7.3 - Poorly Designed Trail Surface

7.7 Trees Adjacent to Pathways

Trees can add value to the experience of using a path. They provide shade for users during hot weather and help to absorb stormwater runoff. As shown in Figure 7.2, trees should be planted no closer than 3 ft from the edge of a path to prevent pavement cracking and heaving of the path surface. Although not preferable, when saplings are planted adjacent to an existing path, root barriers may be installed to prevent pavement cracking and heaving. Larger caliper sized trees are more suitable and can be pruned to provide the desirable clearances.

In general, weaving the path around trees in order to avoid removing them is not recommended, for two reasons:

- The necessary excavation to form the sub-base of the path often does serious damage to tree roots, leading to the slow decline and eventual death of the tree.
- Sharp bends created to curve the path around trees can cause crashes between pathway users.

A better approach is to carefully lay out the trail to preserve the healthy trees and to remove only the minimum number of trees necessary to construct a path with safe alignment for all of its users. Alignment of the path to preserve desirable trees should be evaluated by the Landscape Architect and Forester when making determination to retain or remove trees. Shifts in alignment should be consistent with design criteria appropriate to the type of path being designed.

Root barriers may be desirable when a new path is constructed adjacent to existing trees. Roots encountered during construction should be cleanly cut and completely removed from beneath the trail surface before placing the root barrier.

7.8 Thickened Pavement Edge

Consideration should be given to providing sufficient width and a thickened pavement edge along paths that will serve as service roads for maintenance vehicles (Figure 7.4). Path edges can be damaged when service vehicles are allowed to enter or exit the path at undefined locations. The edge should be designed to handle the point load of the heaviest expected vehicle wheel that will enter/leave the path to the adjoining property.

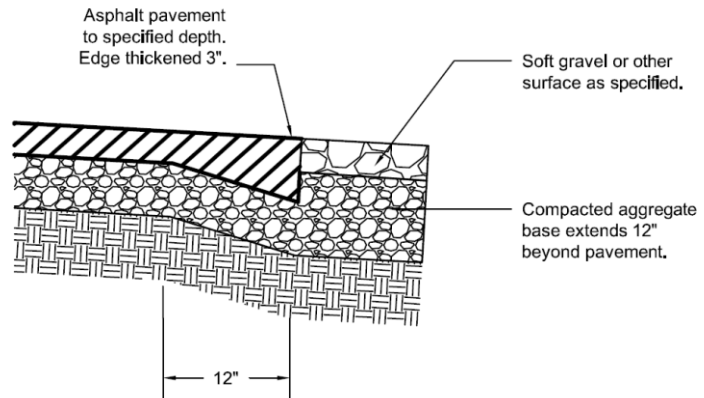


Figure 7.4
Thickened Pavement Edge

7.9 Design Speed

Shared use paths shall be designed for speeds of 20 mph or lower. In urban areas, speeds may be limited to 12 mph or lower to minimize conflicts between different types of users.

7.10 Horizontal Alignment

The design horizontal radius of a path is based upon the angle at which bicyclists lean when cornering to enable them to turn comfortably at speed. In general, bicyclists cannot lean beyond 25 degrees without crashing. Most riders lean at an angle between 15 - 20 degrees.

The design horizontal radius also needs to provide for adequate sight distance around obstructions to facilitate safe use of the path by bicyclists traveling at the design speed. See Section 7.11 in these guidelines and the AASHTO guide for further information.

The minimum horizontal radius for a curve, based on a lean angle up to 15 degrees can be found by using equation (7-1):

$$R = \frac{0.067 V^2}{\tan \theta} \quad (7-1)$$

Where:

- R = Minimum radius of curvature (ft)
- V = Design speed (mph)
- θ = Lean angle from the vertical (degrees)

The minimum horizontal radius for a curve, based on a lean angle between 15 and 20 degrees must factor in the coefficient of friction between the tire and the path as well as the superelevation of the path. **ADA requirements limit the rate of superelevation to a maximum of 2 percent.** The minimum horizontal radius for a curve can be found by using equation (7-2):

$$R = \frac{V^2}{15 \left(\frac{e}{100} + f \right)} \quad (7-2)$$

Where:

- R = Minimum radius of curvature (ft)
 V = Design speed (mph)
 e = Rate of path superelevation (percent)
 f = Coefficient of friction (see Table 7.1 below)

Table 7.1 – Friction Factor on Pavement

Speed	Friction Factor
12 mph	0.31
20 mph	0.28
25 mph	0.25
30 mph	0.21

7.11 Vertical Alignment

Cross slopes on shared use paths shall not exceed 2 percent. For paths adjacent to roadways, the path generally follows the roadway profile. For paths in independent rights-of-way, care should be given to ensure that the cross slope does not create a drainage problem.

Running grades should be kept to a minimum to provide for maximum accessibility. In general, grades should be restricted to a maximum of 5 percent to reduce the strain on ascending bicyclists and the speeds of descending bicyclists.

Every effort should be made to ensure running grades are kept within ADA guidelines on shared use paths. In limited circumstances where achieving these grades would be prohibitively expensive or would denigrate a unique natural environment, exceptions can be made to running grade requirements. Making such an exception does not eliminate the responsibility to meet ADA guidelines on all other aspects of path design. The following steps should be taken to mitigate steeper grades in these situations:

- Provide flat landings with benches to enable path users to stop and rest if necessary;
- Provide hand rails on the sides of the path;
- Widen the path to allow more space for slower users; and
- Provide an alternative accessible route and use signage to direct people with physical disabilities to the route.

Steep downgrades *are not* recommended at roadway intersection approaches. Every effort should be made to keep intersection approaches at or below a 5 percent grade in order to reduce the possibility of a bicyclist or other wheeled user losing control and crashing into the intersection. For situations where grades steeper than 5% are unavoidable, a landing area shall be provided every 200 feet.

7.12 Sight Distance Requirements

Bicyclists must have time to react to slower moving pathway users, intersecting road users, and physical obstructions such as bridge supports, utility poles, bollards, etc. Bicyclists' brake reaction and perception time has been found to be about 2.5 seconds. Bicyclists' eye height has been assumed to be 4.5 ft from the ground surface. Equation (7-3) calculates the required minimum stopping sight distance for bicyclists.

$$S = \frac{V^2}{30(f \pm G)} + 3.67V \quad (7-3)$$

Where:

- S = Stopping sight distance (ft)
- V = Design speed (mph)
- G = Grade (ft/ft)
- f = Coefficient of friction (use 0.25)

For further information on the stopping sight distance based on grade, see the most recent version of the *AASHTO Guide for the Development of Bicycle Facilities*. Motorists should be given time to react to path users who may unexpectedly enter the roadway. For paths located parallel to roadways, the motorists should be provided enough clear sight distance to be able to react and stop when turning across a path.

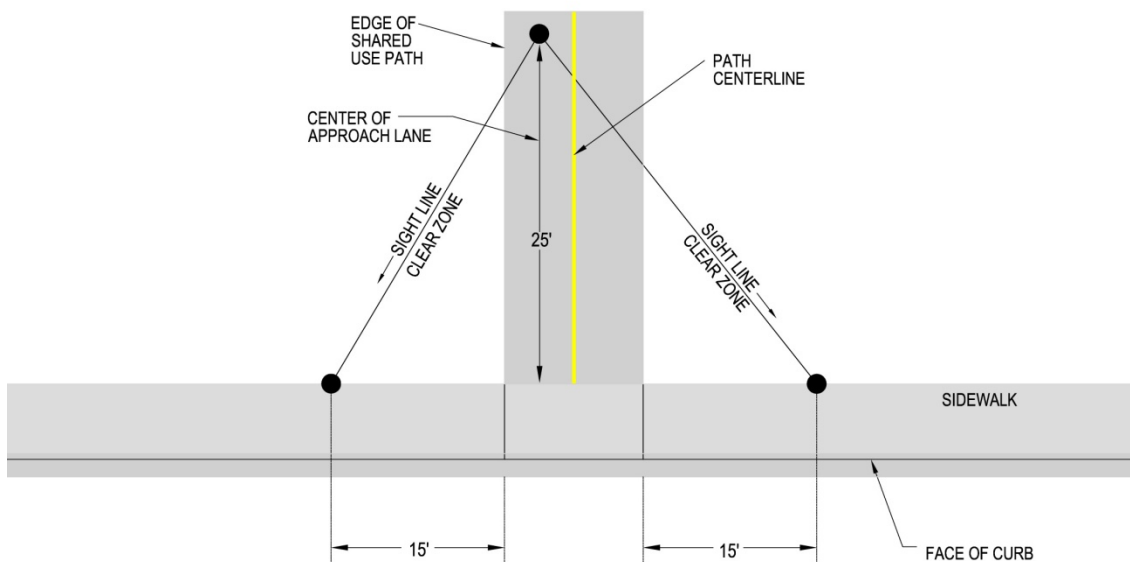


Figure 7.5 – Minimum Sight Distance Triangle at an Intersection with a Sidewalk

A minimum sight distance allowance should also be provided at the intersection of paths with adjoining sidewalks. The clear zone space will enable pedestrians approaching the path to see oncoming bicyclists who may or may not stop. This will increase safety for both users approaching the intersection. This clear zone will also create a decision making space for bicyclists to look for oncoming vehicular traffic and make the determination of whether to stop, yield, or proceed across the intersection. See Figure 7.5.

7.13 Shared Use Path Pavement Markings and Signs

Signing and marking of shared use paths should follow Part 9 – Traffic Control for Bicycle Facilities and Section 3B.18 – Crosswalk Markings of the MdMUTCD. See Figure 7.6 for an example of crosswalk markings.

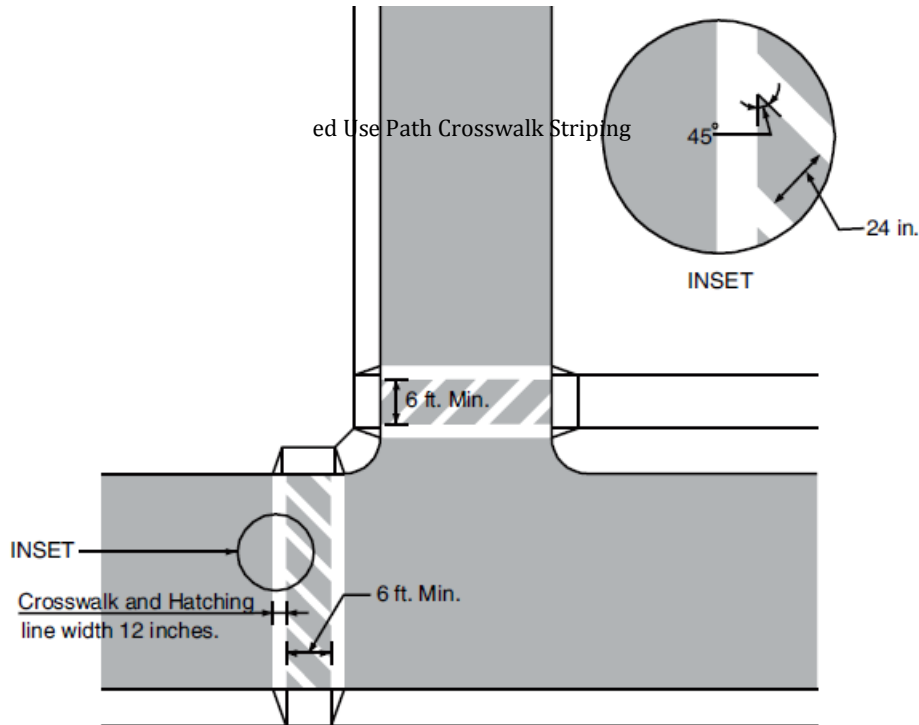


Figure 7.6 – Shared Use Path Crosswalk Markings

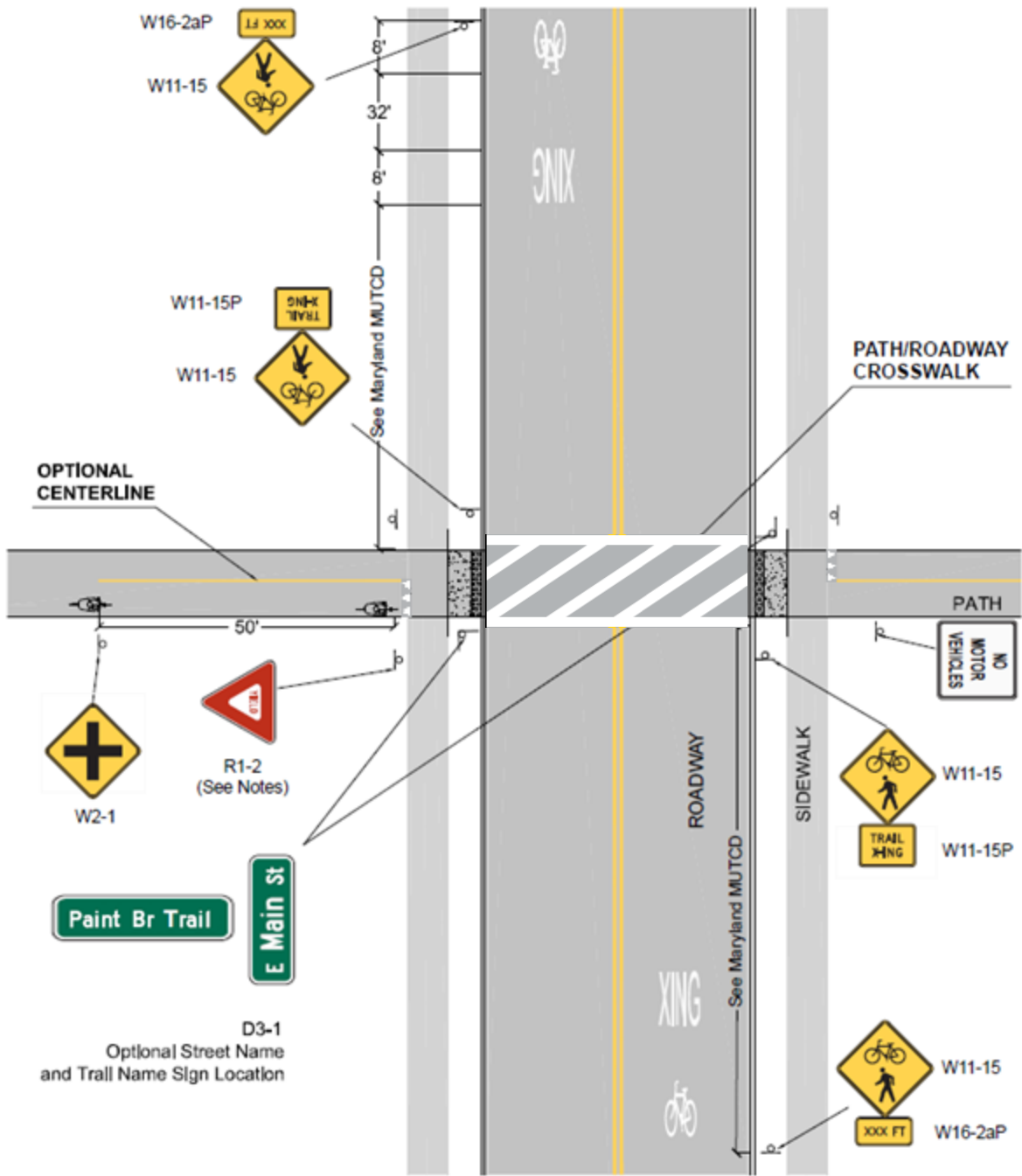
7.14 Shared Use Path Intersection Design

Intersections of shared use paths and roadways can present dangerous conflicts for path users if not properly designed. It is imperative that the proper traffic control devices be assigned to the trail or roadway based on the anticipated traffic on each; otherwise, it may encourage unsafe and unlawful behavior by bicyclists and frustrate trail and roadway users. For at-grade intersections, there are several objectives:

- Site the crossing at a logical and visible location (see Section 7.11 on sight distances);
- Maintain visibility between path users and motorists between intersections;
- Install the appropriate traffic control devices at each intersection based on either existing or planned conditions, as appropriate. Please refer to Section 9B.03 of the Maryland MUTCD for guidance on establishing crossing right-of-way; and
- Adequately warn motor vehicles and path users if the intersection is not located where one might normally be expected.

In addition, standard street signs indicating the names of the street and the path should be provided at all path/roadway intersections to assist travelers in finding their way. Additional directional signing may be needed to direct path users to nearby destinations (see Chapter 6). Figure 7.7 shows an example of a shared use path/roadway intersection.

Figure 7.7 - Shared Use Path at Midblock Intersection



DESIGN OF SHARED USE PATH AT MIDBLOCK INTERSECTION:

- Traffic control should be based upon an engineering evaluation. This is an example of one type of traffic control.

Median Refuge at Pathway Crossings

In locations with longer crossing distances (i.e. more than 4 lanes), median refuges may be of benefit for path users. In particular, median refuges have been shown to increase safety for path users crossing multi-lane roadways at un-signalized crossings (Zegeer et al, 2002). One design that has been shown to improve path user safety is to have the path cross the median at an angle of 30

degrees or greater, as shown in Figure 7.8. This forces path users to turn their bodies towards traffic to facilitate a broader view of approaching motor vehicles and establish eye contact with motorists. For more information on crosswalks or median refuges, refer to Section 3B.18 in the MdMUTCD.

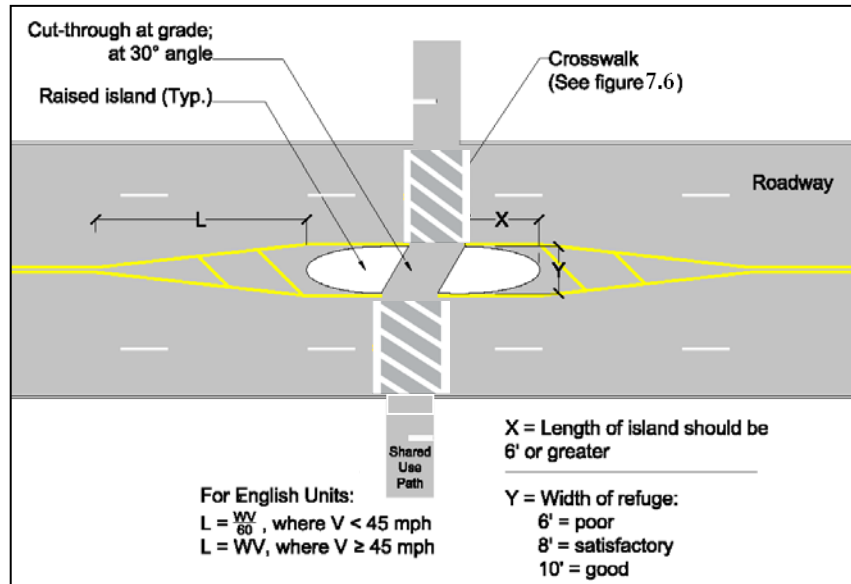


Figure 7.8
Median Refuge Design at Path Crossing

Bollard Use at Intersections

The use of bollards should be avoided whenever possible due to the hazards they create for path users who may either crash into them or crash while trying to avoid them. The term “bollard” in this section includes any barrier device that is used to prevent unauthorized motor vehicle access to the trail. Devices such as vertical posts, fencing with gates, large rocks or boulders, and sections of tree trunk have been used for this purpose.

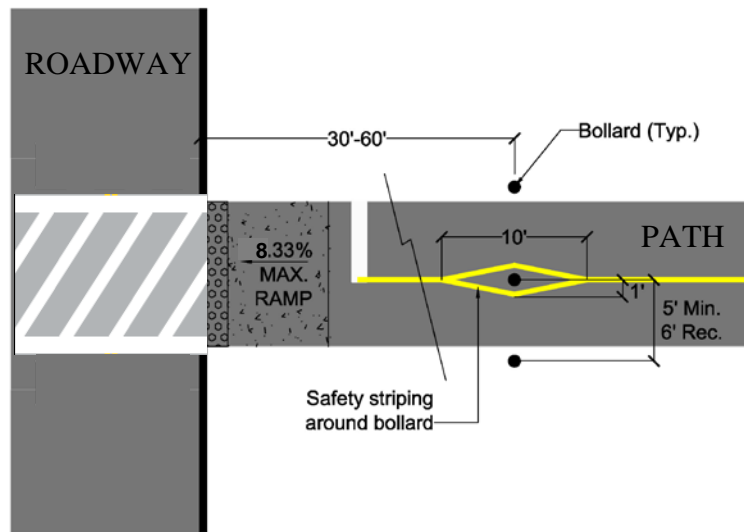


Figure 7.9 – Bollards at an Intersection

Bollards may be used on off-road paths, but only in cases where unauthorized motor vehicle entry is an established problem and education and enforcement activities have failed to solve it. They shall **not** be used to separate a sidepath from motor vehicle lanes. Also, they shall not be installed in locations where unauthorized motor vehicle entry cannot be stopped by their use. Bollards designed to prevent unauthorized entry by motorcycles and other types of narrow motorized vehicles would also prevent access by legitimate users and should never be used.

Bollards should provide at least 5 ft of space for one-way path traffic to pass. This should be wide enough to allow wheelchair users, tandem bicyclists, bicycles towing trailers, and any other wide users to pass. At least one such passage shall be provided for each direction of travel on two-way paths (see Figure 7.9).

If bollards are used, they should be a bright color and reflective for both daytime and nighttime visibility. Yellow striping should be used to delineate the path around the bollard(s) as shown in Figure 7.9. Bollards should never be placed in the center of the bicycle travel lane. Removable bollards may be used to allow access to maintenance and emergency vehicles. The handles on removable bollards should not be placed in such a way to further restrict clearance between them. The same installation and traffic control guidance applies to both removable and stationary bollards.

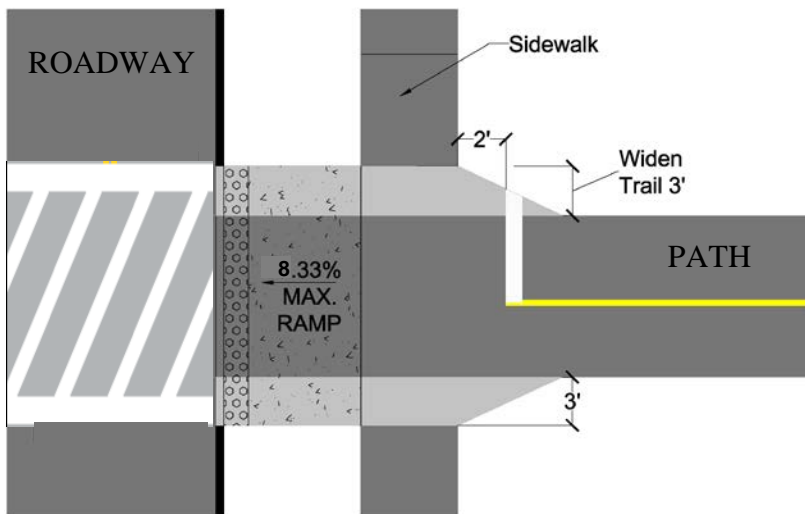


Figure 7.10 – Path Widening at an Intersection

Path Widening at Intersections

For locations where queuing at an intersection results in crowding at the roadway edge, consideration should be given to widening the path throat. The curb ramp should span the entire path width. This can be utilized to increase crossing capacity and it will help reduce conflicts at the path entrance (see Figure 7.10).

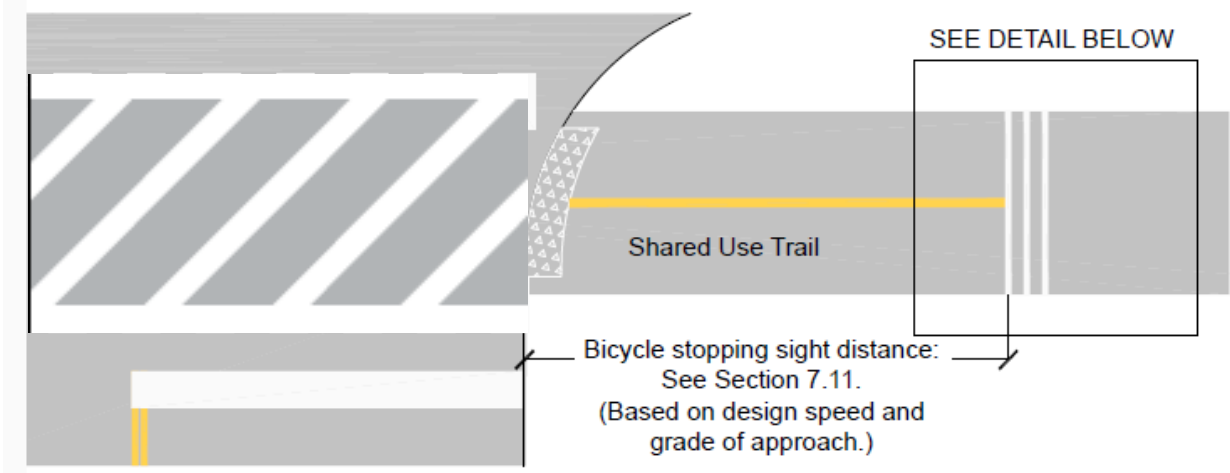
Intersection Warning Rumble Strips

Figure 7.11 shows rumble strips that may be used on shared use paths to alert users that they are approaching an unexpected intersection. Narrow thermoplastic tape or other similar material that causes a *gentle* vibration should be used. The height of the material should be no more than 0.2 in. from the surface of the pavement.

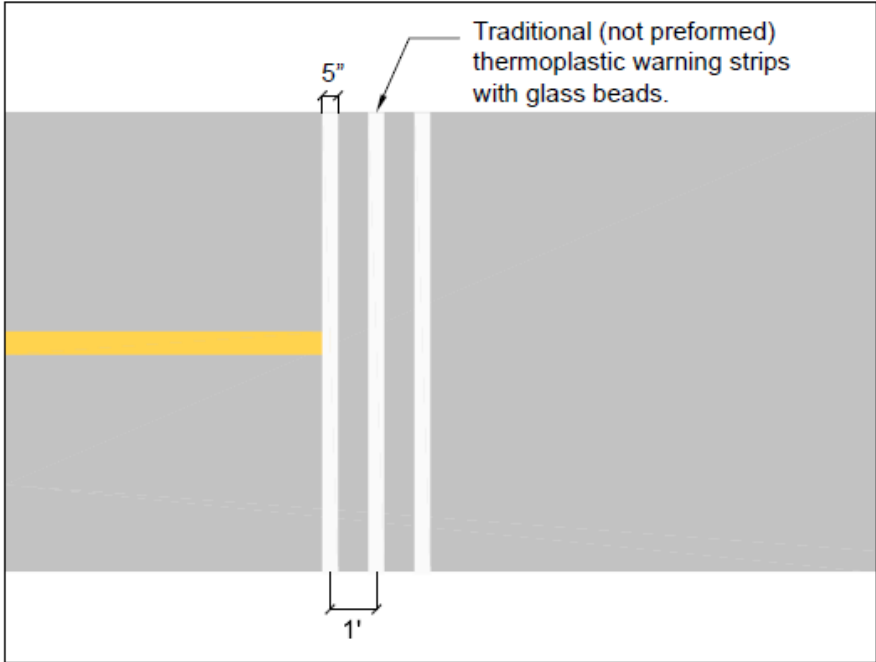
The use of rumble strips should be limited to locations where there is a known safety issue, such as an intersection at the bottom of a hill, an uncontrolled, midblock intersection, or in the case of a sidepath, where the intersection has numerous turning movements. Engineering judgment should be used to determine when the use of rumble strips is appropriate.

Figure 7.11 - Intersection Warning Rumble Strips

PLACEMENT AT INTERSECTION



DETAIL



Path Curb Ramps at Roadway Intersections

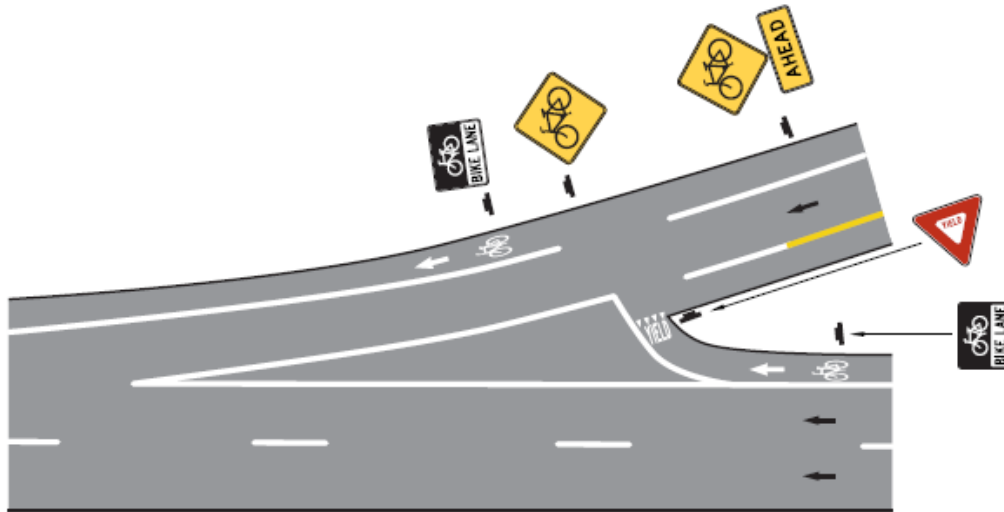
Detectable warnings at curb ramps shall be constructed of a contrasting color to alert path users to an approaching roadway intersection. The curb ramps shall extend the full width of the trail and they shall meet ADA requirements as outlined in SHA's *Accessibility Policy & Guidelines for Pedestrian Facilities along State Highways*.

CHAPTER 8: BICYCLE ACCESS AT INTERCHANGES AND BRIDGES

8.1 Bicycle Access at Interchanges

Interchanges and other locations with access ramps are among the most difficult situations for bicyclists to navigate. The combination of high speed merging traffic and diagonal crossings by bicyclists creates inherent conflicts that can be very uncomfortable for the bicyclists. Particularly in urban and suburban locations where bicycle traffic can be expected to use the roadway, interchange design should account for their needs. When an intersection is converted to an interchange, bicycle access shall be considered in the design.

Figure 8.1 - Bicycle Lane at On-Ramp



One of the most important principles in designing interchanges that safely accommodate bicyclists is to reduce motor vehicle speeds at locations where bicyclists either cross the road or merge with traffic. For this reason, urban interchange design with conventional 90 degree intersections (instead of merge lanes) is preferable for bicycle safety. Interchange designs that enable motor vehicles to maintain speeds above 30 mph without stopping are not conducive to bicycle usage and should be avoided.

8.2 Bridge Policies

All newly constructed and reconstructed bridges shall provide the minimum shoulder widths for marked bike lanes as shown in Table 2.1. A bicycle design waiver is required if these widths cannot be provided.

8.3 Bridges on Controlled Access Highways

Bridge replacement projects on controlled access highways where bicyclists are prohibited will *not* include facilities to accommodate bicycles. However, in cases where a bridge replacement project on a controlled access highway impacts a roadway where bicycles are permitted (i.e. a new overpass over an arterial roadway), the project shall include the necessary access for bicycles on the permitted roadway. This may include such elements as: bike lanes and bicycle crossing improvements on the affected ramps and intersections. Further guidance is provided below.

8.4 Bicycle Design on Bridges

On all bridge projects, bicycle lane width is based on posted speed limits and truck volumes, as identified in the table shown in Table 2.1.

Table 2.1 – Marked Bike lanes

MINIMUM SHOULDER WIDTHS FOR MARKED BIKE LANES		
POSTED SPEED LIMIT	TRUCK VOLUMES (%ADT)	SHOULDER/LANE WIDTH*
≤ 35 MPH	-----	4 FEET
> 35 MPH and ≤ 45 MPH	≤ 8% trucks	5 FEET
	> 8% trucks	6 FEET
> 45 MPH	-----	6 FEET

*The shoulder/lane width is measured excluding the gutter pan.

*Add 1 foot to the shoulder/lane width if operating adjacent to traffic barrier, concrete barrier, a curb without a gutter pan, or on-street parking.

8.5 Locations with Shared Use Paths

Bridges that have an existing or proposed shared use path approaching them should be constructed with a shared use path on that side. The path shall be at least 10 ft wide; although 12 ft is preferred, and will resemble a raised wide sidewalk with a curb (curb type is dependent on design speed). Depending upon the speed and volume of motor vehicle traffic, it may be necessary to separate the path from the adjacent vehicular lanes with a barrier (see Section 8.6 for further guidance). Transitions at the bridge approaches should enable access to the path on the bridge by bicyclists who may be riding on a bikeway parallel to the road rather than on the shared use path.

8.6 Barrier Design

Barriers used to separate a shared use path from adjacent motor vehicle lanes can be constructed in a number of ways, from various materials and, with different heights, depending upon the desired level of physical and visual separation. This decision requires both engineering judgment and attention to the overall aesthetics of the bridge.



Figure 8.2
Woodrow Wilson Bridge Trail

In locations with high volumes of high speed motor vehicle traffic or high volumes of heavy vehicles regardless of speed, a concrete barrier is preferred as shown in Figure 8.2. Use of a uni-directional concrete barrier between the shared use path and adjacent motor vehicle lanes should be designed so that it does not pose a hazard to errant vehicles. It is possible in some instances to design the end of the concrete barrier so that it is sufficiently tapered away from the roadway that a crash cushion is not needed. These barriers are typically 42 in. in height from the surface of the shared use path.

It is recommended that barriers not be used when they are not needed, as they tend to trap trash and other debris and are difficult to maintain. The type of end treatment chosen should be appropriate for both the design speed and site context.

In situations where a uni-directional crashworthy concrete barrier is used between the shared use path and the adjacent motor vehicle lanes, the railing on the other side of the shared use path is not required to be crashworthy. This railing should be constructed to a height of 54 in. from the surface of the shared use path.

8.7 Long Bridges

Bridge replacement projects in urban or suburban areas that include a continuous bridge that is over ½ mile in length should include a shared use path on at least one side of the bridge that is separated from motorized traffic with a concrete barrier. If there is insufficient width to provide a shared use path on both sides of the bridge, on-road bicycle facilities should be provided on the side without a path.

8.8 Bridge Retrofit Projects

Bridges can be retrofitted to better accommodate bicyclists. There are a variety of ways to accomplish this:

- Reduce the width and/or number of travel lanes to create more space for bicycles; and
- Adding a new bicycle structure to the existing bridge structure. In some cases, bridge footers may have been constructed in anticipation of a future roadway widening, or it may otherwise be possible to add an additional structure for bicyclists.

CHAPTER 9: ACCOMMODATING BICYCLISTS THROUGH WORK ZONES

9.1 Bicycle Access

Maryland public policy states that the best engineering practices regarding the needs of bicyclists shall be employed in all phases of transportation planning, including highway design, construction, reconstruction, and repair as well as expansion and improvement of other transportation facilities.

In an effort to maintain accessibility for bicyclists, SHA has developed the following guidelines for accommodating bicyclists through work zones. Closing or detouring a roadway for construction impacts more bicyclists in urban areas; however, there are typically more options available in these areas to provide alternate routes. In rural areas there may not be a large population of bicyclists; however, because of the open space and separation between communities, fully closing a roadway may increase the length of a rider's route significantly. Consequently, all projects should be reviewed and evaluated to determine the best way to maintain bicycle access.

If detours are provided for roadway users, bicyclists must be accommodated as well. If an adjacent path through the construction zone, suitable for bicyclists is available, bicyclists may be detoured on the pathway. If no such path exists, a detour must accommodate bicyclists. However, if bicyclists cannot be accommodated through the detour that is designed for motor vehicles, a separate detour shall be signed to route bicyclists around the construction zone and back to the road which has been closed.

The requirements for providing bicycle access through work zones shall be applied during the planning, design, construction and maintenance phases of all projects where applicable. All proposed road closings and detours should be reviewed with SHA's Bicycle and Pedestrian Coordinator and District Traffic engineering staff. The road closings should also be coordinated with county and/or local jurisdictions if their road serves as the proposed bike detour.

9.2 Bicycle Accommodations

It is preferred that a minimum 5 ft shoulder width (4 ft minimum may be acceptable) should be maintained through work zones to accommodate bicycles. Care should be taken to ensure that obstacles such as bridge abutments, equipment, construction materials, traffic control devices, etc. do not encroach into the bicycle travel-width.

Where the posted speed limit is 50 mph or lower and a minimum 4 ft shoulder width can not be maintained, bicyclists will typically be required to share the road with motorists. In this case, the right-most lane should be made as wide as feasible to minimize friction between the two user groups. Installing SHARE THE ROAD assemblies (see Section 3.3) should be considered. Refer to Chapter 6F – Temporary Traffic Control Zone Devices in the MdMUTCD for sign background and legend colors.

In Maryland, where the posted speed limit is more than 50 mph, bicycles may use the shoulder adjacent to a roadway and enter the roadway only if making or attempting to make a left turn; crossing through an intersection; or the shoulder is overlaid with a right turn lane, a merge lane, a bypass lane, or any other marking that breaks the continuity of the shoulder. Consequently, it is imperative to maintain a minimum 6 ft bikeway on roadways where the posted speed limit is higher than 50 mph. Where a minimum 6 ft bikeway can not be maintained during construction, the affected segment of the roadway shall be posted with appropriate signing to prohibit bicyclists and a detour shall be identified.

When alternate routes are laid out for motor vehicles, it will be necessary for SHA to lay out and sign a reasonable alternate route for bicyclists to bypass construction. For projects of short length (1/4 mile) and/or short duration (24 hours) and where the posted speed limit is 50 mph or less, bicycles may be required to share the road with motorized vehicles. All proposed road closings and proposed detours should be reviewed with the ADE-T.

No accommodations will be considered for bicycle access through work zones on roadways where bicycles are designated as prohibited by signing. This includes all interstate highways and some controlled access highways. For specific information regarding what roadways are prohibited to bicycle access, consult SHA's Bicycle and Pedestrian Coordinator.

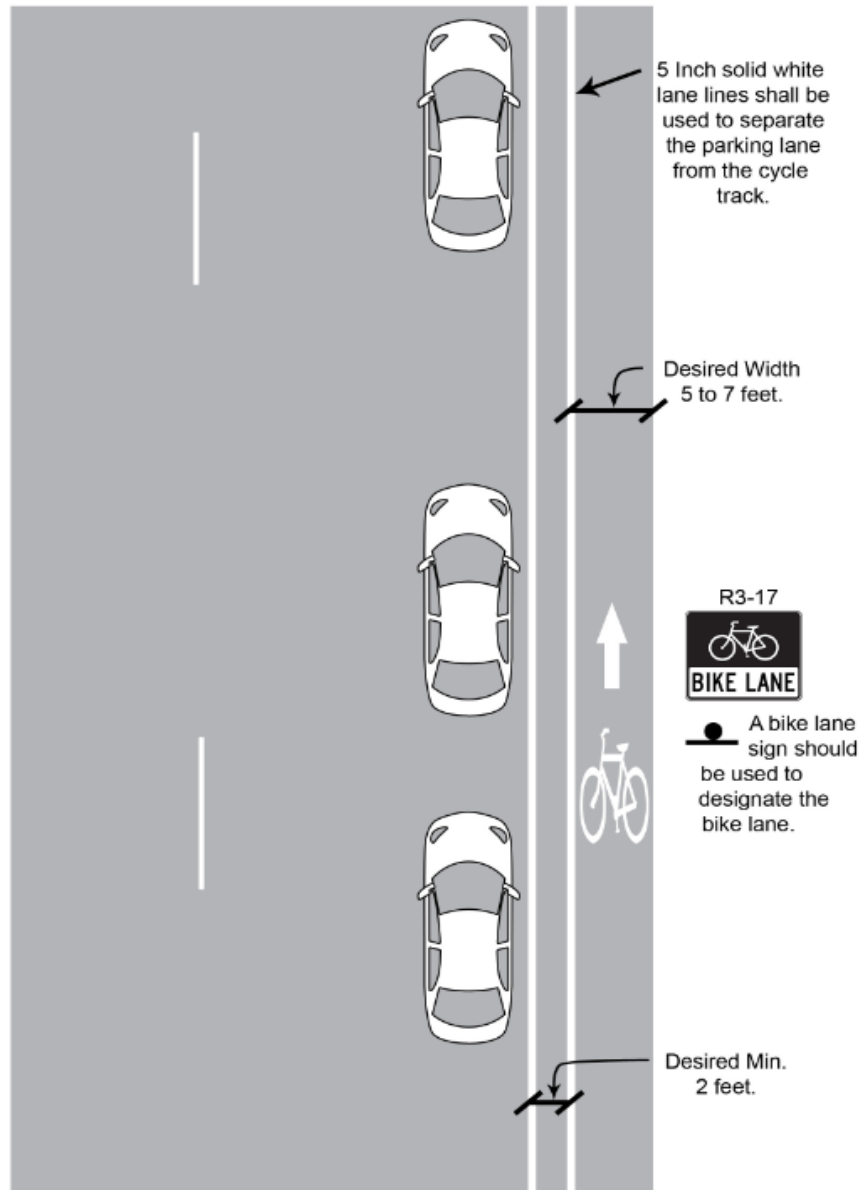
CHAPTER 10: INNOVATIVE BICYCLE DESIGN FEATURES

Innovative bikeway solutions can be found throughout the United States and even the world. In August 2013, the Federal Highway Administration issued a release supporting flexible approaches to bicycle facilities, and referenced the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide as one of those resources. This chapter highlights bikeway solutions that may be considered on State roadways. Although this guidance is allowed, it is not required and should be based on engineering judgment. All innovative practices should be discussed and coordinated with the ADE-T.

10.1 One-Way Cycle Tracks†

One-Way Cycle Tracks are exclusive bikeways that are at street level and use a variety of methods for physical separation from motorized vehicle traffic and pedestrians. A one-way cycle track may be combined with a parking lane or other barrier between the cycle track and motor vehicle travel lane. Cycle tracks should be placed adjacent to the curb. Cycle tracks combine the user experience of a separate path with the on-street infrastructure of a bike lane.

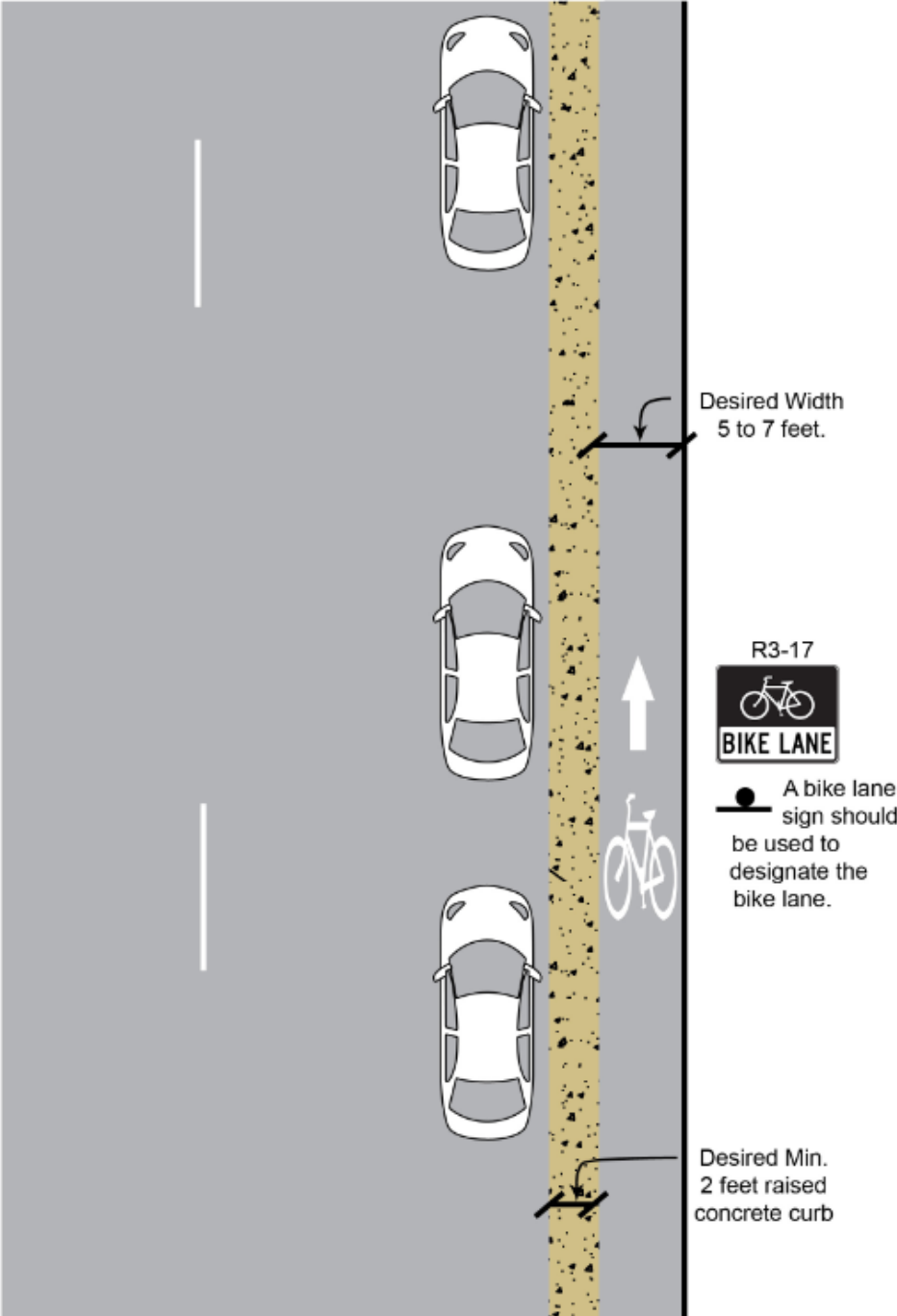
Figure 10.1 One-Way Cycle Tracks



One-Way Cycle Tracks may be installed in areas where one or more of these conditions exist:

- On-street parking is present
- High bicycle volumes
- High motor-vehicle volumes and/or speed
- Infrequent cross streets, driveways, and/or longer block spacing

Figure 10.2 One-Way Cycle Tracks with Raised Curb



All One-Way Cycle Tracks shall have the following features:

1. Bike Lane Marking as shown in Figure 2.2. The spacing of the bike lane marking shall follow the spacing guidance in Section 2.2: Bike Lane Pavement Markings and Signs.
2. If pavement markings are used to separate motor vehicle parking lanes from the One-Way Cycle Track, the buffer shall be marked with a solid 5 inch white line, as shown in Figure 10.1.
3. The standard width shall be a minimum of 5 to 7 feet.
4. In the absence of a raised median or curb, a buffer area with a minimum width of 2 feet shall be striped.

All One-Way Cycle Tracks should have the following features:

1. Where parking lanes are present, a 2 foot buffer should be considered to allow for passenger loading and to prevent door collisions, as shown in Figure 10.2.
2. Yield lines or “Yield to Bikes” signage should be used to identify the conflict area at driveways and minor street crossings.

† Adapted from One-Way Protected Cycle Tracks, NACTO Urban Bikeway Design Guide, Second Edition, pp. 45-52

10.2 Buffered Bike Lanes†

Buffered Bike Lanes are conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motorized vehicle travel and/or parking lane. Support and guidance for buffered bike lanes is provided in Section 3D-01 of the MUTCD in its guidelines for buffered preferential lanes. See Figure 10.3 for supporting guidance to the information below.

All Buffered Bike Lanes shall have the following features:

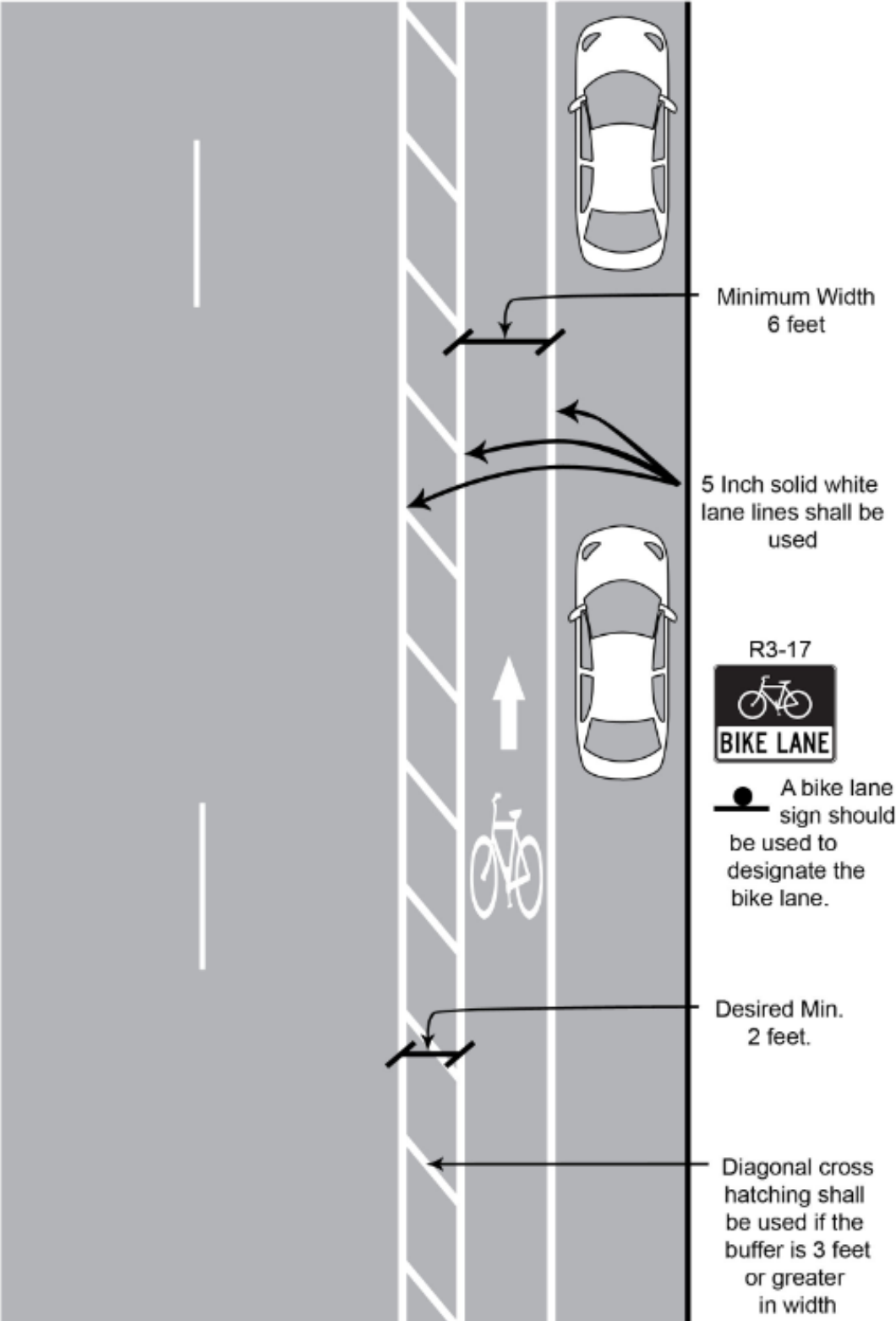
1. The Bike Lane shall be signed and marked as required by the MUTCD and these Guidelines.
2. The buffer shall be marked with two solid 5 inch white lines.
3. The minimum width of a buffer is 2 feet. The combined width of the buffer and bike lane should be considered the “bike lane width.”
4. Diagonal cross-hatching or chevron markings shall be included if the buffer is 3 feet or wider. Cross hatching shall consist of 5 inch white lines, angled at 45 degrees, at 10 to 40 foot intervals

All Buffered Bike Lanes should have the following features:

1. The buffer boundary lines should be dashed where motorized vehicles are expected to cross the buffer and Bike Lane at driveways.
2. At intersection approaches with right turn only lanes, the Bike Lane should be transitioned to a through Bike Lane to the left of the right turn only lane; or a combined bicycle lane/turn lane should be used if available roadway space does not allow for a dedicated bicycle lane.
3. At intersection approaches without right turn only lanes, the buffer markings should transition to a conventional dashed line. (Consider the use of a Bike Box at these locations).

† Adapted from Buffered Bike Lanes, NACTO Urban Bikeway Design Guide, Second Edition, pp. 19-26

Figure 10.3 Buffered Bike Lane



10.3 Bike Boxes†

While the term “Bike Box” is fairly new, de facto bike boxes have existed since marked crosswalks were first installed at signalized intersection. A bike box is a designated area at the head of a traffic lane at a signalized intersection that provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase.

Bike boxes provide increased visibility to bicyclists, safely facilitate left turn positioning, and provide priority for bicyclists at signalized intersections. If there is no need for a bicyclist to get in front of a vehicle prior to entering an intersection, a bike box would not be necessary. See Figure 10.4 for supporting guidance to the information below.


A Bike Box may be installed at signalized intersections where one or more of these conditions exist:

- High volumes of bicycles and/or motor vehicles, especially those with frequent left-turning bicycles and/or right-turning motor vehicles.
- Where there may be right or left turning conflicts between bicyclists and motorists
- Where there is a desire to better accommodate left turning bicycle traffic
- Where a left turn is required to follow a designated bike route
- When the dominant motor vehicle traffic flows right and bicycle traffic continues through (such as a Y intersection or access ramp).

All Bike Boxes shall have the following features:

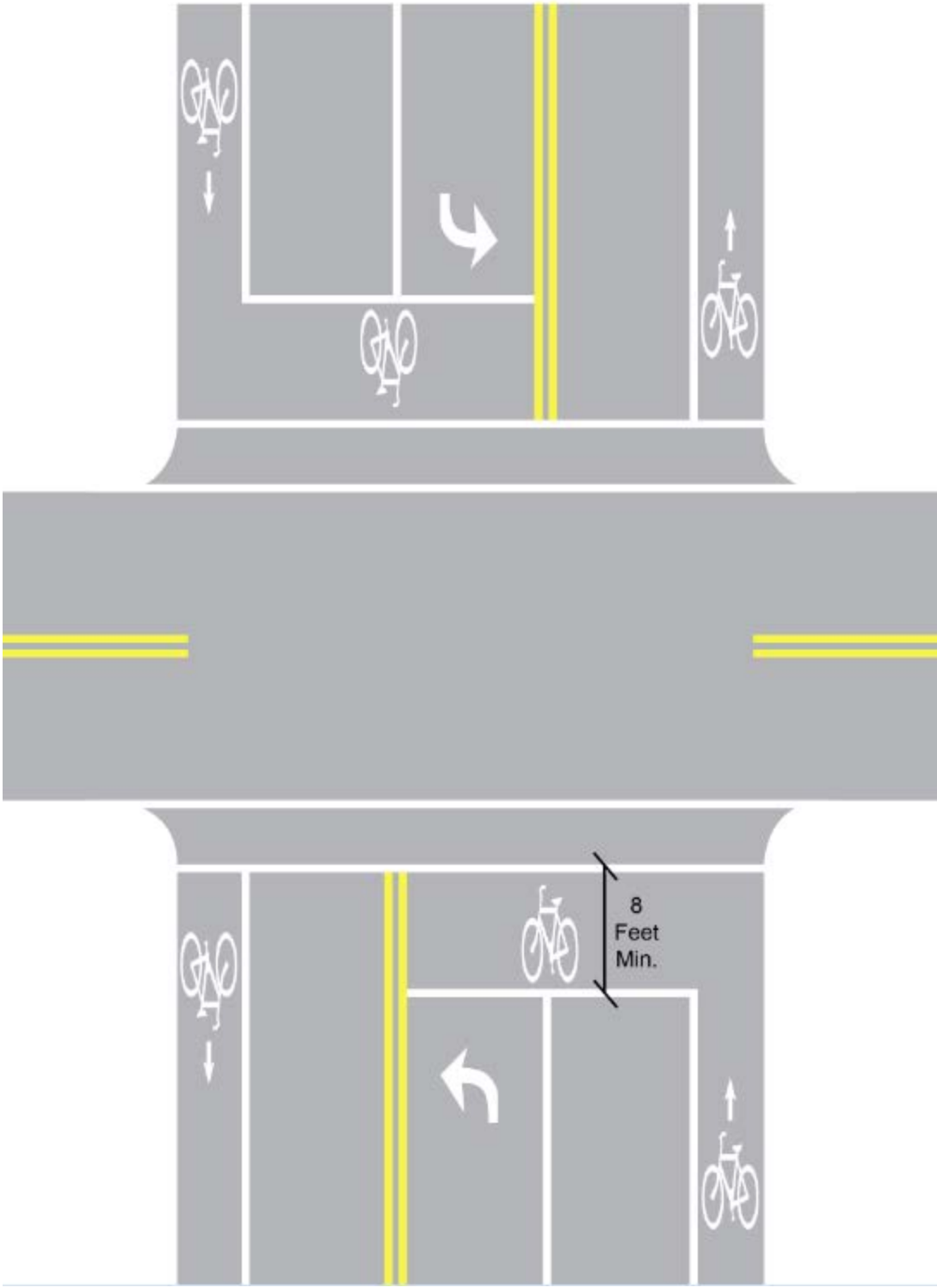
1. The Box is formed by two transverse lines typically 8 feet apart that may span across just the rightmost through lane or the full width of the travel-way. One line shall be the stop-bar for motorized vehicles stopped for the traffic control signal. The near edge of a marked crosswalk may be used for the other line.
2. Bicycle pavement markings shall be used and centered between the far line and the stop line to designate the space as a Bike Box. The marking shall be the bicycle symbol (without a rider) used on Bike Lanes.

All Bike Boxes should have the following features:

1. An R10-6 series STOP HERE ON RED sign should be post mounted at the stop-bar. An EXCEPT BICYCLES supplemental plaque or a separate  STOP HERE ON RED sign may also be installed.
2. An ingress lane should be provided.
3. An R10-11 series No Turn on Red sign should be installed to prevent motorized vehicles from entering the Bike Box.

† Adapted from Bike Boxes, NACTO Urban Bikeway Design Guide, Second Edition, pp. 71-78

Figure 10.4 Bike Box



APPENDIX A: BIBLIOGRAPHY

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APPENDIX B: DEFINITIONS

BICYCLE

A pedal-powered vehicle upon which the human operator sits (from MUTCD, Section 1A.13 Definitions of Words and Phrases in This Manual, 6. Bicycle). The term “bicycle” for this publication includes three and four-wheeled human-powered vehicles, but not tricycles or similar vehicles for children.

BICYCLE FACILITY

A general term denoting improvements and provisions to accommodate or encourage bicycling, including parking and storage facilities and roadway sections specifically designed for bicycle use.

BICYCLE LEVEL OF COMFORT (BLOC)

A mathematical model used to estimate an average bicyclist’s perception of the quality of service of a section of roadway between two intersections.

BICYCLE NETWORK

A system of bikeways within a specific jurisdiction. The system may include BIKE LANES, BIKE ROUTES, SHARED USE PATHS, and other identifiable bicycle facilities.

BIKE (or BICYCLE) LANE

A portion of a roadway that has been designated by signs and pavement markings for preferential or exclusive use by bicyclists (from MUTCD, Section 1A.13, 7. Bicycle Lane). The designation of a BIKE LANE has specific legal consequences under Maryland Law.

BIKE (or BICYCLE) ROUTE

A roadway, bikeway, or combination of both; designated by a jurisdiction with the appropriate authority; along which bicycle guide signs (See MUTCD, Section 9B.20 Bicycle Guide Signs) have been posted to provide directional and distance information. Unique route designation signs may be used, particularly for interstate routes. The installation of signs providing directional, distance, or destination information for bicyclists does not necessarily establish a BIKE ROUTE.

BIKEWAY

A generic term for any road, street, path, etc. which in some manner is specifically designed for bicycle travel, regardless of whether the facility is designated for preferential or exclusive use by bicyclists or is shared with other transportation modes.

GUIDE SIGN

A sign that shows route designations, destinations, directions, distances, services, points of interest, or other geographical, recreational, or cultural information (from MUTCD, Section 1A.13, 30. Guide Sign).

HIGHWAY

A general term for denoting a public way for purposes of travel by vehicular travel, including the entire area within the right-of-way (from MUTCD, Section 1A.13, 32. Highway).

INTERSECTION

(a) The area embraced within the prolongation or connection of the lateral curb lines, or if none, the lateral boundary lines of the roadways of two highways that join one another at, or approximately at, right angles, or the area within which vehicles traveling on different highways that join at any other angle might come into conflict; (b) the junction of an alley or driveway with a roadway or highway shall not constitute an intersection (from MUTCD, Section 1A.13, 39. Intersection).

ISLAND

A defined area between traffic lanes for control of vehicular movements and/or for pedestrian refuge. It includes all end protection and approach treatments. Within an intersection area, a median or an outer separation is considered to be an island (from MUTCD, Section 1A.13, 40. Island).

MEDIAN

The area between two roadways of a divided highway measured from edge of traveled way to edge of traveled way. The median excludes turn lanes. The median width might be different between intersections, interchanges, and at opposite approaches of the same intersection (from MUTCD, Section 1A.13, 48. Median).

MUTCD

The current edition of the *Manual on Uniform Traffic Control Devices*, published under the auspices of the Federal Highway Administration (FHWA). At the time this document was prepared, the 2009 Edition, as amended, was the latest version.

MdMUTCD

The *Maryland Manual on Uniform Traffic Control Devices* is the amended version of the MUTCD that has been officially adopted by the Maryland State Highway Administration. At the time this document was prepared, the 2011 edition was the latest version. In cases of conflict between the MUTCD and the MdMUTCD, the MdMUTCD shall prevail.

RIGHT-OF-WAY

A general term denoting land devoted to transportation purposes. The land may be owned outright by the agency responsible for the roadway or the agency may have a perpetual easement to use it for transportation purposes.

RIGHT-OF-WAY [Assignment]

The permitting of vehicles and/or pedestrians to proceed in a lawful manner in preference to other vehicles or pedestrians by the display of sign or signal indications (from MUTCD, Section 1A.13, 63. Right-of-Way [Assignment]).

ROAD USER

A vehicle operator, bicyclist, or pedestrian within the highway, including persons with disabilities (from MUTCD, Section 1A.13, 67. Road User).

ROADWAY

That portion of a highway, including shoulders, intended for vehicular use.

RUMBLE STRIP

A series of intermittent, narrow, transverse areas of rough-textured, slightly raised, or depressed road surface that is installed to alert road users to unusual traffic conditions (from MUTCD, Section 1A.13, 69. Rumble Strip). Longitudinal rows of rumble strips may be placed along the centerlines and/or shoulder edge-lines of highways to alert drivers that they are straying outside the appropriate lane. Transverse rows of rumble strips may be placed on the roadway surface in the travel lane(s) to alert motorists of upcoming significant speed changes.

RUMBLE STRIPE

A narrow version of a rumble strip placed along the centerlines and/or shoulder edge-lines of highways to alert drivers that they are straying outside the appropriate lane.

SHARED LANE

A shared travel lane where motorized vehicles can pass bicycles without changing lanes. The lane is the furthest right travel lane. Its minimum width is 13 feet measured from the edge of the gutter pan or the edge of paving. The terms WIDE CURB LANE and OUTSIDE LANE are also used for a SHARED LANE.

SHARED LANE MARKING

A pavement marking symbol that indicates appropriate bicycle positioning in a shared lane. See Section 9C.07 Shared Lane Marking and Figure 9C-9 of the MUTCD for the design and additional information.

SHARED ROADWAY

A roadway that is open to both bicycle and motorized vehicle travel. This may be an existing roadway, a street with wide curb lanes, or a road with paved shoulders.

SHARED USE PATH

A roadway where motorized vehicle traffic is prohibited, that is physically separated from motorized vehicle traffic by either open space or a barrier. Shared use paths are generally open to any form of non-motorized travel, including but not limited to: pedestrians (walkers, joggers, and runners), bicycles, roller skates, wheelchairs, scooters, and horses.

SHOULDER

The portion of the highway contiguous with the traveled way, for accommodation of stopped vehicles, emergency use and lateral support of sub-base, base, and surface courses; often used by pedestrians and also by cyclists paved.

SIDEPATH

A SHARED USE PATH located immediately adjacent and parallel to a roadway.

TEMPORARY TRAFFIC CONTROL ZONE

An area of a highway where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, uniformed law enforcement officers, or other authorized personnel (from MUTCD, Section 1A.13, 85. Temporary Traffic Control Zone).

TRAFFIC CONTROL DEVICE

A sign signal, marking, or other device used to regulate, warn, or guide traffic, placed on, over, or adjacent to a street, highway, pedestrian facility, or shared-use path by authority of a public agency having jurisdiction (from MUTCD, Section 1A.13, 87. Traffic Control Device).

TRAVELED WAY

The portion of the roadway for the movement of vehicles, exclusive of shoulders, berms, sidewalks, and parking lanes (from MUTCD, Section 1A.13, 91. Traveled Way).

UNPAVED PATH

A SHARED USE PATH that is not surfaced with a hard, durable surface such as asphalt or Portland cement concrete.

VEHICLE

Every device in, upon, or by which any person or property can be transported or drawn upon a highway, except trains and light rail transit operating in exclusive or semiexclusive alignments. Light rail transit operating in a mixed-use alignment, to which other traffic is not required to yield the right-of-way by law is a vehicle (from MUTCD, Section 1A.13, 93. Vehicle).

APPENDIX C: ANNOTATED CODE OF MARYLAND RELATED TO BICYCLES

TITLE 2 DEPARTMENT OF TRANSPORTATION

Subtitle 6 Bicycle and Pedestrian Access

2-602 Public Policy

The General Assembly finds that it is in the public interest for the State to include enhanced transportation facilities for pedestrians and bicycle riders as an essential component of the State's transportation system, and declares that it is the policy of the State that:

(1) Access to and use of transportation facilities by pedestrians and bicycle riders shall be considered and best engineering practices regarding the needs of bicycle riders and pedestrians shall be employed in all phases of transportation planning, including highway design, construction, reconstruction, and repair as well as expansion and improvement of other transportation facilities;

(2) The modal administrations in the Department shall ensure that the State maintains an integrated transportation system by working cooperatively to remove barriers, including restrictions on bicycle access to mass transit, that impede the free movement of individuals from one mode of transportation to another;

(3) As to any new transportation project or improvement to an existing transportation facility, the Department shall work to ensure that transportation options for pedestrians and bicycle riders will be enhanced and that pedestrian and bicycle access to transportation facilities will not be negatively impacted by the project or improvement; and

(4) In developing the annual Consolidated Transportation Program, the Department shall:

(i) Ensure that there is an appropriate balance between funding for:

1. Projects that retrofit existing transportation projects with facilities for pedestrians and bicycle riders;

and

2. New highway construction projects; and

(ii) In transit-oriented areas within priority funding areas, as defined in § 5-7B-02 of the State Finance and Procurement Article, place increased emphasis on projects that retrofit existing transportation projects with facilities for pedestrians and bicycle riders and increase accessibility for the greatest number of pedestrians and bicycle riders.

2-604 Bicycle-Pedestrian Master Plan

(a) Requirements; goals of Plan. -- The Director shall develop and coordinate policies and plans for the provision, preservation, improvement, and expansion of access to transportation facilities in the State for pedestrians and bicycle riders, including development of a Statewide 20-Year Bicycle-Pedestrian Master Plan that:

(1) (i) Identifies short-term and long-range goals that are consistent with the purposes of this subtitle; and

(ii) For each identified goal, includes:

1. Reasonable cost estimates for achieving the goal; and

2. For purposes of the annual report required under § 3-216 of this article, objective performance criteria against which progress in achieving the goal can be measured;

(2) Complies with applicable federal funding requirements;

(3) Provides a model to guide political subdivisions of the State in enhancing bicycle and pedestrian access to transportation facilities;

(4) Proposes long-term strategies for improving the State's highways to ensure compliance with the most advanced safety standards for pedestrians and bicycle riders; and

(5) After consultation with political subdivisions in the State, identifies bicycle-pedestrian priority areas to facilitate the targeting of available funds to those areas of the State most in need.

(b) Revision of Plan at time of revision of Maryland Transportation Plan. -- The Statewide 20-Year Bicycle-Pedestrian Master Plan shall be reviewed and updated each year that the Maryland Transportation Plan, as described in § 2-103.1 of this title, is revised.

(c) Duties of Director. -- To carry out the purposes of this subtitle, the Director shall:

(1) Participate in the planning of new transportation facilities and improvements to existing transportation facilities;

(2) Advise the Secretary on matters concerning bicycle and pedestrian access and any other matter as

requested by the Secretary;

(3) Initiate a program of systematic identification of and planning for projects related to bicycle and pedestrian transportation that qualify for funds under Federal Highway Administration guidelines;

(4) Monitor State transportation plans, proposals, facilities, and services to ensure maximum benefits for pedestrians and bicycle riders in the State; and

(5) Consult regularly with the Bicycle and Pedestrian Advisory Committee established under § 2-606 of this subtitle.

(d) Secretary's authority. -- The exercise of the powers and duties of the Director is subject to the authority of the Secretary.

TITLE 8 HIGHWAYS

Subtitle 1 Definitions; General Provisions

8-101 Definitions

(a) In general. -- In this title the following words have the meanings indicated.

(b) Administration. -- "Administration" means the State Highway Administration.

(c) Administrator. -- "Administrator" means the State Highway Administrator.

(d) Bicycle and pedestrian priority area. -- "Bicycle and pedestrian priority area" means a geographical area where the enhancement of bicycle and pedestrian traffic is a priority.

(e) Commission. -- "Commission" means the State Roads Commission.

(f) Controlled access highway. -- "Controlled access highway" means a major highway with the same characteristics as an expressway, except that the conflict of cross streams of traffic is not eliminated necessarily at each intersection by grade separation structures.

(g) County road. -- "County road" means any public highway:

(1) The title to which or the easement for the use of which, is vested in a public body or governmental agency; and

(2) That is not a State highway or located in Baltimore City.

(h) Expressway. -- "Expressway" means a major highway of two or more traffic lanes in each direction that is designed to eliminate principal traffic hazards and has the following characteristics:

(1) A median divider separating opposing traffic lanes to eliminate head-on collisions and sideswiping;

(2) Grade separation structures to eliminate the conflict of cross streams of traffic at each intersection;

(3) Points of entrance and exit limited to predetermined locations;

(4) Vertical curves enough to provide long sight distances; and

(5) Shoulders wide enough to permit vehicles to stop or park out of traffic lanes.

(i) Highway. -- "Highway" includes:

(1) Rights-of-way, roadway surfaces, roadway subgrades, shoulders, median dividers, drainage facilities and structures, related stormwater management facilities, and structures, roadway cuts, roadway fills, guardrails, bridges, highway grade separation structures, railroad grade separations, tunnels, overpasses, underpasses, interchanges, entrance plazas, approaches, and other structures forming an integral part of a street, road, or highway, including bicycle and walking paths; and

(2) Any other property acquired for the construction, operation or use of the highway.

(j) Interstate highway. -- "Interstate highway" means a State highway that is part of the national interstate system in the State, as designated by the Administration and approved by the United States Secretary of Transportation under Title 23 of the United States Code.

(k) Maintenance.

(1) "Maintenance" means the upkeep and repair by which a highway, building, equipment, and other property is kept in an ordinarily efficient operating condition.

(2) "Maintenance" does not include construction, reconstruction, or relocation.

(l) Primary highway. -- "Primary highway" means a State highway that has been designated a primary highway by the Administration with the approval of the Secretary.

(m) Project. -- "Project" means the construction, reconstruction, or relocation of one or more sections or parts of the State highway system.

(n) Railroad grade separation.

(1) "Railroad grade separation" means any overpass or underpass that eliminates a railroad grade crossing.

- (2) "Railroad grade separation" includes:
 - (i) The overpass and underpass structure and the approaches to them;
 - (ii) Any related entrance plazas, interchanges, connecting highways. And other structures; and
 - (iii) Any other property acquired for the construction, operation, or use of the railroad grade separation.
- (o) Road. – "Road" means a highway.
- (p) Secondary highway. – "Secondary highway" means a State highway that is either a primary highway or interstate highway.
- (q) State highway. – "State highway" means any public highway owned by this State.
- (r) State highway system. – "State highway System" means the system of State-owned primary and secondary highways throughout the State.
- (s) Street. – "Street" means a highway.

8-204 General powers and duties of Administration

- (a) In general. – In addition to the specific powers granted and duties imposed by this title, the Administration has the powers and duties set forth in this section.
- (b) Rules and regulations. – The Administration may adopt rules and regulations to carry out the provisions of this title.
- (c) Establishment and maintenance of State highway system. –
 - (1) The Administration shall:
 - (i) Determine and may change from time to time the location, construction, geometric, design, and maintenance of the State highway system; and
 - (ii) 1. If the Administration and a local government designate an area as a bicycle and pedestrian priority area, implement a plan developed in cooperation with the local government to increase safety and access for bicycle or pedestrian traffic.
 - 2. If there is no State highway within the limits of the bicycle and pedestrian priority area, the plan shall be developed by the local government.
 - (2) A plan for traffic management in a bicycle and pedestrian priority area shall provide for:
 - (i) Appropriate changes to the location, construction, geometrics, design, and maintenance of the State highway system to increase safety and access for bicycle and pedestrian traffic in the bicycle and pedestrian priority area; and
 - (ii) The appropriate use of traffic control devices including pedestrian control signals, traffic signals, stop signs, and speed bumps.
- (d) Consultations and contracts with others. – The Administration may consult, confer, and contract with any agency or representative of the federal government, this State, or any other state or with any other person in furtherance of the duties of the Administration and the purposes of this title.
- (e) Agents and employees. –
 - (1) Subject to Section 2-103.4 of this article, the Administration may employ engineers, accountants, professional and technical experts, surveyors, skilled and unskilled laborers, advisors, consultants, and other agents and employees that it considers necessary to carry out its powers and duties.
 - (2) Any employee of the Administration may be bonded under Title 9, Subtitle 17 of the State Government Article.
 - (3) The Administration may determine the compensation of executive management positions, as recommended by the Secretary of Transportation and approved by the Governor, subject to approval in the budget.
- (f) Equipment and material. – The Administration may purchase any machines, tools, implements, appliances, supplies, materials, and working agencies that it considers necessary to carry out any of its powers or duties under this title.
- (g) Lease offices. – The Administration may rent or lease any offices and other places that it considers necessary to carry out its powers and duties.
- (h) Control of public use areas. – By rules or regulations consistent with the safety and welfare of the traveling public, the Administration may govern the control and use of rest areas, scenic overlooks, roadside picnic areas, and other public use areas within State highway rights-of-way.
- (i) Bicycle priority route system. – The Administration shall:
 - (1) Plan, select, construct, improve, and maintain the State highway system; and

(2) By July 1, 1997, in accordance with local governments, draft a plan for a bicycle priority route system that provides a viable network for bicycle transportation throughout the State.

Subtitle 6 Construction and Maintenance
Part I General Provisions

8-601.1 Project resulting in severance or destruction of bicycle route

(a) Prohibition. – The Administration may not construct any project that will result in the severance or destruction of an existing major route for bicycle transportation traffic, unless the project provides for construction of a reasonable alternative route or such a route already exists.

(b) Guidelines. – The Administration shall develop guidelines jointly with local governments to carry out the provisions of this section.

8-630 Sidewalks or bicycle pathways along urban highways; nighttime illumination

(a) Definitions. –

(1) In this section the following words have the meanings indicated.

(2) “Municipal corporation” has the meaning stated in Article 23A, Section 9 of the Code.

(3) “Urban highway” means a highway, other than an expressway, that is:

(i) 1. Constructed with a curb and gutter and an enclosed type storm drainage system;
2. Located in an urban area and on which is located a public facility that creates appreciable pedestrian traffic along the highway from adjacent areas;

3. Located within urban boundaries as defined by the U.S. Census Bureau; or

4. Located within the boundaries of a municipal corporation; and

(ii) Part of the State highway system.

(b) Sidewalks – Construction generally, -

(1) Sidewalks shall be constructed at the time of construction or reconstruction on an urban highway, or in response to the request of a local government unless:

(i) The Administration determines that the cost or impacts of constructing the sidewalk would be too great in relation to the need for them or their probable use; or

(ii) The local government indicates that there is no need for sidewalks

(2) Sidewalks constructed under this section shall be consistent with area master plans and transportation plans adopted by the local planning commission.

(c) Sidewalks and bicycle pathways – Financing; maintenance; construction when no adjacent roadway construction. –

(1) If sidewalks or bicycle pathways are constructed or reconstructed as part of a roadway construction or reconstruction project, the Administration shall fund the sidewalks or bicycle pathway construction or reconstruction as a part of the cost of the roadway project.

(2) Except as provided in paragraph (3) of this subsection, if sidewalks or bicycle pathways are constructed or reconstructed in response to a request from a local government and the adjacent roadway is not being concurrently constructed or reconstructed, the cost to construct or reconstruct the sidewalk or bicycle pathway shall be shared equally between the State and local governments.

(3) If sidewalks or bicycle pathways within the sustainable community as defined in § 6-301 of the Housing and Community Development Article are constructed or reconstructed in response to a request from a local government and the adjacent roadway is not being concurrently constructed or reconstructed, the cost to construct or reconstruct the sidewalk or bicycle pathway may be funded entirely by the State.

(4)(i) This paragraph does not apply to a priority funding area that is a sustainable community as defined in § 6-301 of the Housing and Community Development Article.

(ii) If sidewalks or bicycle pathways within an area designated as a priority funding area under § 5-7B-02 of the State Finance and Procurement Article are constructed or reconstructed in response to a request from a local government and the adjacent roadway is not being concurrently constructed or reconstructed, and if the Administration determines that construction would not occur under this section due to insufficient contribution of funds by the local government, the cost to construct or reconstruct the sidewalk or bicycle pathway shall be shared between the State and local government as follows:

1. 75 percent of the cost shall be funded by the State; and

2. 25 percent of the cost shall be funded by the local government

(iii) If sidewalks or bicycle pathways within an area designated as priority funding area under §5-7B-02 of the State Finance and Procurement Article are constructed or reconstructed based on a determination by the Administration that a substantial public safety risk or significant impediment to pedestrian access exists and the adjacent roadway is not being concurrently constructed or reconstructed, then;

1. The Administration shall categorize the sidewalk or bicycle pathway construction project as “system preservation” and give corresponding funding priority to the project; and
2. The cost to construct or reconstruct the sidewalk or bicycle pathway may be funded entirely by the State.

(5) If sidewalks or bicycle pathways are being constructed or reconstructed in response to a request from a local government and the adjacent roadway is not being concurrently constructed or reconstructed, the local government shall:

- (i) Provide public notice and opportunities for community involvement prior to the construction of a sidewalk or bicycle pathway; and
- (ii) Secure necessary right-of-way that may be needed beyond the right-of-way already owned by the State.

(6)(i) Except as provided in subparagraph (ii) of this paragraph, after sidewalks and bicycle pathways are constructed under this section, they shall be maintained and repaired by the political subdivision in which they are located.

(ii) Subject to approval and the availability of funds, the Administration promptly shall reimburse a political subdivision for the preapproval and documented costs incurred in reconstructing a segment of a sidewalk or bicycle pathway that has deteriorated to the extent that repair is not practical or desirable for public safety.

(d) Existing pedestrian routes. – The Administration may not construct any project that will result in the severance or destruction of an existing major route for pedestrian transportation traffic, unless the project provides for construction for a reasonable alternative pedestrian route or such a route already exists.

(e) Guidelines. – The Administration shall develop guidelines jointly with local governments to carry out the provisions of this section.

(f) Nighttime illumination. – The Administration shall maintain and repair all facilities for nighttime illumination that:

- (1) Are constructed by the Administration for the safe conduct of vehicular traffic; and
- (2) Exist adjacent to urban highways.

8-648 Storm drain covers in highways

Any new or replacement storm drain cover, installed on a street or highway in the State, after January 1, 1980, shall consist of:

- (1) Bars running perpendicular to the flow of traffic on the highway;
- (2) A grating composed of intersecting bars; or
- (3) Other designs approved by the Department of Transportation which meet safety design criteria as well as engineering and structural design demands.

TITLE 11 DEFINITIONS; GENERAL PROVISIONS

Subtitle 1 Definitions

11-104 Bicycle

"Bicycle" means a vehicle that:

- (1) Is designed to be operated by human power;
- (2) Has two or three wheels, of which one is more than 14 inches in diameter; and
- (3) Has a drive mechanism other than by pedals directly attached to a drive wheel.

11-127 Highway

"Highway" means:

(1) The entire width between the boundary lines of any way or thoroughfare of which any part is used by the public for vehicular travel, whether or not the way or thoroughfare has been dedicated to the public and accepted by any proper authority; and

(2) For purposes of the application of State laws, the entire width between the boundary lines of any way or thoroughfare used for purposes of vehicular travel on any property owned, leased, or controlled by the United States government and located in the State.

11-130.1 Low Speed Vehicle

"Low speed vehicle" means a four-wheeled electric vehicle that has a maximum speed capacity that exceeds 20 miles per hour but is less than 25 miles per hour.

11-134.1 Moped

"Moped" means a bicycle that:

(1) Is designed to be operated by human power with the assistance of a motor;

(2) Is equipped with pedals that mechanically drive the rear wheel or wheels;

(3) Has two or three wheels, of which one is more than 14 inches in diameter; and

(4) Has a motor with a rating of 1.5 brake horsepower or less and, if the motor is an internal combustion engine, a capacity of 50 cubic centimeters piston displacement or less.

11-134.5 Motor Scooter

(a) In general. -- "Motor scooter" means a nonpedal vehicle that:

(1) Has a seat for the operator;

(2) Has two wheels, of which one is 10 inches or more in diameter;

(3) Has a step-through chassis;

(4) Has a motor:

(i) With a rating of 2.7 brake horsepower or less; or

(ii) If the motor is an internal combustion engine, with a capacity of 50 cubic centimeters piston displacement or less; and

(5) Is equipped with an automatic transmission.

(b) Off-road vehicles. -- "Motor scooter" does not include a vehicle that has been manufactured for off-road use, including a motorcycle and an all-terrain vehicle.

11-135 Motor vehicle

(a) In general

(1) "Motor vehicle" means, except as provided in subsection (b) of this section. A vehicle that:

(i) Is self-propelled or propelled by an electric power obtained from overhead electric wires; and

(ii) Is not operated on rails.

(2) "Motor vehicle" includes a low speed vehicle.

(b) Moped or motor scooter. -- "Motor vehicle" does not include:

(1) A moped, as defined in subsection 11-134.1 of this subtitle; or

(2) A motor scooter, as defined in subsection 11-134.5 of this subtitle.

11-145 Pedestrian

"Pedestrian" means an individual afoot.

11-151 Roadway

(a) In general. -- "Roadway" means that part of the highway that is improved, designed, or ordinarily used for vehicular travel, other than the shoulder.

(b) Two or more separate roadways. -- If a highway includes two or more separate roadways, the term "roadway" is used in the Maryland Vehicle Law refers to any one roadway separately, and not to all roadways collectively.

11-154.1 Scooter

"Scooter" means a two-wheeled vehicle that:

- (1) Has handlebars; and
- (2) Is designed to be stood on by the operator.

11-176 Vehicle

(a) In general. --

(1) "Vehicle " means, except as provided in subsection (b) of this section, any device in, on, or by which any individual or property is or might be transported or towed on a highway.

(2) "Vehicle" includes a low speed vehicle and an off-highway recreational vehicle.

(b) Exceptions. -- "Vehicle" does not include an electric personal assistive mobility device as defined in § 21-101(j) of this article.

TITLE 15 VEHICLE LAWS – LICENSING OF BUSINESS AND OCCUPATIONS

Subtitle 1 Definition: General Provisions

15-112 Sale of Minibikes; warning required

(a) State restriction. -- Any dealer or agent or employee of a dealer, any vehicle salesman, or any other person who sells a motorized minibike shall inform the buyer in writing that a motorized minibike may not be driven on a highway in the State.

(b) Local restriction. -- Any dealer or agent or employee of a dealer, any vehicle salesman, or any other person who sells a motorized minibike shall inform the buyer in writing that local law, ordinance, and regulation may limit the use of the motorized minibike.

TITLE 21 VEHICLES LAWS – RULES OF THE ROAD

Subtitle 1 Definitions; General Provisions

21-101 Definitions

(a) In general. -- In this title and Title 25 of this article the following words have the meanings indicated.

(b) Alley. -- "Alley" means a street that:

- (1) Is intended to provide access to the rear or side of a lot or building in an urban district; and
- (2) Is not intended for through vehicular traffic.

(c) Bicycle path. -- "Bicycle path" means any travelway designed and designated by signing or signing and marking for bicycle use, located within its own right-of-way or in a shared right-of-way, and physically separated from motor vehicle traffic by berm, shoulder, curb, or other similar device.

(d) Bicycle way. --

(1) "Bicycle way" means:

- (i) Any trail, path, part of a highway, surfaced or smooth shoulder, or sidewalk; or
- (ii) Any other travelway specifically signed, marked, or otherwise designated for bicycle travel.

(2) "Bicycle way" includes:

- (i) Bicycle path; and
- (ii) Bike lane.

(e) Bike lane. -- "Bike lane" means any portion of a roadway or shoulder designated for single directional bicycle flow.

(f) Business district. -- "Business district" means an area that adjoins and includes a highway where at least 50 percent of the frontage along the highway, for a distance of at least 300 feet, is occupied by buildings used for business.

(g) Controlled access highway. -- "Controlled access highway" means a highway or roadway to or from which persons, including the owners or occupants of abutting lands, have no right of access except at the points and in the manner determined by the public authority with jurisdiction over the highway or roadway.

(h) Crossover. -- "Crossover" means a transverse roadway or opening that connects the separate roadways of a divided highway at a point other than an intersection of the divided highway with another highway.

(i) Crosswalk. -- "Crosswalk" means that part of a roadway that is:

- (1) Within the prolongation or connection of the lateral lines of sidewalks at any place where 2 or more

roadways of any type meet or join, measured from the curbs or, in the absence of curbs, from the edges of the roadway;

(2) Within the prolongation or connection of the lateral lines of a bicycle way where a bicycle way and a roadway of any type meet or join, measured from the curbs or, in the absence of curbs, from the edges of the roadway; or

(3) Distinctly indicated for pedestrian crossing by lines or other markings.

(j) Electric personal assistive mobility device. -- "Electric personal assistive mobility device" or "EPAMD" means a pedestrian device that:

(1) Has two nontandem wheels;

(2) Is self-balancing;

(3) Is powered by an electric propulsion system;

(4) Has a maximum speed capability of 15 miles per hour; and

(5) Is designed to transport one person.

(k) Expressway. -- "Expressway" means a major highway of 2 or more traffic lanes in each direction that is designed to eliminate principal traffic hazards and has the following characteristics:

(1) A median divider separating opposing traffic lanes to eliminate head-on collisions and sideswiping;

(2) Grade separation structures to eliminate the conflict of cross streams of traffic at each intersection;

(3) Points of entrance and exit limited to predetermined locations;

(4) Vertical curves long enough to provide long sight distances; and

(5) Shoulders wide enough to permit vehicles to stop or park out of traffic lanes.

(l) Intersection. --

(1) "Intersection" means:

(i) The area within the prolongation or connection of the lateral curb lines or, in the absence of curbs, the lateral boundary lines of the roadways of two highways that join at or approximately at right angles; or

(ii) The area within which vehicles traveling on different highways joining at any other angle may come in conflict.

(2) If a divided highway includes two roadways that are 30 feet or more apart, every crossing of each roadway of the divided highway by an intersecting highway is a separate intersection. If the intersecting highway also includes two roadways that are 30 feet or more apart, every crossing of two roadways of these highways is a separate intersection.

(m) Play vehicle. -- "Play vehicle" means a vehicle that:

(1) Has two or three wheels;

(2) Is propelled only by human power; and

(3) Is not a bicycle, as defined in Title 11 of this article.

(n) Private road or driveway. -- "Private road or driveway" means any way or place that:

(1) Is privately owned; and

(2) Is used for vehicular travel by its owner and by those having express or implied permission from the owner, but not by other persons.

(o) Public bicycle area. -- "Public bicycle area" means any highway, bicycle path, or other facility or area maintained by this State, a political subdivision of this State, or any of their agencies for the use of bicycles.

(p) Railroad. -- "Railroad" means a carrier of people or property on cars that are operated on stationary rails.

(q) Railroad sign or signal. -- "Railroad sign" or "railroad signal" means any sign, signal, or device placed by authority of a public body or official or by a railroad to warn of the presence of railroad tracks or the approach of a railroad train.

(r) Railroad train. -- "Railroad train" means any locomotive or any other car, rolling stock, equipment, or other device that, alone or coupled to others, is operated on stationary rails.

(s) Residential district. -- "Residential district" means an area that:

(1) Is not a business district; and

(2) Adjoins and includes a highway where the property along the highway, for a distance of at least 300 feet, is improved mainly with residences or residences and buildings used for business.

(t) Right-of-way. -- "Right-of-way" means the right of one vehicle or pedestrian to proceed in a lawful manner on a highway in preference to another vehicle or pedestrian.

(u) Safety zone. -- "Safety zone" means an area in a roadway that:

(1) Is officially set apart for the exclusive use of pedestrians; and

- (2) Is protected or is so marked or indicated by adequate signs as to be plainly visible at all times while set apart as a safety zone.
- (v) Shoulder. -- "Shoulder" means that portion of a highway contiguous with the roadway for the accommodation of stopped vehicles, for emergency use, for use by bicycles and motor scooters, and for the lateral support of the base and surface courses of the roadway.
- (w) Sidewalk. -- "Sidewalk" means that part of a highway:
 - (1) That is intended for use by pedestrians; and
 - (2) That is between:
 - (i) The lateral curb lines or, in the absence of curbs, the lateral boundary lines of a roadway; and
 - (ii) The adjacent property lines.
- (x) Through highway. -- "Through highway" means a highway or part of a highway:
 - (1) On which vehicular traffic is given the right-of-way; and
 - (2) At the entrances to which vehicular traffic from intersecting highways is required by law to yield the right-of-way to vehicles on that highway or part of a highway, in obedience to either a stop sign or yield sign placed as provided in the Maryland Vehicle Law.
- (y) Urban district. -- "Urban district" means an area that:
 - (1) Adjoins and includes any street; and
 - (2) Is built up with structures that are:
 - (i) Devoted to business, industry, or dwelling houses; and
 - (ii) Situated at intervals of less than 100 feet, for a distance of at least a quarter of a mile.
- (z) Wheelchair. -- "Wheelchair" means a mobility aid belonging to any class of three- or four-wheeled devices that:
 - (1) Is usable indoors;
 - (2) Does not exceed 30 inches in width and 48 inches in length, when measured 2 inches above the ground; and
 - (3) Is designed for and used by a mobility impaired individual, whether operated manually or powered.

Subtitle 2 Traffic Signs, Signals and Markings

21-202 Traffic lights with steady indication.

- (a) In general. --
 - (1) Except for special pedestrian signals that carry a legend, where traffic is controlled by traffic control signals that show different colored lights or colored lighted arrows, whether successively one at a time or in combination, only the colors green, red, and yellow may be used.
 - (2) These lights apply to drivers and pedestrians as provided in this section.
- (b) Green indication. -- Vehicular traffic facing a circular green signal may proceed straight through or, unless a sign at the place prohibits the turn, turn right or left.
- (c) Yielding right-of-way to vehicles or pedestrians within intersections or crosswalks. -- Vehicular traffic described under subsection (b) of this section, including any vehicle turning right or left, shall yield the right-of-way to any other vehicle and any pedestrian lawfully within the intersection or an adjacent crosswalk when the signal is shown.
- (d) Entering intersection on green arrow. -- Vehicular traffic facing a green arrow signal, whether shown alone or with another indication, cautiously may enter the intersection, but only to make the movement indicated by the arrow or to make another movement permitted by other indications shown at the same time.
- (e) Yielding right-of-way to certain pedestrians and other traffic. -- Vehicular traffic described under subsection (d) of this section shall yield the right-of-way to any pedestrian or bicycle lawfully within an adjacent crosswalk and to any other traffic lawfully using the intersection.
- (f) When pedestrians may cross roadways. -- Unless otherwise directed by a pedestrian control signal as provided in § 21-203 of this subtitle, a pedestrian facing any green signal, unless the green signal is only a turn arrow, may cross the roadway, within any marked or unmarked crosswalk, in the direction of the green signal.
- (g) Steady yellow indication. --
 - (1) Vehicular traffic facing a steady yellow signal is warned that the related green movement is ending or that a red signal, which will prohibit vehicular traffic from entering the intersection, will be shown immediately after the yellow signal.

(2) Unless otherwise directed by a pedestrian control signal as provided in § 21-203 of this subtitle, a pedestrian facing a steady yellow signal is warned that there is not enough time to cross the roadway before a red signal is shown, and a pedestrian may not then start to cross the roadway.

(h) Steady red indication -- In general. --

(1) Vehicular traffic facing a steady circular red signal alone:

(i) Shall stop at the near side of the intersection:

1. At a clearly marked stop line;
2. If there is no clearly marked stop line, before entering any crosswalk; or
3. If there is no crosswalk, before entering the intersection; and

(ii) Except as provided in subsections (i), (j), and (k) of this section, shall remain stopped until a signal to proceed is shown.

(2) Vehicular traffic facing a steady red arrow signal:

(i) May not enter the intersection to make the movement indicated by the arrow;

(ii) Unless entering the intersection to make a movement permitted by another signal, shall stop at the near side of the intersection:

1. At a clearly marked stop line;
2. If there is no clearly marked stop line, before entering any crosswalk; or
3. If there is no crosswalk, before entering the intersection; and

(iii) Except as provided in subsections (i), (j), and (k) of this section, shall remain stopped until a signal permitting the movement is shown.

(i) Steady red indication -- Entering intersection for right turn or for left turn from one-way street onto one-way street. -- Unless a sign prohibiting a turn is in place, vehicular traffic facing a steady red signal, after stopping as required by subsection (h) of this section, cautiously may enter the intersection and make:

(1) A right turn; or

(2) A left turn from a one-way street onto a one-way street.

(j) Steady red indication -- Entering intersection to make turn indicated by sign. -- If a sign permitting any other turn is in place, vehicular traffic facing a steady red signal, after stopping as required by subsection (h) of this section, cautiously may enter the intersection and make the turn indicated by the sign.

(k) Steady red indication -- Yielding right-of-way to certain pedestrians. -- In each instance, vehicular traffic described in subsections (i) and (j) of this section shall yield the right-of-way to any pedestrian or bicycle lawfully within an adjacent crosswalk and to any vehicle in the intersection or approaching on another roadway so closely as to constitute an immediate hazard.

(l) Steady red indication -- Pedestrians prohibited from entering roadway. -- Unless otherwise directed by a pedestrian control signal as provided in § 21-203 of this subtitle, pedestrians facing a steady red signal alone may not enter the roadway.

(m) Applicability of section. -- Except for those provisions of this section that by their very nature cannot apply, this section applies to a traffic control signal placed at a location other than an intersection. Each stop required by the signal shall be made at a sign or marking on the pavement indicating where the stop shall be made or, if there is no sign or marking, at the signal.

Subtitle 3 Driving on Right Side of Roadway; Overtaking and Passing; Use of Roadway

21-313 Restrictions on the use of controlled access highways

(a) State Highway Administration and local authorities may prohibit certain uses. — The State Highway Administration, by order, or any local authority, by ordinance, may prohibit the use of any controlled access highway in its jurisdiction by parades, low speed vehicles, funeral processions, bicycles, or other nonmotorized traffic or by any person operating a motorcycle.

(b) Soliciting funds, rides, employment, or business in Charles, Frederick, and Washington counties. — The County Commissioners of Charles County, Frederick County, and Washington County, by ordinance, may prohibit the use of any controlled access highway in the county's jurisdiction by any person to solicit money, donations of any kind, employment, business, or a ride from the occupant of any vehicle on the controlled access highway.

(c) Sign required. — The State Highway Administration or the local authority adopting any prohibition under this section shall place and maintain signs on the controlled access highway to which the prohibition is applicable. If signs are so placed, a person may not disobey the restrictions stated on them.

Subtitle 12 Operation of Bicycles and Play Vehicles**21-1201 Scope of Subtitle**

(a) Authorizing minor or ward to violate provisions. – The parent of any minor or guardian of any ward may not authorize the minor or ward to violate any provision of this subtitle.

(b) Knowingly permitting minor or ward to violate provision. – The parent of any minor or the guardian of any ward may not knowingly permit a minor or ward to violate any provision of this subtitle.

(c) Applicability of subtitle. – With the exceptions stated in this subtitle, the provisions of this subtitle that are applicable to bicycles apply whenever a bicycle, an EPAMD, or motor scooter is operated on any highway or whenever a bicycle or an EPAMD is operated on any path set aside for the exclusive use of bicycles.

21-1202 Traffic laws apply to bicycles and motor scooters

Every person operating a bicycle or a motor scooter in a public bicycle area has all the rights granted to and is subject to all the duties required of the driver of a vehicle by this title, including the duties set forth in 21-504 of this title except:

- (1) As otherwise provided in this subtitle; and
- (2) For those provisions of this subtitle that by their very nature cannot apply.

21-1205 Riding on roadways or on highway

(a) Riding to right side of roadway. — Each person operating a bicycle or a motor scooter at a speed less than the speed of traffic at the time and place and under the conditions then existing on a roadway shall ride as near to the right side of the roadway as practicable and safe, except when:

- (1) Making or attempting to make a left turn;
- (2) Operating on a one-way street;
- (3) Passing a stopped or slower moving vehicle;
- (4) Avoiding pedestrians or road hazards;
- (5) The right lane is a right turn only lane; or

(6) Operating in a lane that is too narrow for a bicycle or motor scooter and another vehicle to travel safely side by side within the lane.

(b) Riding two abreast. — Each person operating a bicycle or a motor scooter on a roadway may ride two abreast only if the flow of traffic is unimpeded.

(c) Passing. – Each person operating a bicycle or a motor scooter on a roadway shall exercise due care when passing a vehicle.

(d) Walking bicycles on right side of highway. — Each person operating a bicycle or a motor scooter on a roadway may walk the bicycle or motor scooter on the right side of the highway if there is no sidewalk.

21-1205.1 Bicycles, motor scooters, and EPAMD's prohibited on certain roadways and highways; speed limit

(a) In general. -- Notwithstanding any other provision of this title, a person may not ride a bicycle or a motor scooter:

(1) Notwithstanding any other provision of this title, a person may not ride a bicycle or a motor scooter:

(i) Except as provided in paragraph (2) of this subsection, on any roadway where the posted maximum speed limit is more than 50 miles an hour; or

(ii) On any expressway, except on an adjacent bicycle path or way approved by the State Highway Administration, or on any other controlled access highway signed in accordance with section 21-313 of this title.

(2) If a person is lawfully operating a bicycle or a motor scooter on a shoulder adjacent to a roadway for which the posted maximum speed limit is more than 50 miles an hour, the person may enter the roadway only if:

(i) Making or attempting to make a left turn;

(ii) Crossing through an intersection; or

(iii) The shoulder is overlaid with a right turn lane, a merge lane, a bypass lane, or any other marking that breaks the continuity of the shoulder.

(b) Roadway with bike lane or shoulder paved to smooth surface. --

(1) Where there is not a bike lane paved to a smooth surface, a person operating a bicycle or a motor scooter may use the roadway or the shoulder.

(2) Where there is a bike lane paved to a smooth surface, a person operating a bicycle or a motor scooter shall use the bike lane and may not ride on the roadway, except in the following situations:

(i) When overtaking and passing another bicycle, motor scooter, pedestrian, or other vehicle within the bike lane if the overtaking and passing cannot be done safely within the bike lane;

(ii) When preparing for a left turn at an intersection or into an alley, private road, or driveway;

(iii) When reasonably necessary to leave the bike lane to avoid debris or other hazardous condition; or

(iv) When reasonably necessary to leave the bike lane because the bike lane is overlaid with a right turn lane, merge lane, or other marking that breaks the continuity of the bike lane.

(3) A person operating a bicycle or a motor scooter may not leave a bike lane until the movement can be made with reasonable safety and then only after giving an appropriate signal.

(4) The Department shall adopt regulations pertaining to this subsection, including a definition of "smooth surface".

(c) Motor scooter speed limit. -- A motor scooter may not be operated at a speed in excess of 30 miles per hour.

(d) Restrictions on operating EPAMDs. -- Notwithstanding any other provision of this title, a person may not operate an EPAMD on any roadway where there are sidewalks adjacent to the roadway or the posted maximum speed limit is more than 30 miles an hour.

(e) EPAMD speed limit. -- An EPAMD may not be operated at a speed in excess of 15 miles per hour.

21-1208 Securing bicycle, motor scooter or EPAMD to certain objects

(a) Prohibition – A person may not secure a bicycle, an APAMD, or a motor scooter to a fire hydrant, police or fire call box, or traffic control device.

(b) Poles, etc. within bus or taxi zones. – A person may not secure a bicycle, an EPAMD, or motor scooter to a pole, meter, or device located within a bus or taxi loading zone.

(c) Poles, etc. within 25 feet of intersection – A person may not secure a bicycle, an EPAMD or a motor scooter to a pole, meter, or device located within 25 feet of an intersection.

(d) Poles, etc. having forbidding securing of bicycles. – A person may not secure a bicycle, an EPAMD, or motor scooter to a pole, meter or device on which notice has been posted by the appropriate authorities forbidding the securing of bicycles.

(e) Obstructing or impeding traffic or pedestrian movement. – A person may not secure a bicycle, an EPAMD, or motor scooter to any place where the securing of a bicycle or motor scooter would obstruct or impede vehicular traffic or pedestrian movement.

(f) Securing to parking meter. – A bicycle, an EPAMD or a motor scooter may be secured to a parking meter, without payment of the usual fees, if it is entirely removed from the bed of the street normally used for vehicular parking.

21-1209 Throwing object at bicycle, motor scooter, or EPAMD

(a) Drivers to exercise due care. -- Notwithstanding any other provision of this title, the driver of a vehicle shall:

(1) Exercise due care to avoid colliding with any bicycle, EPAMD, or motor scooter being ridden by a person; and

(2) When overtaking a bicycle, an EPAMD, or a motor scooter, pass safely at a distance of not less than 3 feet, unless, at the time:

(i) The bicycle, EPAMD, or motor scooter rider fails to operate the vehicle in conformance with § 21-1205(a) of this subtitle ("Riding to right side of roadway") or § 21-1205.1(b) of this subtitle ("Roadway with bike lane or shoulder paved to smooth surface");

(ii) A passing clearance of less than 3 feet is caused solely by the bicycle, EPAMD, or motor scooter rider failing to maintain a steady course; or

(iii) The highway on which the vehicle is being driven is not wide enough to lawfully pass the bicycle, EPAMD, or motor scooter at a distance of at least 3 feet.

(b) Throwing objects. -- A person may not throw any object at or in the direction of any person riding a bicycle, an EPAMD, or a motor scooter.

(c) Opening doors with intent to strike, injure, etc. -- A person may not open the door of any motor vehicle with intent to strike, injure, or interfere with any person riding a bicycle, an EPAMD, or a motor scooter.

(d) Yielding right-of-way. -- Unless otherwise specified in this title, the driver of a vehicle shall yield the right-of-way to a person who is lawfully riding a bicycle, an EPAMD, or a motor scooter in a designated bike lane or shoulder if the driver of the vehicle is about to enter or cross the designated bike lane or shoulder.