Chapter 9

Bicycle Facilities

Figures

Tables

9 Bicycle Facilities

9.1 ~~A~~ Introduction

Bicycle facilities shall be given full consideration in the planning and development of transportation facilities, including the incorporation of such facilities into state, regional, and local transportation plans, and programs under the assumption that transportation facilities will be used by cyclists. Bicycle facilities should be established in conjunction with the construction, reconstruction, or other change of any transportation facility and special emphasis should be given to projects in or within 1 mile of an urban area. The provision for bicycle facilities is also desirable for resurfacing, restoration & rehabilitation (RRR) projects.

Bicycle and pedestrian facilities are not required to be established:

1. Where their establishment would be contrary to public safety.
2. When the cost would be excessively disproportionate to the need or probable use; or
3. Where other available means or factors indicate an absence of need.

Appropriately designed and located bicycle facilities play an important role in supporting bicycle travel. Bicyclists shall be considered in all phases of transportation planning, design, construction, and maintenance activities. Emphasis should be given to new construction, reconstruction, intersection improvement, and transit projects. Bicycle facilities can include bicycle lanes, paved shoulders, wide curb lanes, shared lanes, shared use paths, and bicycle parking facilities.

In addition to the design criteria provided in this chapter, shared use paths and structures that include provisions for pedestrians shall be designed to be accessible to persons with disabilities. For more information on accessible design requirements, see **Chapter 8 – Pedestrian Facilities.**

9.2 ~~B~~ On-Street Facilities

Provisions for bicycle traffic should be incorporated in the original roadway design. All roadways, except where bicycle use is prohibited by law, should be designed, constructed, and maintained under the assumption they will be used by bicyclists. Roadway conditions should be favorable for bicycling, with smooth pavement and limited changes in elevation along edge

lines. Drainage inlets and utility covers that cannot be moved out of the travel way shall be designed flush with grade, well seated, and make use of bicycle-compatible grates and covers.

Railroad grade crossings on a diagonal can cause steering difficulties for bicyclists. Crossings for bicycle facilities should be perpendicular to the rail. This can be accomplished with a widened shoulder or bicycle lane, or separate path. Consideration shall be given to improving the smoothness of the crossing and reducing the width and depth of the flangeway opening. Flangeway fillers can be used on heavy rail lines to minimize the size of the opening adjacent to the rail.

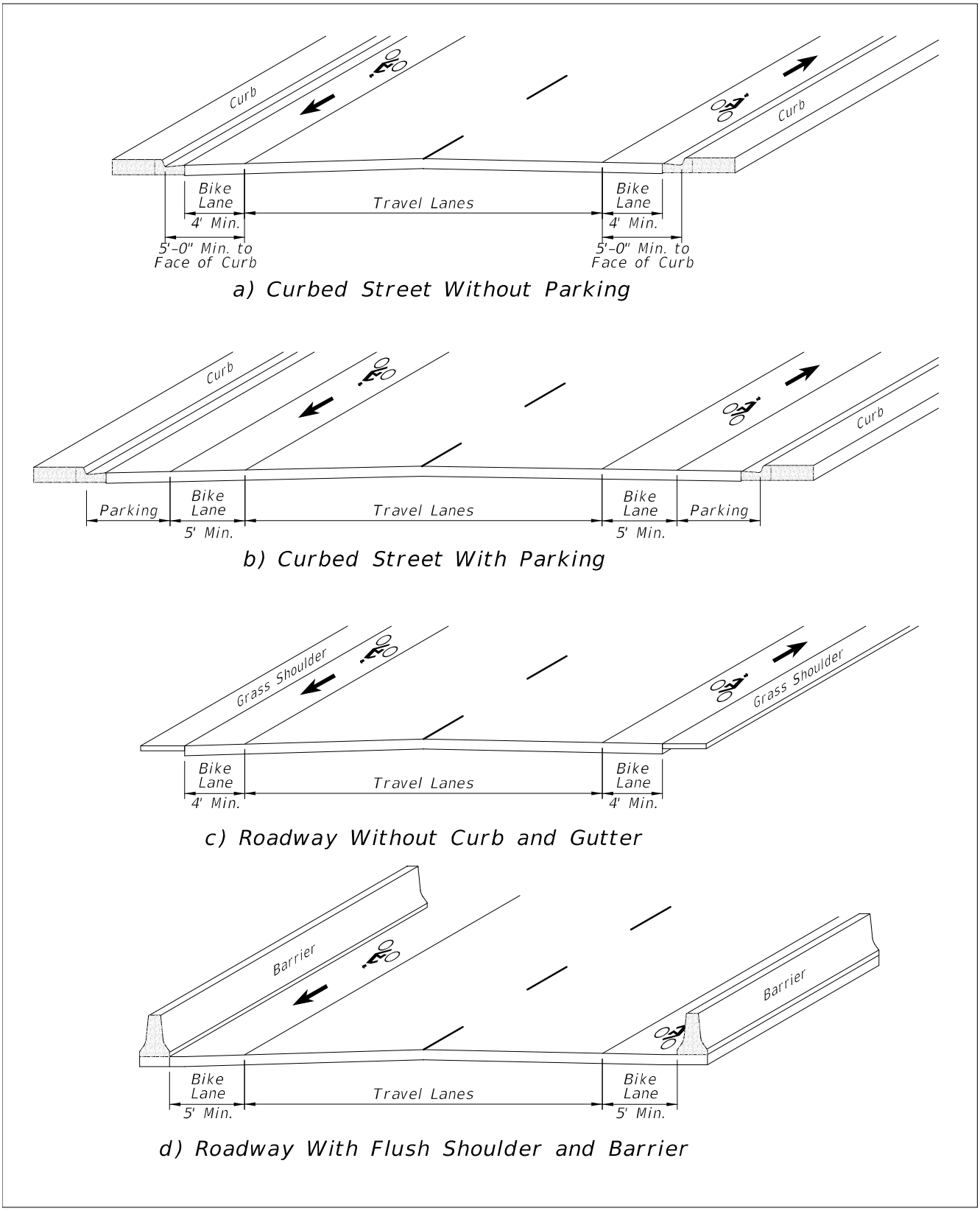
Bicycle lanes, paved shoulders, wide curb lanes, or shared lanes should be included to the fullest extent feasible. The appropriate selection of a bicycle facility depends on many factors, including motor vehicle and bicycle traffic characteristics, adjacent land use and expected growth patterns. All new or reconstructed arterial and collector roadways, in and within one mile of an urban area, should include bicycle lanes.

Rumble strips used in a traffic lane to alert operators to conditions ahead (e.g., stop signs, traffic signals or curves) should provide clear space (free of rumble strips) for bicyclists. This clear space may be a paved shoulder or if no paved shoulder is present, a minimum of 1.5 feet of clear space at the outermost portion of the lane.

9.2.1 ~~B.1~~ Bicycle Lanes

Bicycle lanes delineate available roadway space for preferential use by bicyclists, providing more predictable movements by motorists and bicyclists. Bicycle lanes also help increase the total capacity of highways carrying mixed bicycle and motor vehicle traffic. Bicycle lanes shall have a minimum functional width of 4 feet. At least 1-foot additional width is needed when the bicycle lane is adjacent to a curb or other barrier, on-street parking is present, there is substantial truck traffic (>10%), or posted speeds exceed 50 mph. Minimum bicycle lane widths are illustrated in **Figure 9 – 1 Minimum Widths for Bicycle Lanes**. The 4-foot bicycle lane shown in the flush shoulder typical section assumes the grass portion of the shoulder provides emergency maneuvering room.

Figure 9-1 Minimum Widths for Bicycle Lanes



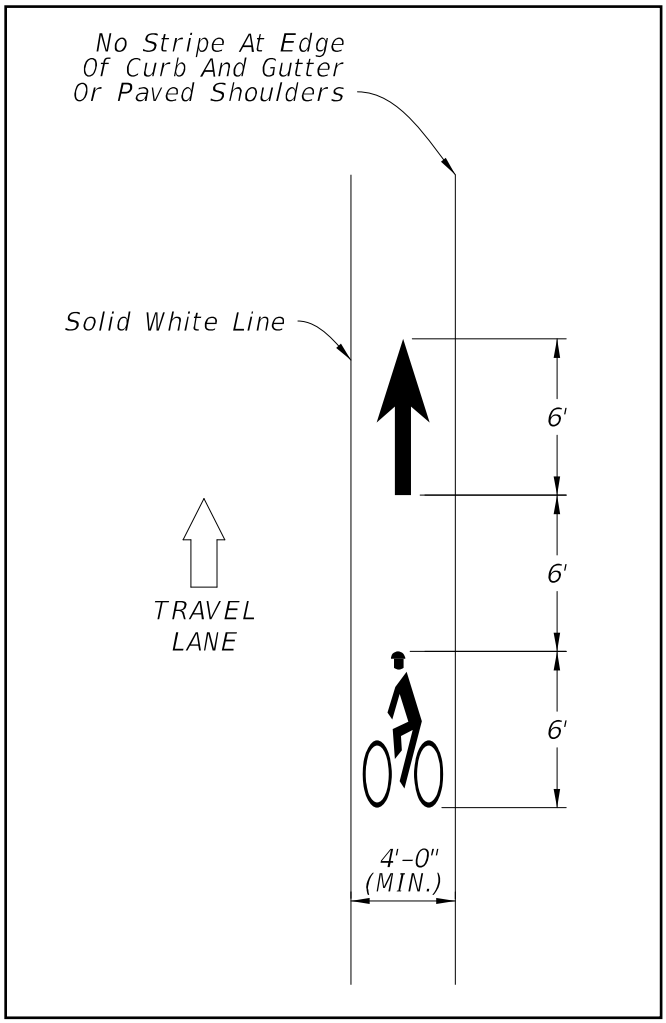
Bicycle lanes are one-way facilities and carry bicycle traffic in the same direction as the adjacent motor vehicle traffic. A bicycle lane shall ~~should~~ be delineated from the travel lanes

with a solid white line and be marked with the bicycle symbol and arrow as shown in **Figure 9 – 2 Detail of Bicycle Lane Markings**. The dimensions for each pavement marking is 72” long, separated by 72”.

The recommended placement of bicycle lane markings is:

1. At the beginning of a bicycle lane, on the far side of major intersections, and prior to and within the bicycle lane between a through lane and turn lane.
2. Along the roadway as needed to provide a maximum spacing of 1,320 for posted speeds less than or equal to 45 mph, 2,640 feet for a posted speed of 50 mph or greater.

Figure 9-2 Detail of Bicycle Lane Markings



If used, bike lane signs and plaques should be placed in advance of the upstream end of the bicycle lane, at the downstream end of the bicycle lane, and at periodic intervals based upon prevailing speed of bicycle and other traffic, block length, and distances from adjacent

intersections, and other considerations. They should only be used in conjunction with marked bicycle lanes. Bike lane signs are not required.

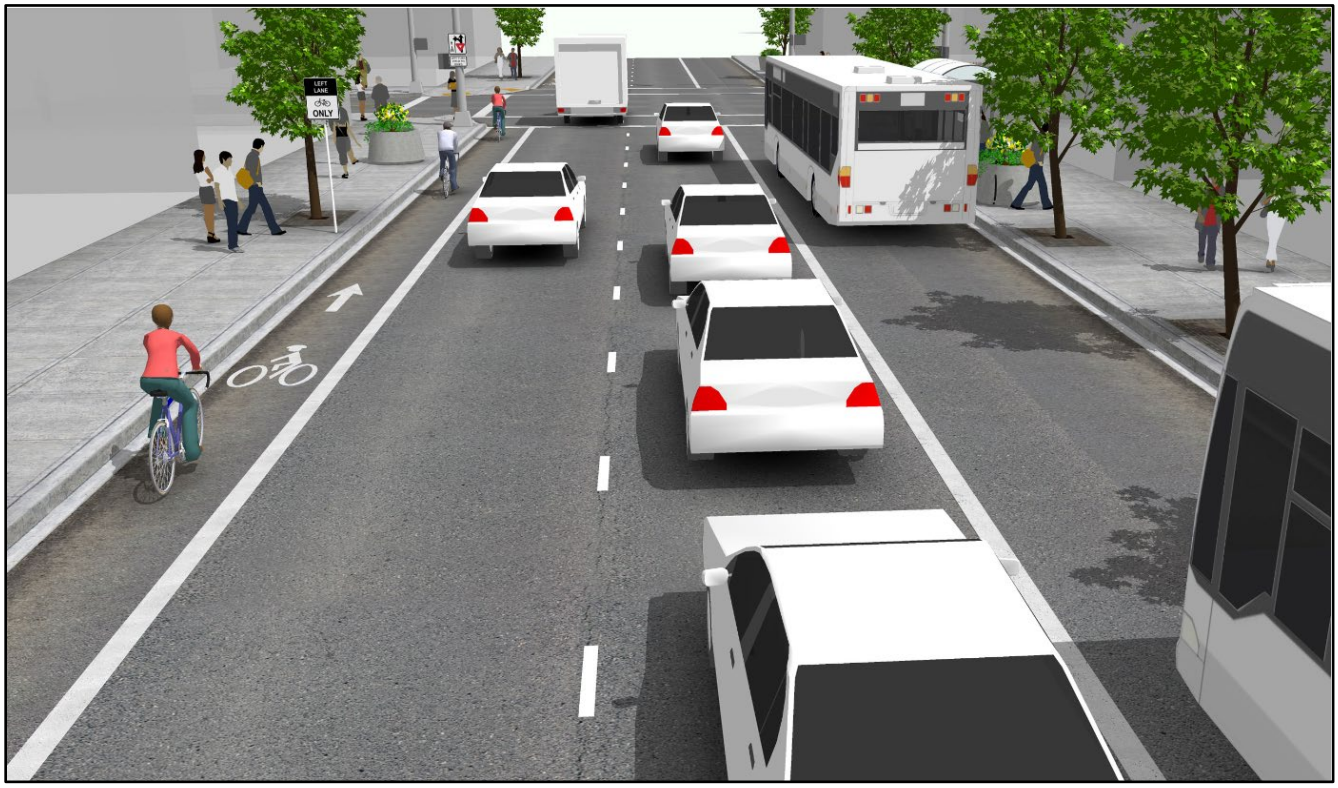
Figure 9-3 Bicycle Lanes

Source: NACTO Urban Bikeway Design Guide, National Association of City Transportation Officials

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. For new construction, reconstruction, and traffic operations projects, where bicycle lanes are provided between the through lane and right turn lane, bus bay or parking lane they shall be a minimum of 5 feet wide. For bicycle lanes adjacent to parking lanes, if the parking volume is substantial or the turnover is high a width of 6-7 feet is desirable to avoid opening vehicle doors.

On one-way streets, bicycle lanes should generally be placed on the right side of the street. A bicycle lane on the left side of the street can be considered when a bicycle lane on the left will substantially decrease the number of conflicts, such as those caused by frequent bus traffic, heavy right turning movements, high-turnover parking lanes, or if there are a significant number of left turning bicyclists. See **Figure 9 – 4 Left Side Bicycle Lanes** for an illustration.

Figure 9-4 Left Side Bicycle Lanes



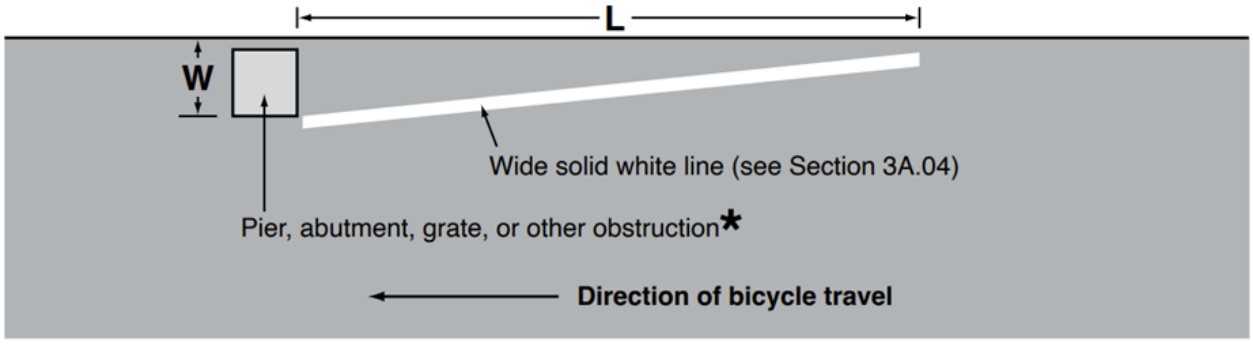
Source: NACTO Urban Bikeway Design Guide, National Association of City Transportation Officials

Bicycle lanes shall not be provided in the circulatory roadway of an unsignalized circular intersection that includes conflicts at entry or exit points except as provided in ***MUTCD Section 9E.05 Paragraph 4*** which permits separated bicycle lanes in circular intersections. Further guidance on bicycle lane transitions is provided in the ***MUTCD***. ~~Bicycle lanes shall not be provided on the circular roadway of a roundabout, and shall be transitioned prior to the roundabout in accordance with the .~~

Existing drainage inlets, grates and utility covers shall be evaluated as to whether they present an obstruction to bicyclists, and should be relocated out of the cyclist's path of travel. Drainage inlets, grates and utility covers to remain should be adjusted to be flush with the adjacent pavement surface, utilize a grate recommended for bicycle travel, and may be marked as an obstruction.

Advance warning of an inlet or other obstruction may be provided as shown in ***Part 9*** of the ***MUTCD*** ~~***MUTCD, Part 9***~~. Additional information on appropriate drainage inlets in or near pedestrian and bicycle facilities can be found in the FDOT's ***Drainage Manual, Section 3.7.4 Inlet Placement, (2022)***.

Figure 9-5 Example of Obstruction Pavement Markings



B – Obstruction at the edge of the path or roadway

L = WS, where W is the offset in feet and S is bicycle approach speed in mph

*Provide an additional foot of offset for a raised obstruction and use the formula L = (W+1) S for the taper length

Traffic signals should be responsive to bicyclists. Regular maintenance of bicycle lanes should be a priority, since bicyclists are unable to use a lane with potholes, debris, or broken glass.

In conjunction with resurfacing projects, the roadway width shall be redistributed when practical to provide for bicycle facilities. The types of bicycle facilities considered for implementation include buffered bicycle lanes, bicycle lanes, wide outside lanes, and shared lanes. Lane widths on urban multilane roadways and two-lane curb and gutter roadways may be reduced as shown in **Table 9 – 1 Lane Widths** to provide for bicycle facilities.

Table 9-1 Lane Widths Urban Multilane or Two-Lane with Curb and Gutter

Design Year AADT	Design Speed (mph)	Minimum Thru Lane (ft.)	Minimum Turn Lane (ft.)	Minimum Parking Lane (ft.)
ALL	ALL	10[1]	9[2]	7[3]

Notes:

1. 11 ft. where either of the following conditions exist:
   a. Trucks are >10% of Design Year Traffic.
   b. Design Speed is 40 mph or greater.
2. 10 ft. for 2 Way Left Turn Lanes.
3. A minimum width of 7 ft. measured from face of curb may be left in place. Otherwise provide 8 ft. minimum, measured from face of curb.

Various configurations of bicycle lanes on curb and gutter and flush shoulder typical sections are illustrated in **Figures 9 – 6** to **9 – 23**.

Figure 9-6 Bicycle Lane Markings

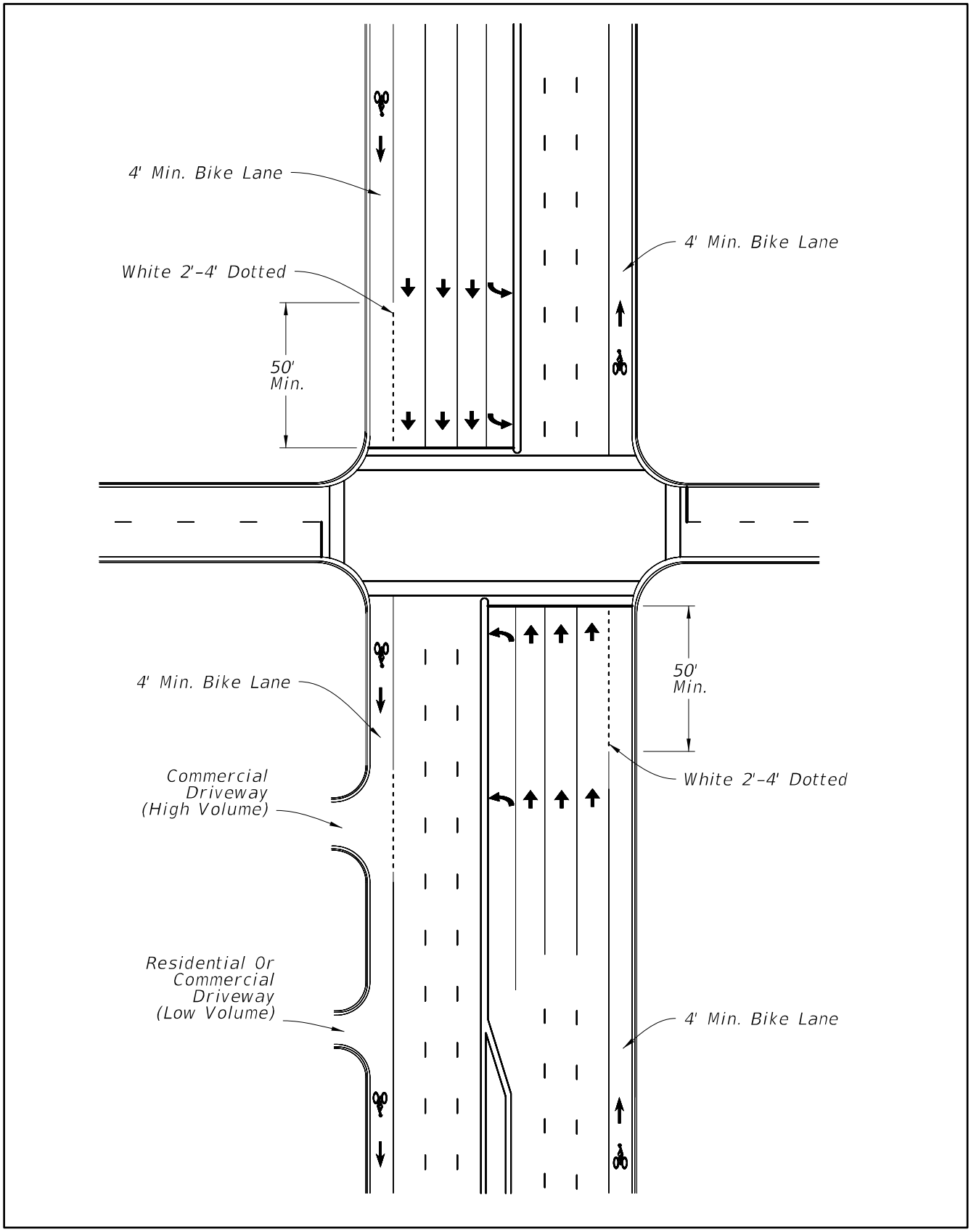


Figure 9-7 Bicycle Lanes with Separate Right Turn Lane (Curb and Gutter)

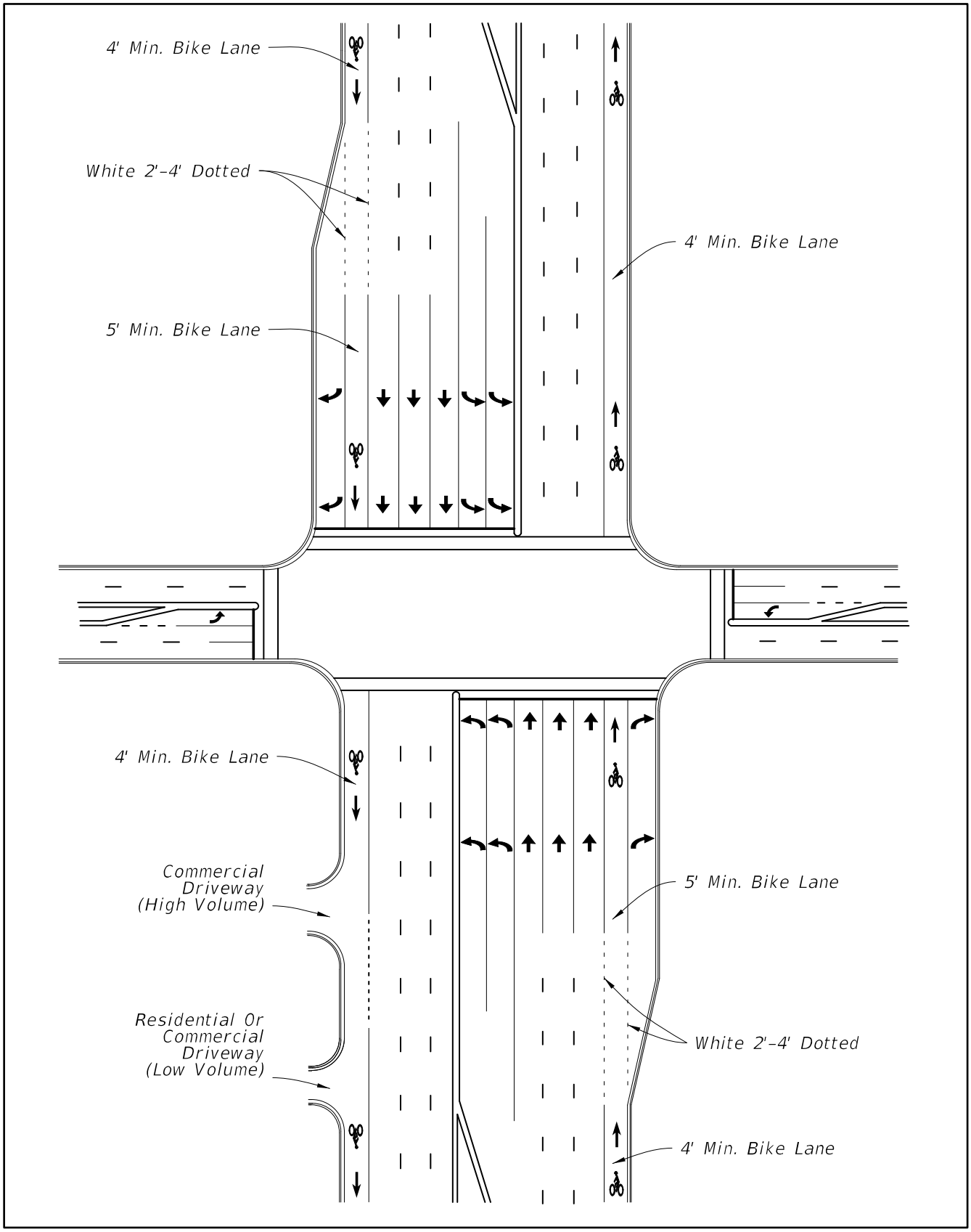


Figure 9-8 Bicycle Lanes with On Street Parking, No Right Turn Lane (Curb and Gutter)

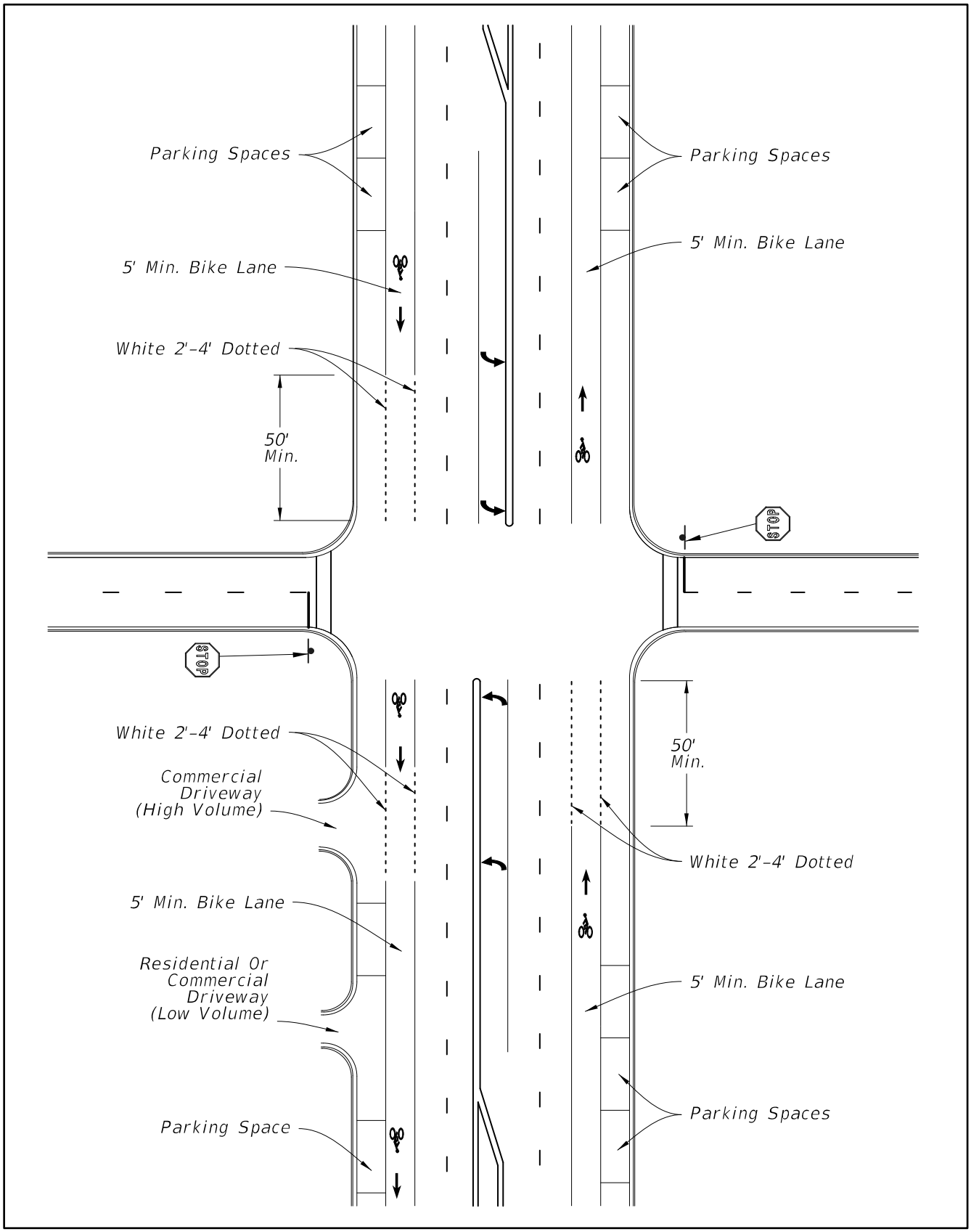


Figure 9-9 Bicycle Lane with Right Turn Drop Lane (Curb and Gutter)

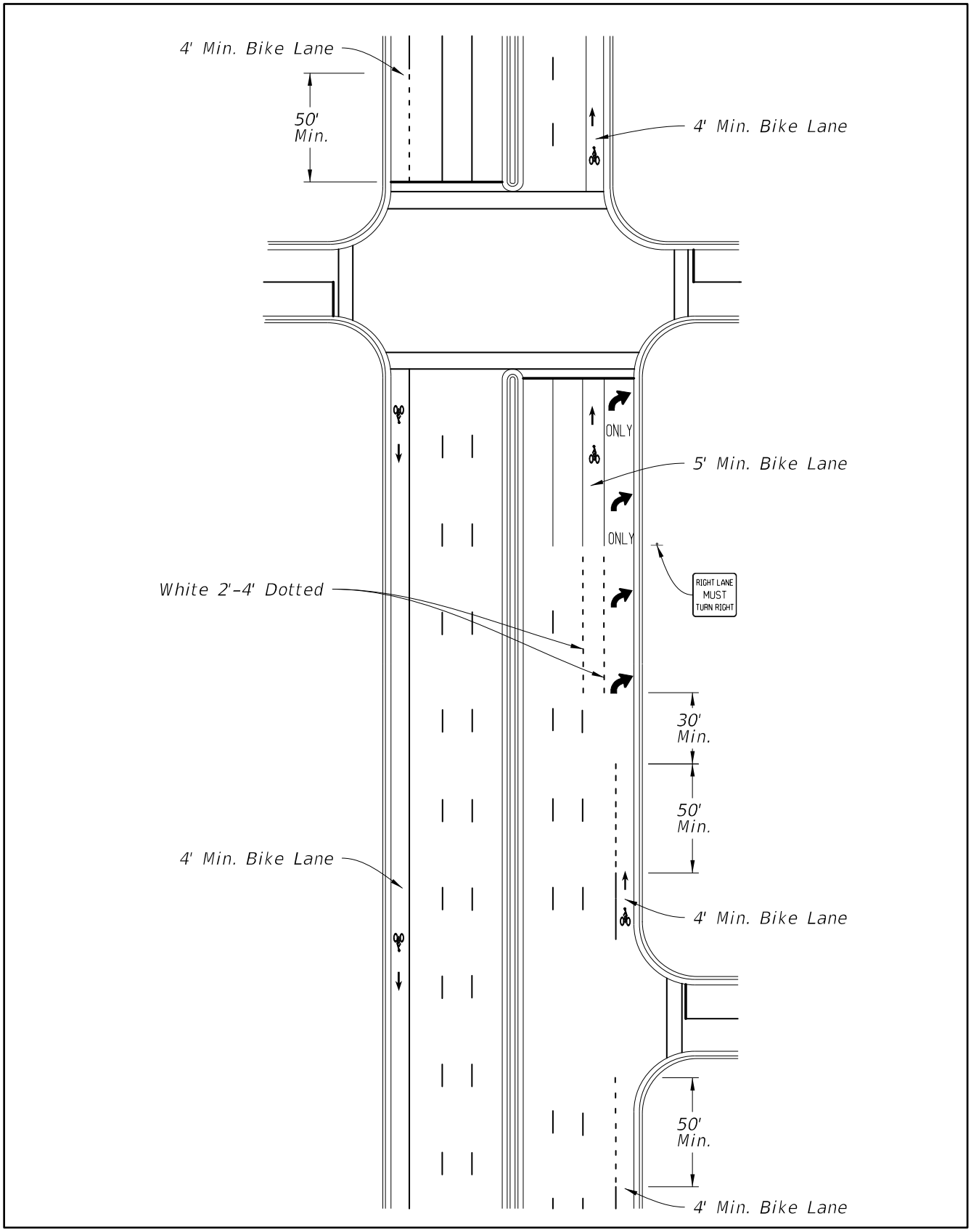


Figure 9-10 "Tee" Intersection with Bicycle Lane, Separate Right and Left Turn Lanes (Curb and Gutter)

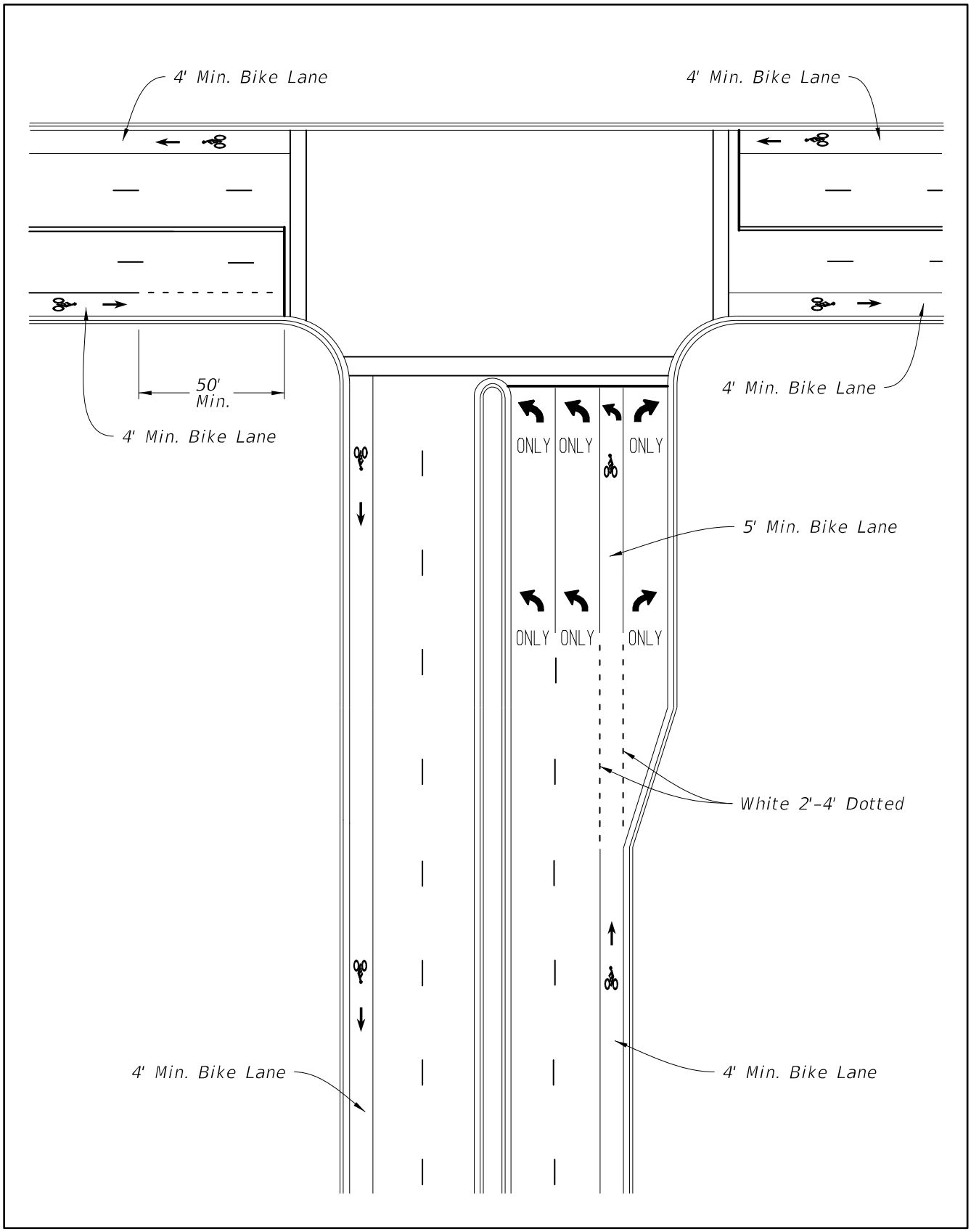


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Figure 9-11 "Tee" Intersection with Bicycle Lanes, Left Turn Lane and Right Turn Drop Lane (Curb and Gutter)

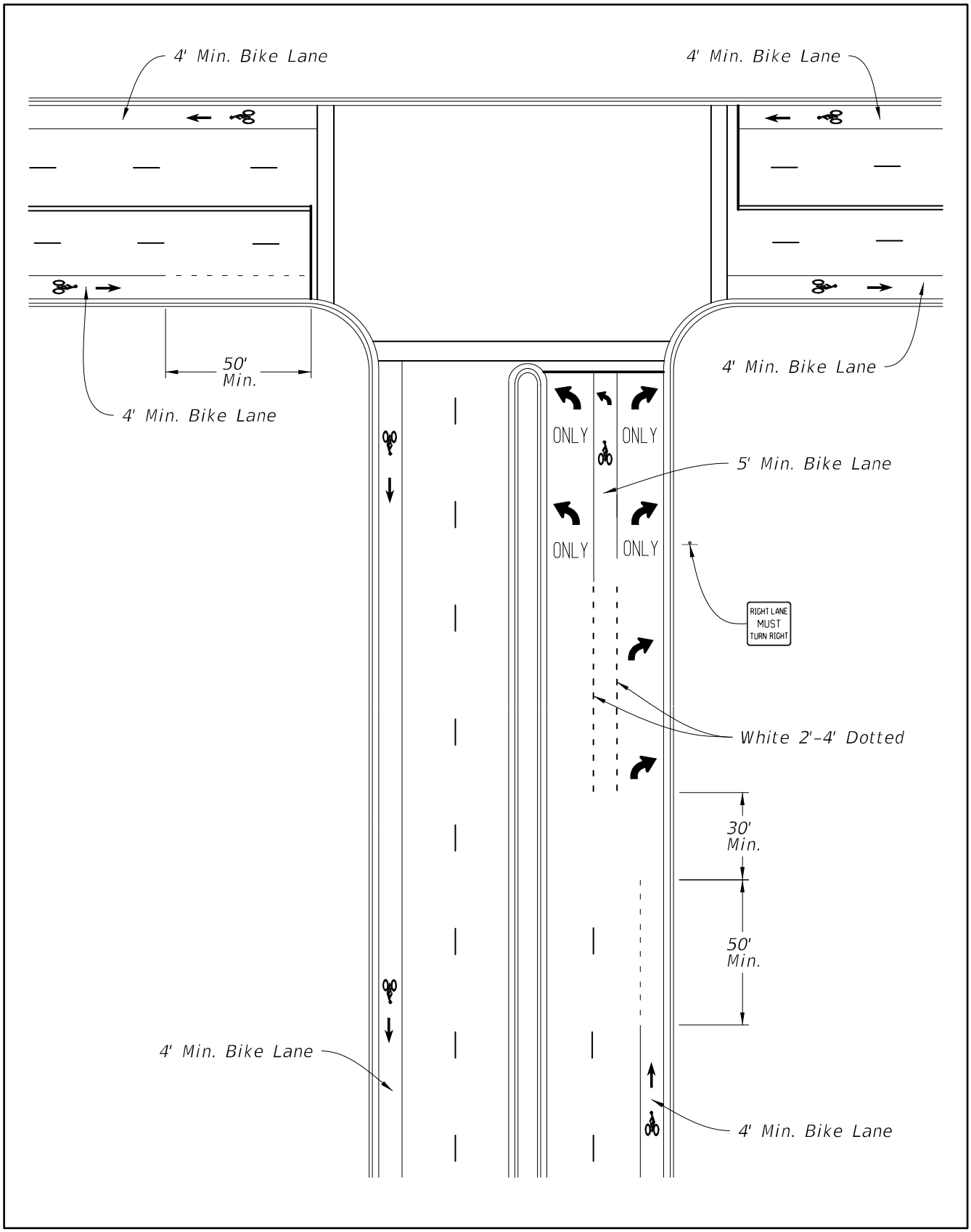


Figure 9-12 Bicycle Lanes with No Right Turn Lane (Flush Shoulder)

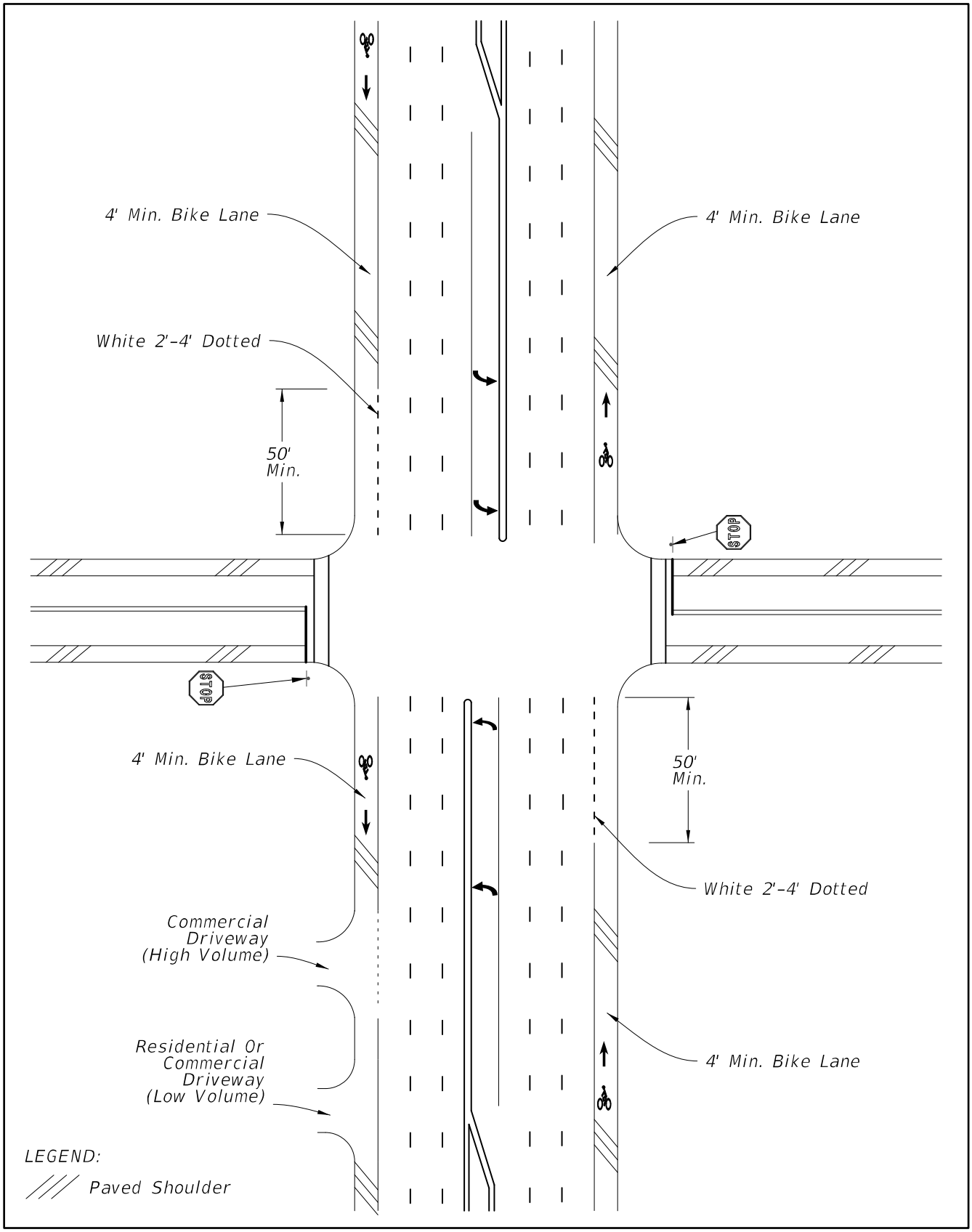


Figure 9-13 Bicycle Lane with Separate Right Turn Lane (Flush Shoulder)

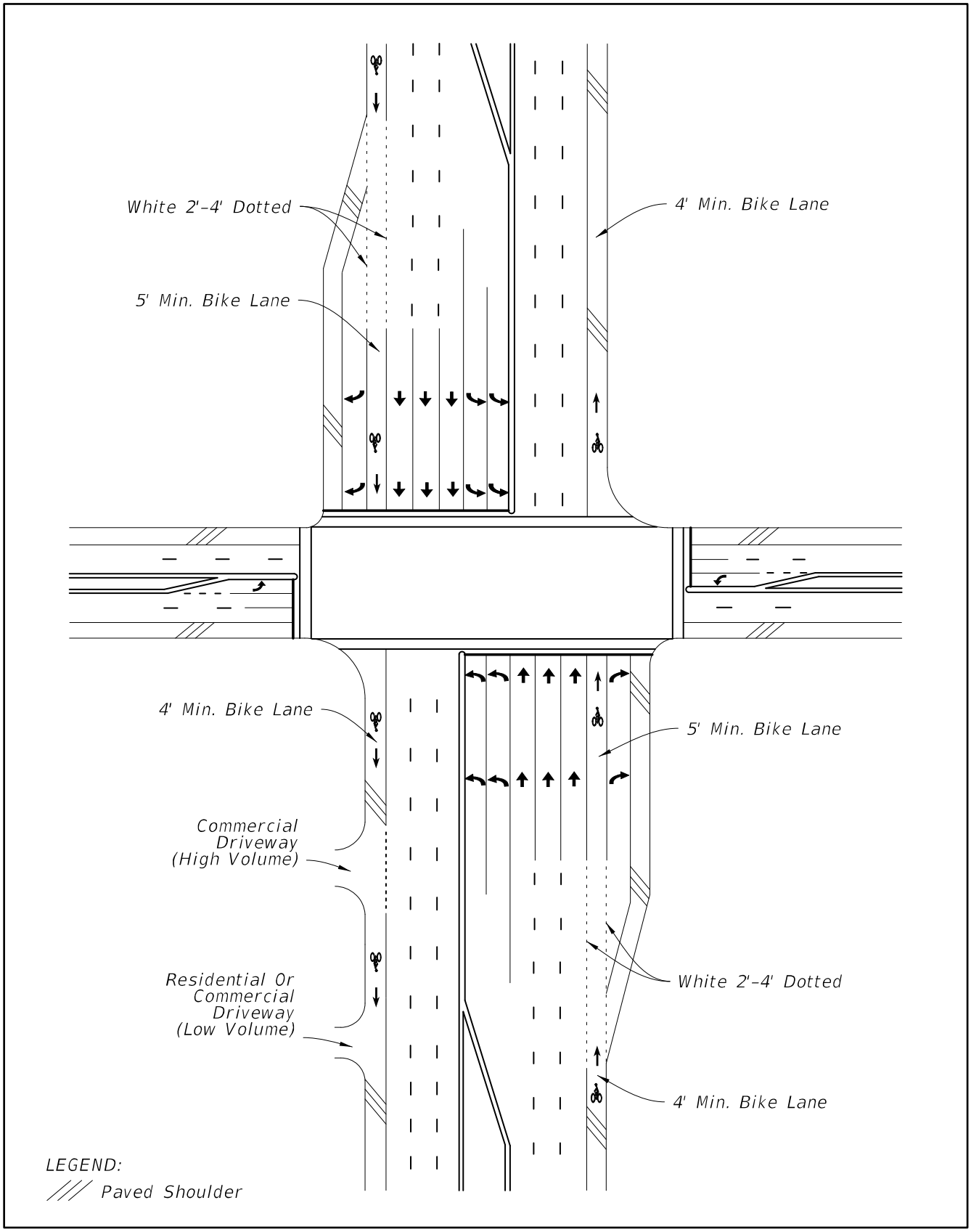


Figure 9-14 Bicycle Lanes with Bus Bay, No Right Turn Lane (Curb and Gutter)

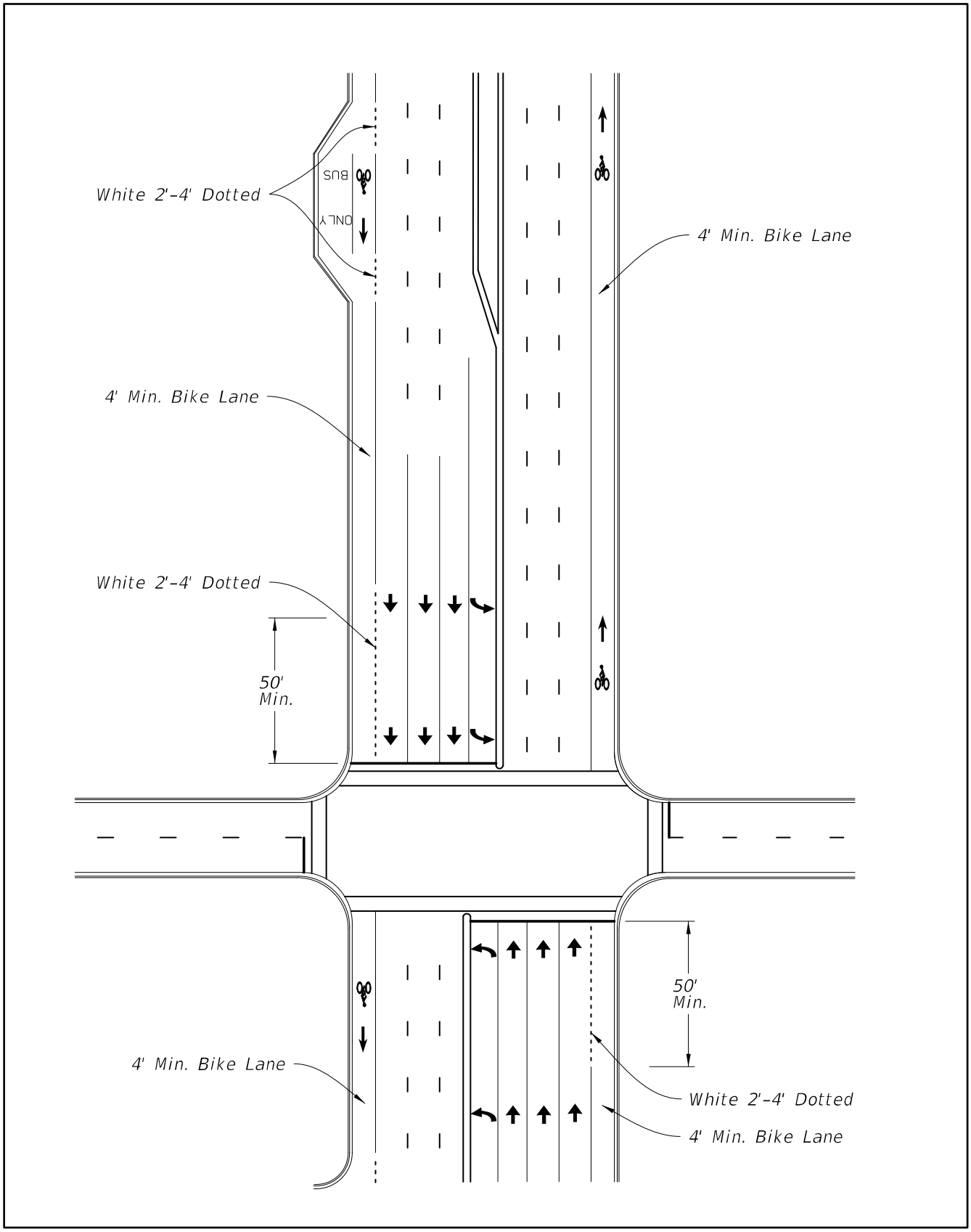
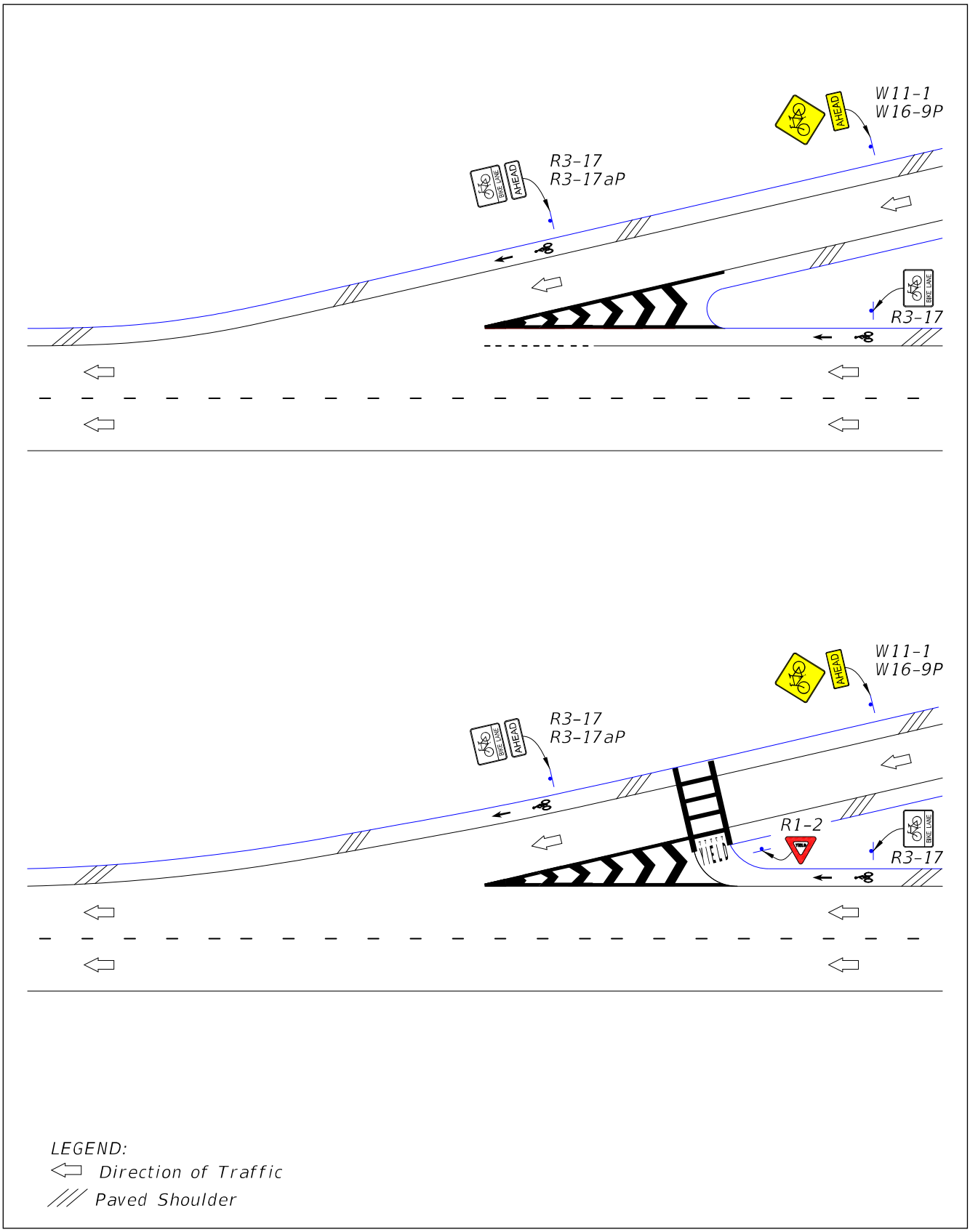


Figure 9-15 Bicycle Lanes on Interchange Ramps (Flush Shoulder)



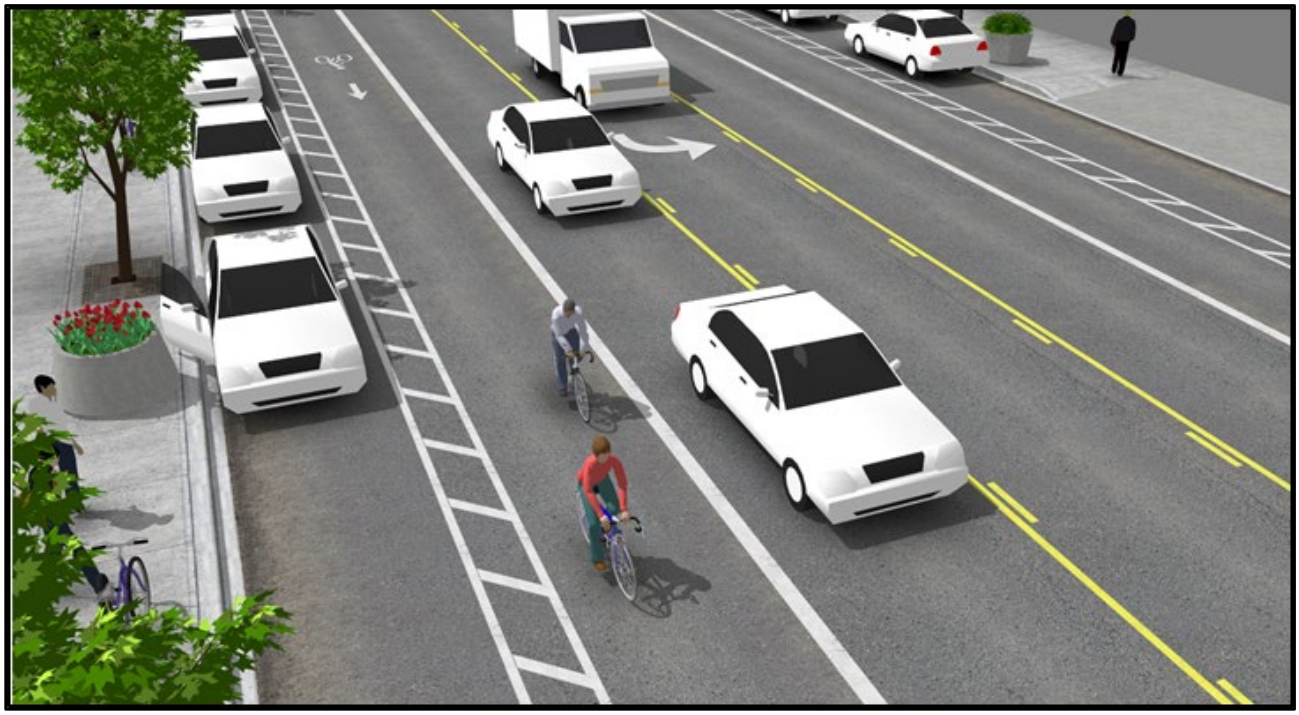
9.2.2 ~~B.2~~ Buffered Bicycle Lanes

Buffered bicycle lanes are bicycle lanes separated from either the adjacent travel lane or parking lane with a marked buffer area. They provide greater shy distance between motor vehicles and bicyclists and encourage bicyclists to ride outside of the “door zone” of parked cars. Typical applications include streets with high travel speeds, high traffic volumes, high amounts of truck or transit traffic, or where there are underutilized travel lanes or extra pavement width.

The bicycle lane symbol and arrow markings shall be used, along with longitudinal lines to create the buffer. ~~There are several options for marking the buffer area, including a wide solid double line (crossing prohibited), wide solid single line (crossing discouraged) or wide dotted single line (crossing permitted to make right hand turn).~~ Where the buffer space is wider than 2 ~~4~~ feet and crossing the buffer is prohibited, chevron markings should be placed in the buffer area. ***MUTCD Chapter 9E.06*** Buffer-Separated Bicycle Lanes provide additional information on the striping of buffered bicycle lanes.

At an intersection approach, the buffer striping should transition to a wide dotted stripe using a 2/4 skip pattern. The transition should begin 150 feet in advance of an intersection to provide sufficient distance for an automobile or truck to merge into the bicycle lane before turning right. **Figures 9 – 16, 17 and 18** provide examples of buffered bicycle lanes. ***MUTCD Chapter 9E.06 Buffer-Separated Bicycle Lanes*** ~~***Chapter 3D. Markings for Preferential Lanes of the MUTCD***~~ provide~~s~~ additional information on the striping of buffered bicycle lanes.

Figure 9-16 Buffered Bicycle Lane Adjacent to On-Street Parking



Source: NACTO Urban Bikeway Design Guide, National Association of City Transportation Officials

Figure 9-17 Buffered Bicycle Lane Markings

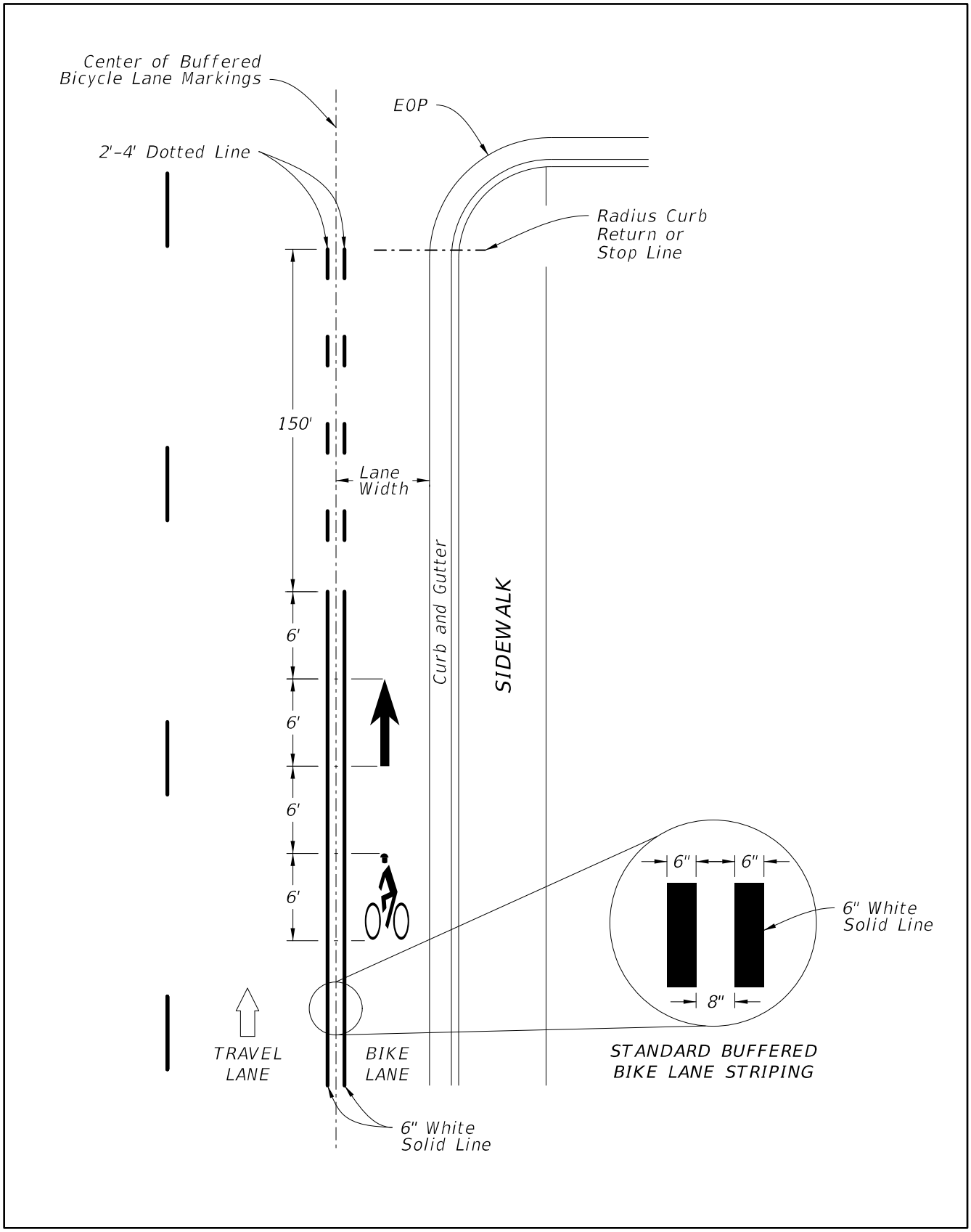
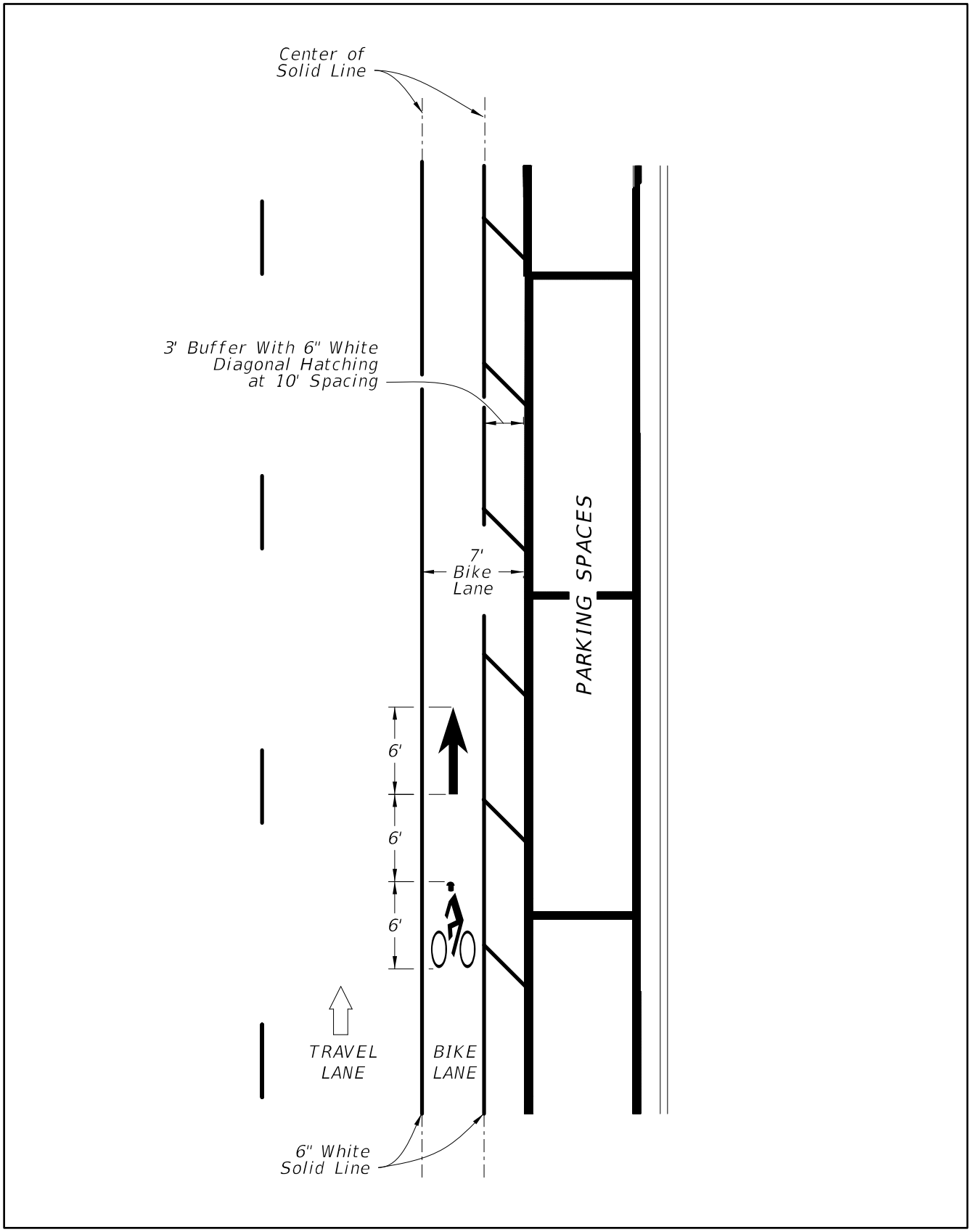


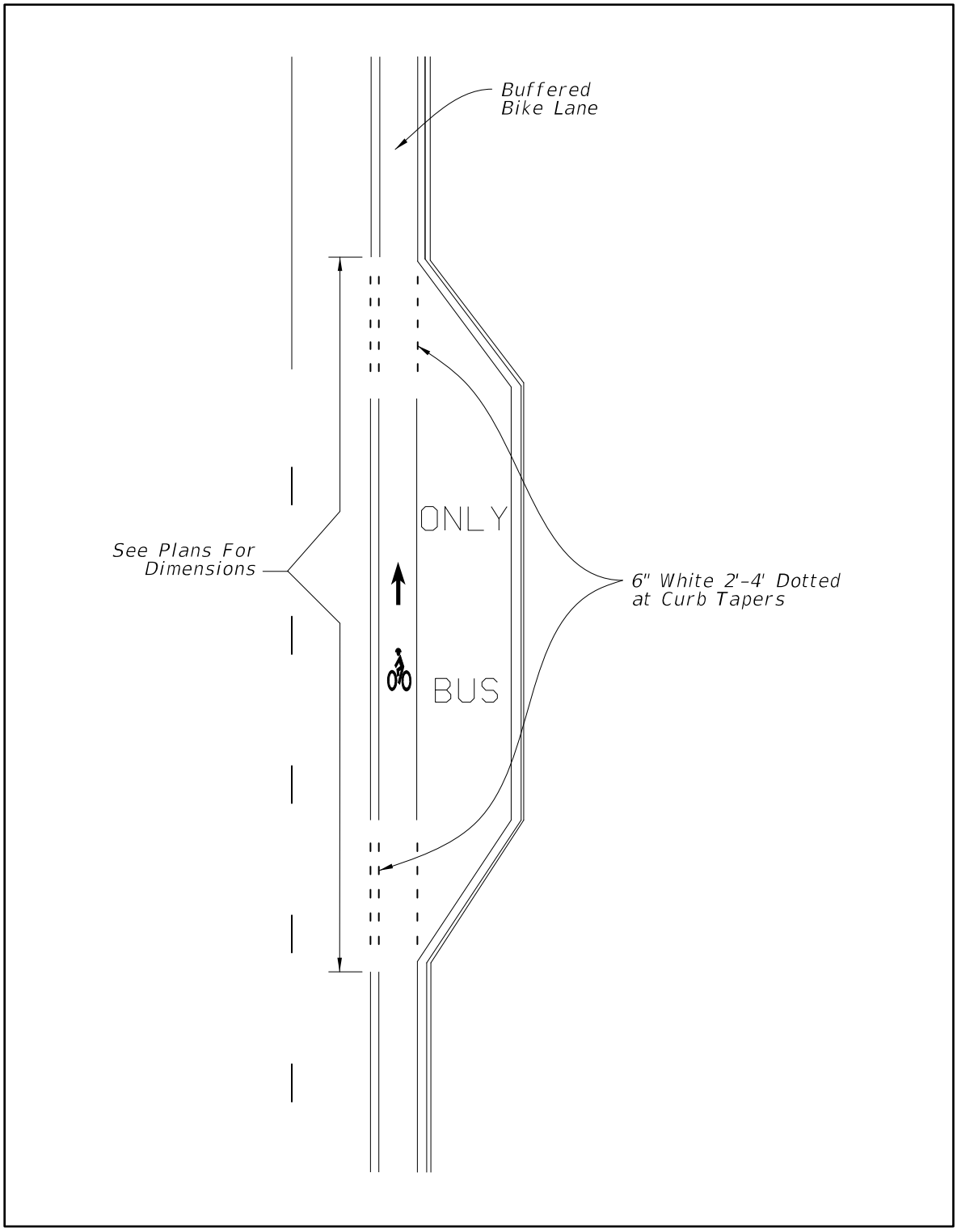
Figure 9-18 Buffered Bicycle Lane Markings with On-Street Parking



9.2.3 ~~B.3~~ Bicycle Lane with Bus Bay

When a bus bay is provided on roadways with bicycle lanes, the bicycle lane shall be continued adjacent to the bus bay. **Figure 9 – 19 Buffered Bicycle Lane with Bus Bay Marking** provides an example of a buffered bicycle lane with a bus bay.

Figure 9-19 Buffered Bicycle Lane with Bus Bay Marking (Curb and Gutter)



9.2.4 ~~B.4~~ Separated Bicycle Lanes

Separated bicycle lanes use a combination of horizontal separation (buffer distance) and vertical separation (e.g., flex posts, parked cars, medians, traffic separators, or curbs) to separate people bicycling from motor vehicle traffic. The combination of lateral separation distance and vertical separation elements (such as flexible delineators, curbs or height differences, or vehicle parking) can improve the comfort level of bicycling. They may be designed to support either one-way or two-way traffic. The amount of separation tends to increase as adjacent motor vehicle traffic volumes and speed increase.

Required features of a separated bicycle lane include:

- Is a preferential use lane, signed and marked as required by the ***MUTCD Chapter 9E.07 Separated Bicycle Lanes*** ~~***MUTCD***~~ provides additional information on bicycle lane separation. Include the bicycle lane symbol and arrow markings at the beginning of the lane and at periodic intervals.
- A horizontal separation is required, vertical elements may be added when required or desired.
- Types of vertical elements include changes in elevation, tubular markers, or similar type of lane delineator, raised medians, traffic separators, on-street parking, and rigid barriers (with appropriate end treatments). For posted speeds of 40 to 45 mph, raised medians, traffic separators or rigid barriers are required.
- The widths of separation are:
    1. A minimum of 3 feet separation is required if adjacent to on-street parking.
    2. If adjacent to travel lanes:
        i) Posted speeds of 35 mph or less – a 6 feet minimum separation is preferred, 3 feet minimum (unless using tubular markers or similar type of lane delineator or raised median; then 2 feet minimum).
        ii) Posted speeds of 40 to 45 mph – an 8 feet minimum separation is preferred, 3 feet minimum.
- For one-way separated bicycle lanes, 7 feet is the preferred width, 6 feet is the minimum allowed. For two-way separated bicycle lanes, 12 feet is the preferred width, 10 feet is the minimum allowed.
- Separation is maintained between bicycle and motorized vehicle traffic through intersections.

- Conflict points are minimal and mitigated through pavement markings, color or other treatment.
- For additional information on planning and designing separated bike lanes, please see ***FHWA's Separated Bike Lane Planning and Design Guide***.

9.1.1 Green Colored Bicycle Lanes

~~The Federal Highway Administration (FHWA) has issued an ***Interim Approval*** for the use of green colored pavement in bicycle lanes and in extensions of bicycle lanes through intersections and other traffic conflict areas.~~ Colored pavements shall not replace or be used in lieu of required markings for bike lanes as defined in the ***MUTCD***, but shall only supplement such markings. Traffic conflict areas include where the:

- bicycle lane crosses a right turn lane,
- traffic in a right turn lane crosses a bike lane, or
- bicycle lane is adjacent to a dedicated bus bay.

~~The Interim Approval may be found at the following website and provides further information on how to submit a written request to use green colored pavement:~~

~~***http://mutcd.fhwa.dot.gov/res-interim_approvals.htm***~~

The effectiveness of green colored pavement is maximized if the treatment is used only where the path of bicyclists and other road users cross and yielding must occur. ~~Because colored pavements are addressed in the 2009 MUTCD, they are a traffic control device whose need should be demonstrated before they are used.~~ A need for this treatment can be demonstrated by either of the following:

1. A history of 3 or more motor vehicle-bicycle crashes exists at or adjacent to the traffic conflict area over the most recent three-year period, or
2. A government agency has observed and documented conflicts (failure of the motor vehicle to yield to the bicyclist) between cyclists and motor vehicles at an average rate of two per peak hour. The documentation for conflicts shall include observations from a minimum of two separate data collection periods, conducted on different days in a one month period, and include at least one weekday and one weekend count period during peak bicycle travel times. Each period should be at least 2 hours in duration. Peak times vary by region and surrounding land use, but are typically:

- Weekday, 11:00 AM to 1:00 PM

- Weekday, 5:00 PM to 7:00 PM
- Saturday, 8:00 AM to 2:00 PM

When used in conjunction with white skip lines, such as when extending a bike lane across a right turn lane or access to a bus bay, the transverse colored marking shall match the 2'-4' white skip line pattern of the bike lane extension. The green colored pavement should begin as a solid pattern 50 feet in advance of the skip striping, match the 2' 4' skip through the conflict area, and then resume the solid color for 50' after the conflict area, unless such an extent is interrupted by a stop bar or an intersection curb radius. Details of each installation and associated pavement markings shall be shown in the plans. **Figures 9 – 20, 21, 22 and 23** illustrate how the green portion of the bicycle lane may be marked.

Materials permitted to color the bike lane green shall be non-reflective and fall within the color parameters defined in the **MUTCD** ~~by FHWA in their interim approval~~. Materials which have been tested to meet these requirements can be found in the FDOT's ***Product Application and Tracking System (PATH)*** which includes products on both the FDOT's ***Approved Product List (APL)***, ***Specification 523, Patterned Pavement*** or the FDOT's ***Innovative Products List (IPL), Dev-714 Green-Colored Pavement Markings***.

Figure 9-20 Green Bicycle Lane with Separate Right Turn Lane

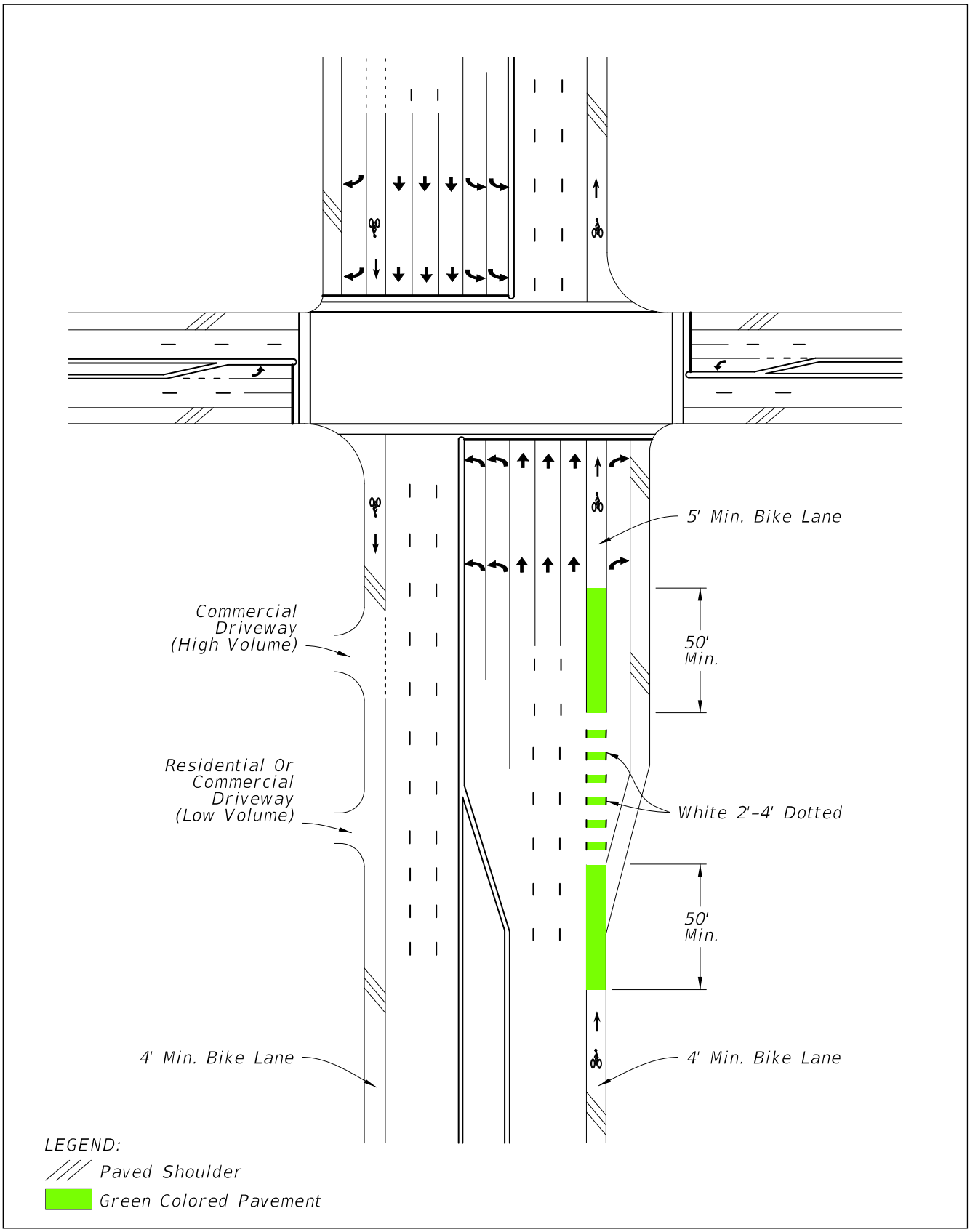


Figure 9-21 Green Bicycle Lane with Right Turn Drop Lane

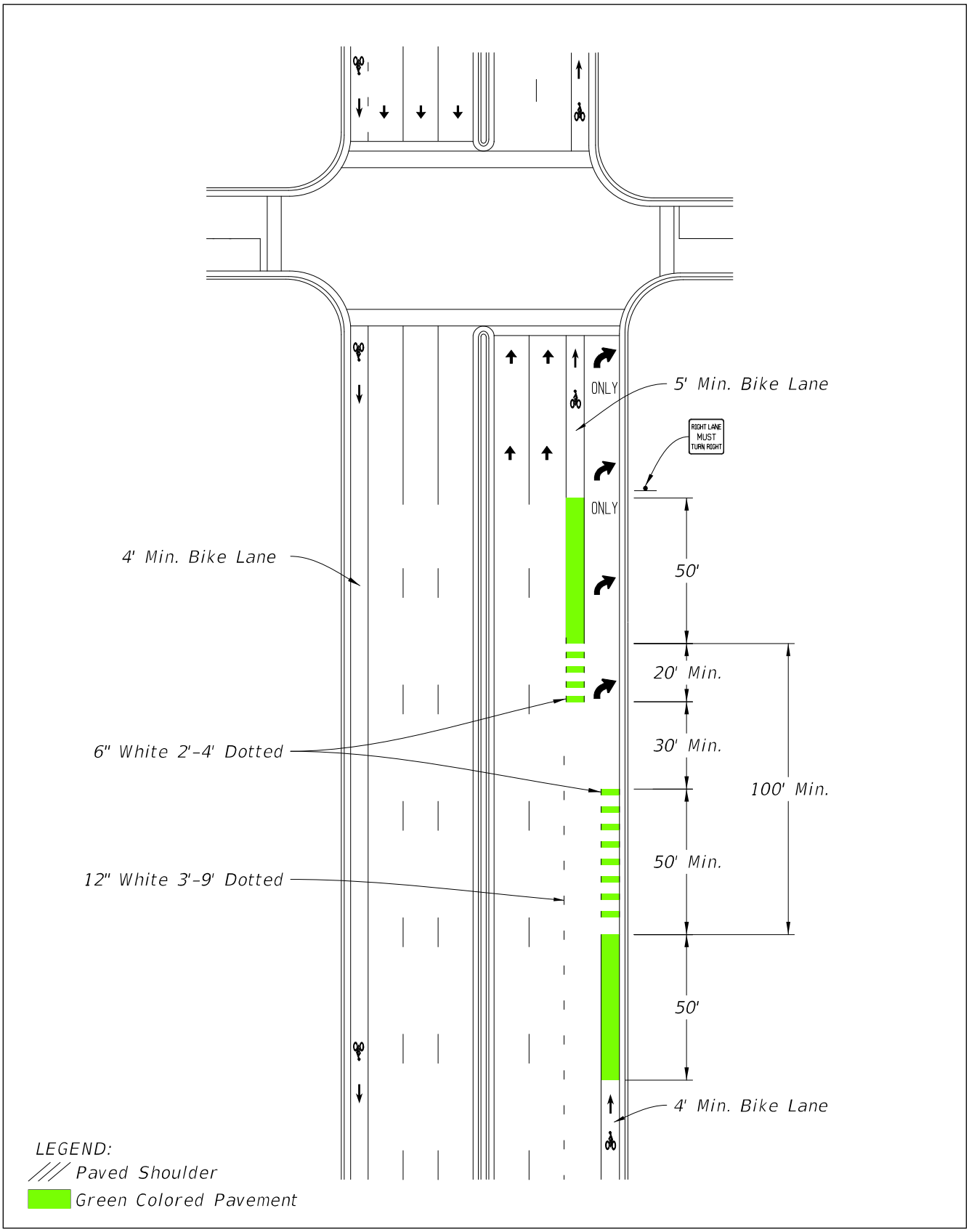
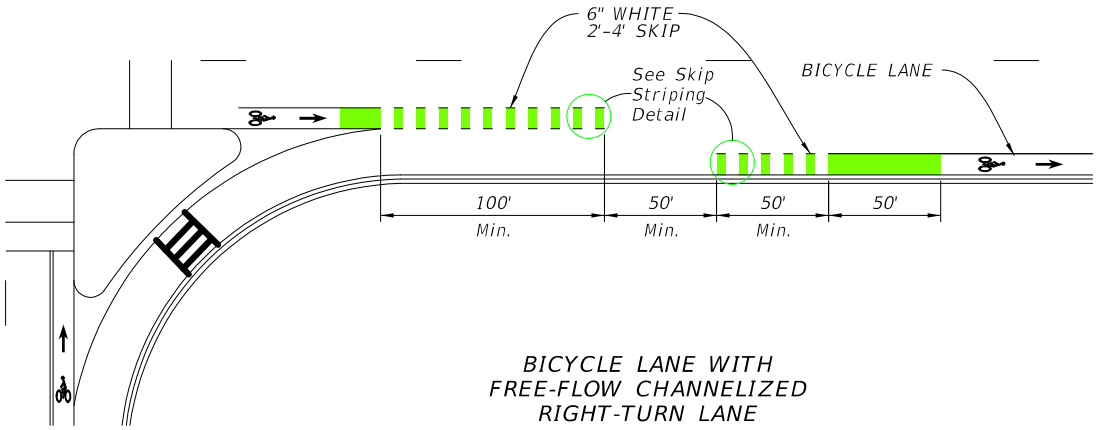
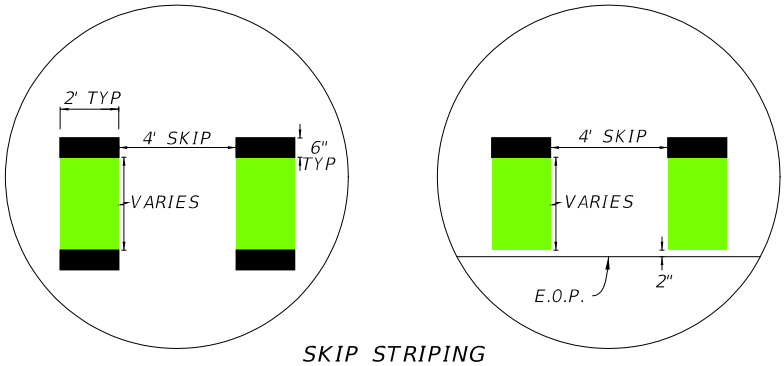


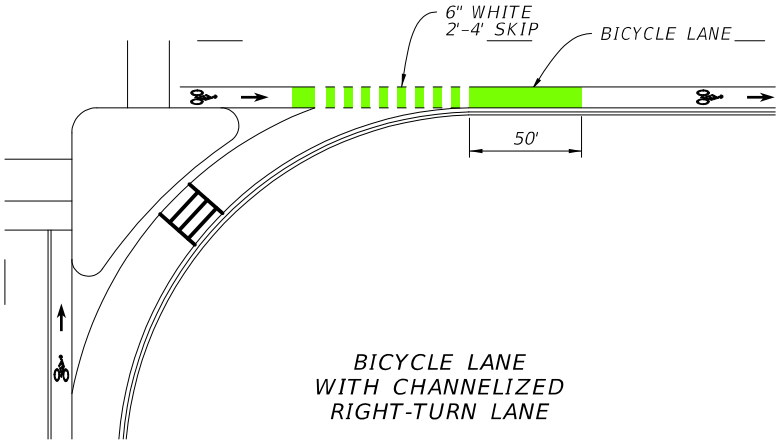
Figure 9-22 Green Bicycle Lane with Channelized Right Turn Lane



BICYCLE LANE WITH
FREE-FLOW CHANNELIZED
RIGHT-TURN LANE



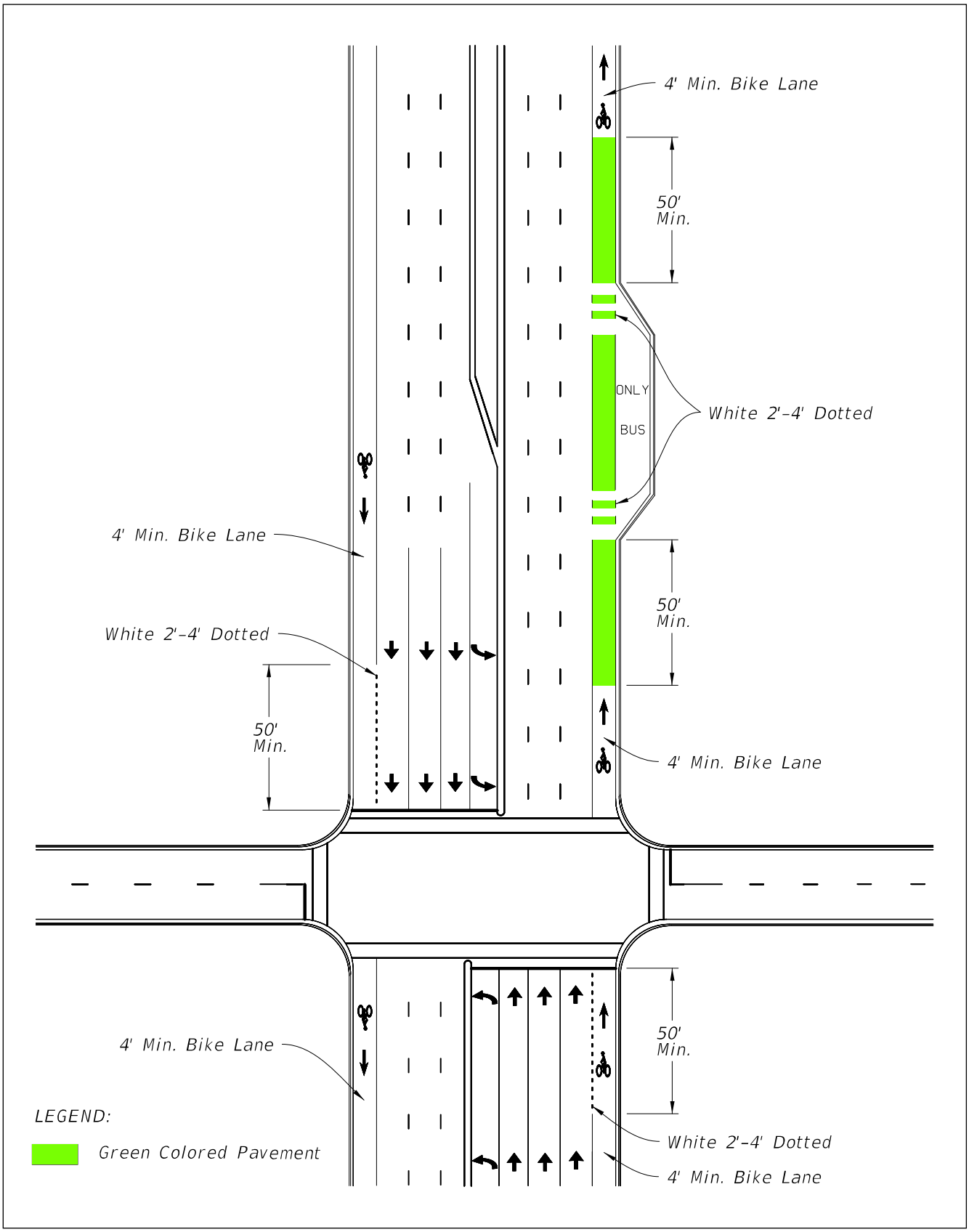
SKIP STRIPING
DETAILS



BICYCLE LANE
WITH CHANNELIZED
RIGHT-TURN LANE

Legend
Green Colored Pavement

Figure 9-23 Green Bicycle Lane with Bus Bay



9.2.6 ~~B.6~~ Paved Shoulders

A paved shoulder is a portion of the roadway which has been delineated by edge line striping. Adding, widening or improving paved shoulders often can be an acceptable way to accommodate bicyclists. However, when a shoulder is intended to serve as a bicycle facility and is adjacent to a curb, guardrail or other roadside barrier, a minimum 5-foot clear width between the traveled way and the face of the barrier is required. Additional shoulder width is desirable if the posted speed exceed 50 mph, or the percentage of trucks, buses, or recreational vehicles is high (>10%).

Ground-in rumble strips should not be included in paved shoulders if a minimum clear width of 4 feet outside of the rumble strip cannot be provided.

9.2.7 ~~B.7~~ Wide Outside Lanes

Wide outside lanes on curbed roadways are through lanes that provide a minimum of 14 feet in width, which allows most motor vehicles to pass cyclists safely within the travel lane. Bicycle lanes are preferred for arterial and collector roadways, however, in some conditions, such as resurfacing projects, wide outside lanes may be the only practical option for a bicycle facility.

9.2.8 ~~B.8~~ Shared Lane Markings

The shared lane marking is an optional pavement marking for roadways where bicyclists and motor vehicles are intended to share the lane and no bicycle lane or paved shoulder exists or is feasible. Shared lane markings should be limited to roadways with a posted speed of 35 mph or less. They are not intended to be placed on every roadway without bicycle facilities or on shared use paths.

Shared lane markings provide guidance to cyclists on their lateral positioning, especially on roadways with on-street parking or lanes that are too narrow to share side by side with a motor vehicle. They also help to discourage wrong way riding and encourage safer passing of bicyclists by motorists. Shared lane markings may be used to identify an alternate route as part of an approved temporary traffic control plan. **Figure 9 – 24** provides the dimensions for shared lane markings.

Shared lane markings should be placed as follows:

- If used on a roadway without on-street parking that has an outside travel lane that is 14 feet wide or less, the Shared Lane Markings should be centered in the travel lane (**Figure 9 – 25**).

- If used on a roadway with on-street parking, the Shared Lane Markings should be centered in the travel lane (**Figure 9 – 26**).
- Shared Lane Markings should be placed immediately after an intersection and spaced at intervals not greater than 250 feet thereafter.

Figure 9-24 Shared Lane Marking

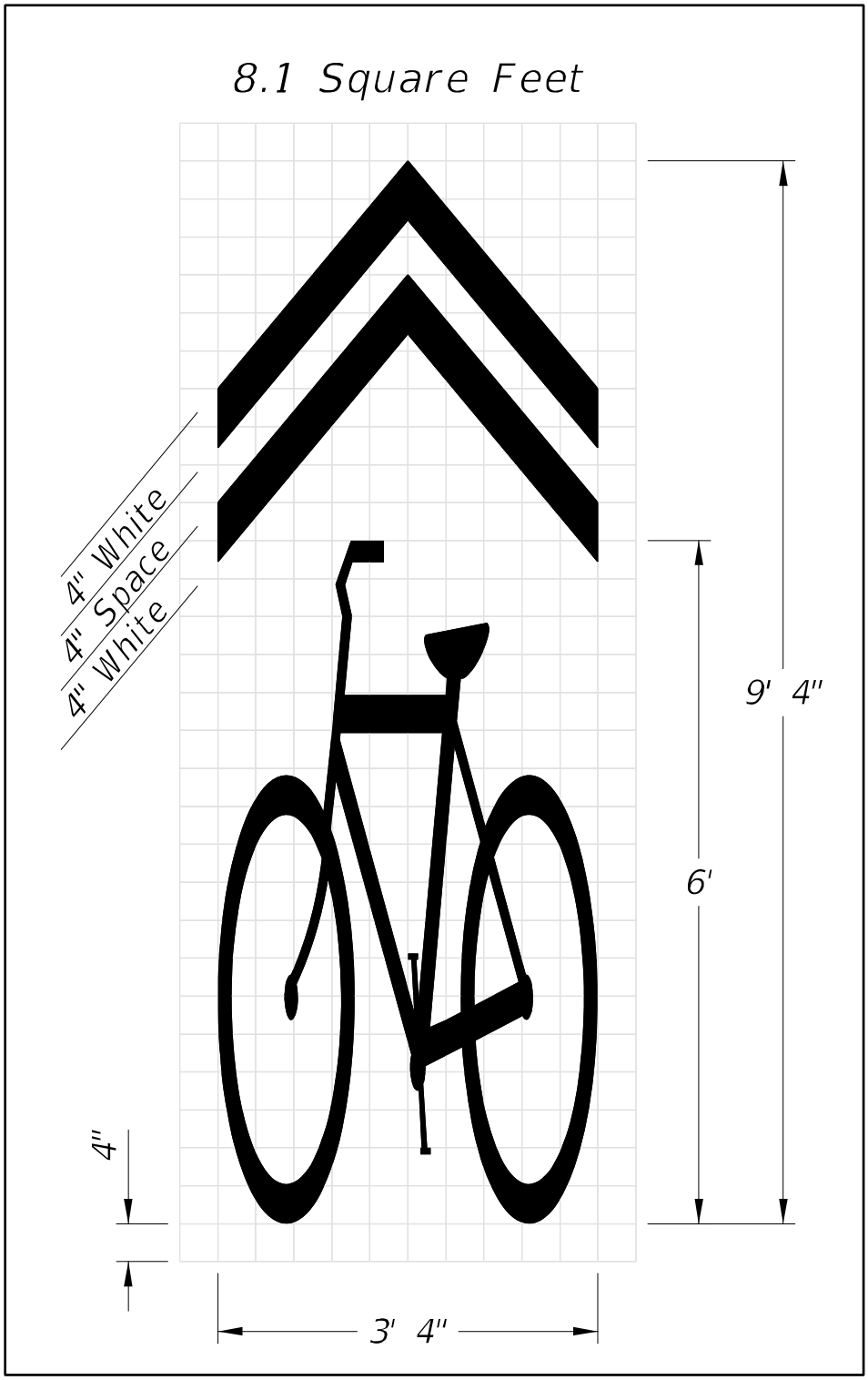


Figure 9-25 Shared Lane Marking Placement

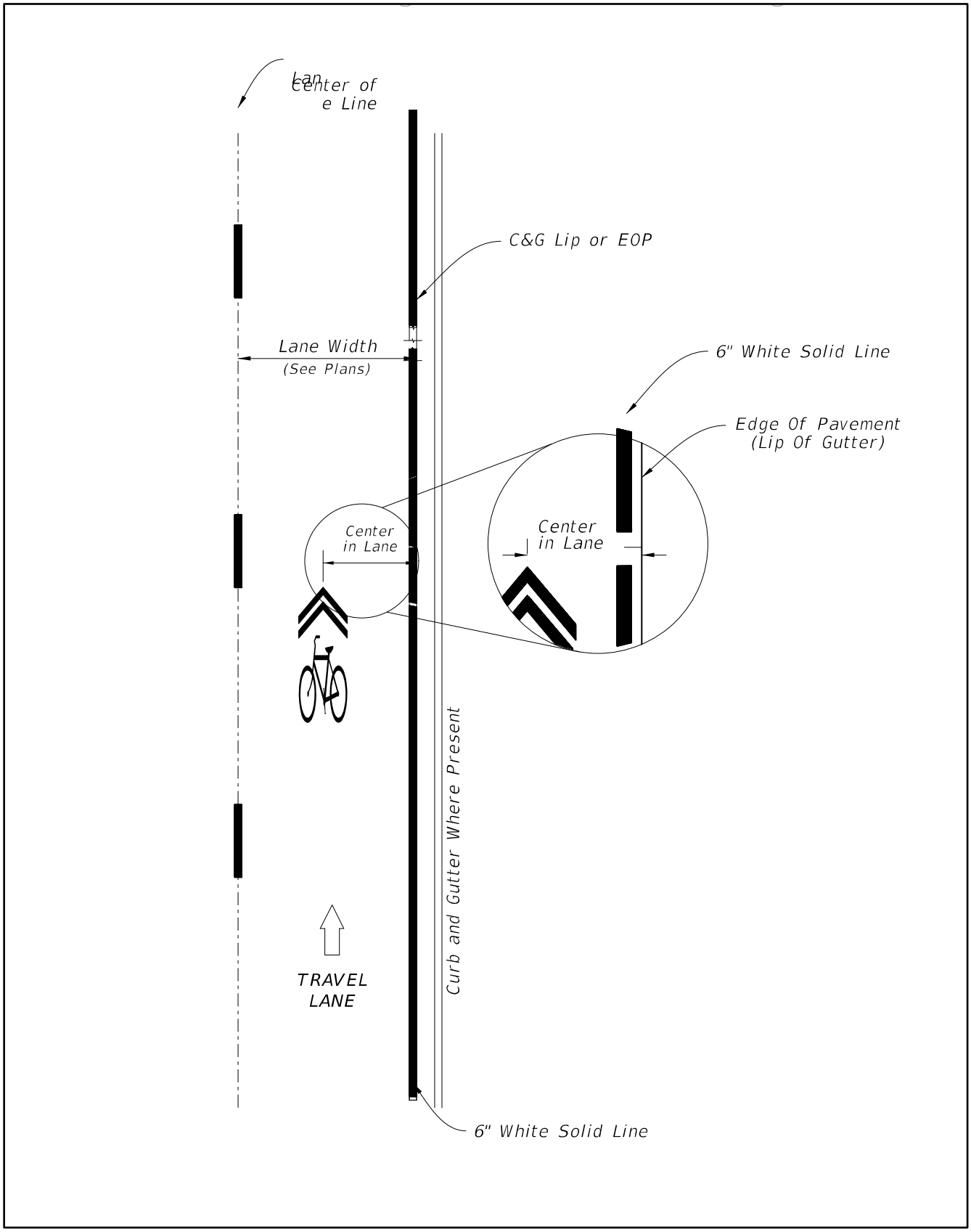
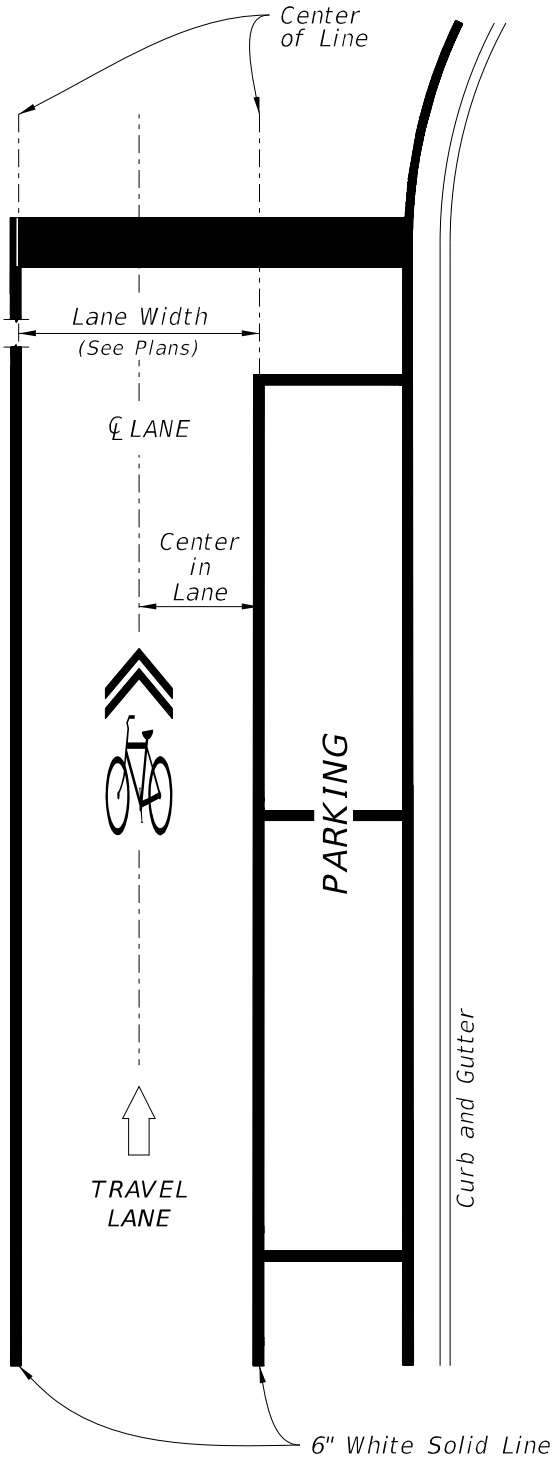


Figure 9-26 Shared Lane Marking Placement (With On-Street Parking)



9.2.9 ~~B.9~~ Bicycles Allowed ~~May~~ Use of Full Lane Sign

The Bicycles ~~May~~ Allowed Use of Full Lane sign (R4-20 ~~R4-11~~) may be used on roadways where no bicycle lanes or adjacent shoulders useable by bicyclists are present and where travel lanes are less than 14' wide. The **MUTCD** provides additional information on the use of the sign.

9.3 ~~C~~ Shared Use Paths

Shared use paths are paved facilities physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right of way or an independent right of way, with minimal cross flow by motor vehicles. They are used by bicyclists, pedestrians, runners, skaters, and in some cases equestrians. The bicycle's operating characteristics will govern the design of shared use paths, along with requirements for accessibility since they also serve as pedestrian facilities.

In addition to the design criteria provided in this manual, the following documents provide criteria and guidance in the design of shared use paths:

- ***United States Department of Transportation ADA Standards for Transportation Facilities (2006)*** and as required by ***49 C.F.R 37.41 or 37.43***.
- ***United States Department of Justice ADA Standards (2010)*** as required by ***28 C.F.R 35 (title II) and 36 (title III)***.
- ***Public Rights-of-Way Accessibility Guidelines (PROWAG)*** provides additional information for the design of pedestrian facilities.

The ***2020 Florida Building Code, Accessibility, 7th Edition*** as required by ***61G20-4.002*** contains ADA requirements for accessibility to sites, facilities, buildings, and elements by people with disabilities.

Shared use paths serve a variety of purposes. They can provide a school age child, a recreational cyclist, or a person with a disability an alternative to busy roadways. Shared use paths can be located along former rail corridors, the banks of rivers or canals, and through parks and forests. Shared use paths can also provide access to areas otherwise served only by limited access highways. For transportation purposes, they should be thought of as an extension of the roadway network for non-motorized users. The inclusion of a shared use path should not be considered as an alternative to providing on-street facilities, but, rather, as a supplement.

For additional information on shared use path design, refer to the ***AASHTO Guide for the Development of Bicycle Facilities (2024, 5th Edition)*** ~~***AASHTO Guide for the Development of Bicycle Facilities (2012, 4th Edition)***~~.

9.3.1 ~~C.1~~ Width and Clearance

The useable width and horizontal clearance for a shared use path are primary design considerations. The minimum paved width for a two-way path is 10 feet. Typically, widths range from 10 to 14 feet, with the wider values applicable to areas with high use or a wider variety of users, on steep grades, through curves, or used by larger maintenance vehicles.

In very rare circumstances, a reduced width of 8 feet may be used where the following conditions prevail:

- Bicycle traffic is expected to be low, even on peak days or during peak hours.
- Pedestrian use of the facility is not expected to be more than occasional.
- Horizontal and vertical alignments provide frequent, well-designed passing and resting opportunities.
- The path will not be regularly subjected to maintenance vehicle loading conditions that would cause pavement edge damage.

In addition, a path width of 8 feet may be used for a short distance due to a physical constraint such as an environmental feature, bridge abutment, utility structure, or fence.

A minimum 2 foot wide graded, clear area with a maximum 1:6 slope shall be maintained adjacent to both sides of the path; however, 3 feet or more is desirable to provide clearance from trees, poles, walls, fences, guardrails, or other lateral obstructions. See **Chapter 8, Section 8.4** ~~**Section D**~~ **Barrier Separation** and **Chapter 4 – Roadside Design, Figure 4 – 8 Location of Guardrail** for information on when and how longitudinal barriers should be utilized,

Where the path is adjacent to canals, ditches, or slopes steeper than 1:3, a wider separation should be considered. A minimum 5 foot separation from the edge of the path pavement to the top of the slope is desirable. Depending on the height of embankment and condition at the bottom, a physical barrier, such as a railing or chain link fence may need to be provided.

Where the clear area adjacent to the shared use path is less than 5 feet wide, physical barriers or rails are recommended in the following situations:

- Slopes 1:3 or steeper, with a drop of 6 feet or greater.

- Slopes 1:3 or steeper, adjacent to a parallel body of water or other substantial obstacle
- Slopes 1:2 or steeper, with a drop of 4 feet or greater; and
- Slopes 1:1 or steeper, with a drop of 1 foot or greater.

The ***AASHTO Guide for the Development of Bicycle Facilities (2024, 5th Edition)*** ~~***AASHTO Guide for the Development of Bicycle Facilities (2012, 4th Edition)***~~ provides additional information on the design of barriers or railings.

The desirable vertical clearance to obstructions is 10 feet. Fixed objects should not be permitted to protrude within the vertical or horizontal clearance of a shared use path. The recommended minimum vertical clearance that can be used in constrained areas is 8 feet. In some situations, vertical clearance greater than 10 feet may be needed to permit passage of maintenance and emergency vehicles.

9.3.2 ~~C.2~~ Separation Between Shared Use Paths and Roadways

When shared use paths are located adjacent to a roadway, a separation shall be provided. This demonstrates to both path users and motorists that the shared use path is a separate facility.

The minimum distance between a path and roadway shall be 5 feet. On roadways with curb, the distance is measured from the face of curb to the nearest edge of the path. On roadways with flush shoulders, this separation is measured from the:

- Paved shoulder - outside edge of the paved shoulder to the inside edge of the path
- Unpaved shoulders - outside edge of the traveled way to the inside edge of the path
- Where the separation is less than 5 feet, a physical barrier or railing should be provided between the path and the roadway.

A barrier or railing between the path and adjacent highway should not impair sight distance at intersections, and should be designed to limit the potential for injury to errant motorists or bicyclists. The barrier or railing need not be of size and strength to redirect errant motorists toward the roadway, unless other conditions indicate the need for a crashworthy barrier.

Barriers or railings at the outside of a structure or steep fill embankment that not only define the edge of the path but also prevent bicyclists from falling over the rail to a substantially lower elevation should be a minimum of 42” high. Barriers at other locations that serve only to separate the area for motor vehicles from the path should generally have a minimum height equivalent to the height of a standard guard rail.

When a path is placed along a high-speed highway, a separation greater than 5 feet is desirable.

9.3.3 ~~C.3~~ Design Speed

For paths in relatively flat areas (grades less than or equal to 4%), a design speed of 18 mph shall be used. When a sustained downgrade greater than 4% exists, refer to the ***AASHTO Guide for the Development of Bicycle Facilities (2024, 5th Edition)*** ~~***AASHTO Guide for the Development of Bicycle Facilities (2012, 4th Edition)***~~ for further guidance,

9.3.4 ~~C.4~~ Horizontal Alignment

The typical adult bicyclist is the design user for horizontal alignment. Please refer to the ***AASHTO Guide for the Development of Bicycle Facilities (2024, 5th Edition)*** ~~***AASHTO Guide for the Development of Bicycle Facilities (2012, 4th Edition)***~~ for further information on determining the minimum radius of curves on shared use paths.

Shared use paths should be transitioned as necessary towards the roadway at intersections to provide a more functional crossing location that also meets driver expectation.

9.3.5 ~~C.5~~ Accessibility

Since nearly all shared use paths are intended to be used by pedestrians, they fall under the accessibility requirements of the Americans with Disabilities Act.

Where a shared use path is contained within a street or highway right of way, the grade of the shared use path shall not exceed the general grade established for the adjacent street or highway. Where a shared use path is not contained within a street or highway right of way, the grade of the shared use path shall be 5 percent maximum.

Where compliance with the maximum grade requirements for shared use paths is not practicable due to existing terrain or infrastructure, right-of-way availability, a notable natural feature, or similar existing physical constraints, compliance is required to the extent practicable.

The cross slope of a shared use path shall be 2% maximum.

Pull boxes, manholes (and other utility covers), and other types of existing surface features in the location of a proposed curb ramp or detectable warning should be relocated when feasible. When relocation is not feasible, the feature shall be adjusted to meet the ADA requirements for surfaces (including the provision of a nonslip top surface, and adjustment to be flush with and at the same slope as the adjacent surface).

The detectable warning systems are designed to work with concrete surfaces. In areas where the path has an asphalt surface, the engineer must specify an appropriate detectable warning system. In these cases, consider including a short section of concrete that will accommodate any system.

If curb ramps or blended transitions are included in the path design, they shall be parallel to and the full width of the approaching path width. Shared use path crossings shall meet the same grade and cross slope requirements as sidewalks where the grade should not exceed 5%, and the maximum cross slope shall be no more than 2%.

Project design shall include an evaluation of existing driveways to determine if it is feasible to upgrade nonconforming driveway turnouts to meet maximum cross slope criteria. Nonconforming driveways are not required to be upgraded if it is not feasible within the scope of the project.

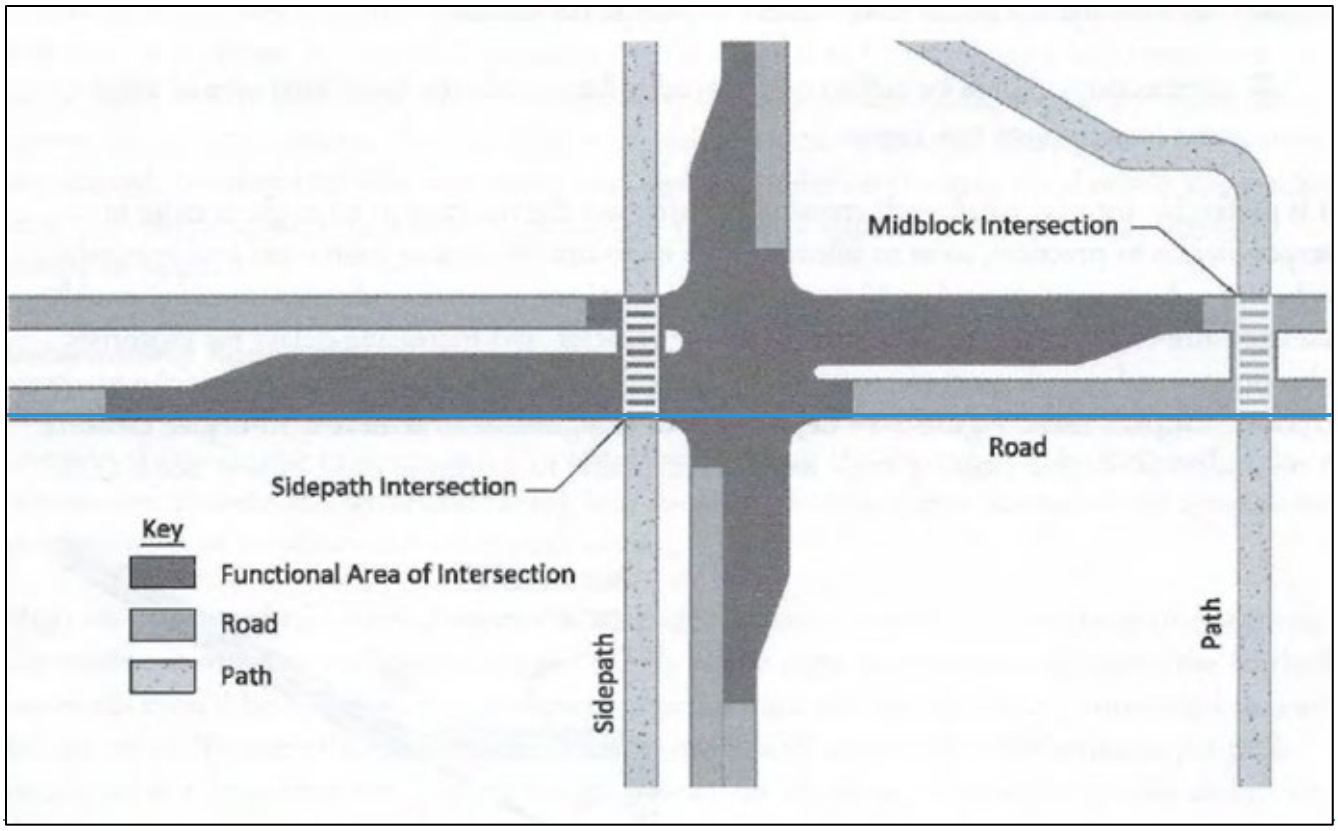
Chapter 8 – Pedestrian Facilities provides additional information regarding accessible design of shared use paths.

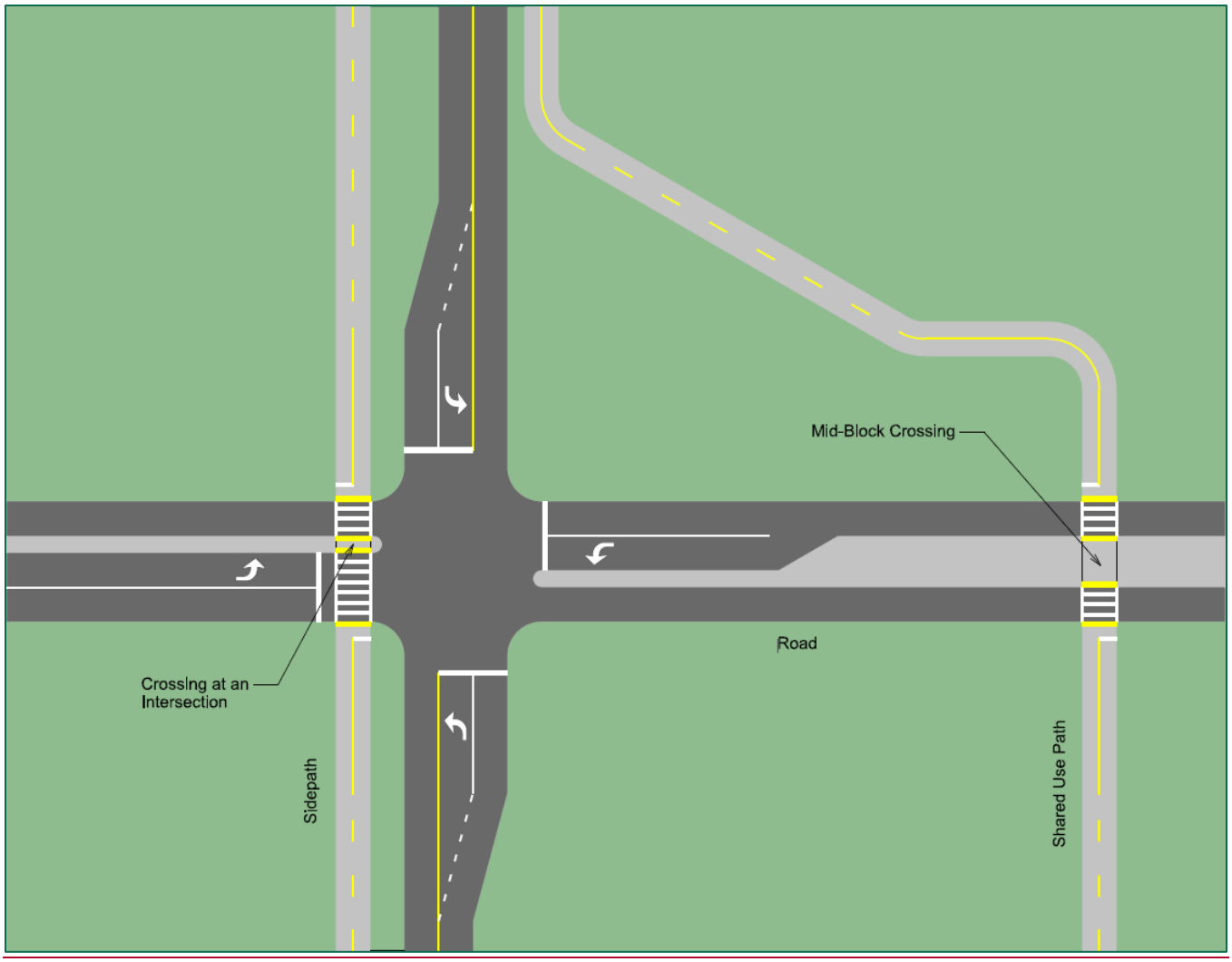
9.3.6 ~~C.6~~ Shared Use Path – Roadway Intersections

Shared use path crossings fall into three basic categories:

- Grade Separated Crossings – Crossings consisting of either a bridge over the roadway or an underpass beneath the roadway.
- Sidepath/Intersection Crossings – Crossings that are located within the functional area of an intersection of two or more roadways and the path is running parallel with the roadway. Sidepath crossings are typically parallel to one of the intersecting roadways. See **Figure 9 – 27 Mid-Block and Sidepath Crossings Relative to Intersection Functional Area**.
- Midblock Crossings – Crossings that are located outside the functional area of an intersection. See **Figure 9 – 27 Mid-Block and Sidepath Crossings Relative to Intersection Functional Area**.

Figure 9-27 Mid-Block and Sidepath Crossings Relative to Intersection Functional Area


Midblock Intersection
Road
Sidepath Intersection
Key
Functional Area of Intersection
Road
Path
Sidepath
Path



Source: 2024 AASHTO Guide to the Development of Bicycle Facilities ~~2012 AASHTO Guide to Bicycle Facilities~~

9.3.6.1 ~~C.6.a~~ Grade Separated Crossings

Grade separated crossings involve considerable expense but may be warranted in certain locations. The need for a grade separated crossing should be based on an engineering analysis to assess existing and future path user characteristics and volume, motor vehicle traffic volume and speed, opportunity for improved at-grade crossings in close proximity, feasibility of accessible design, consistency with existing and future surrounding land use and activities, and long term maintenance costs and responsibility. For further information on conducting such an analysis, see the ***AASHTO Guide for the Development of Bicycle Facilities (2024, 5th Edition) Chapter 13*** ~~***AASHTO Guide to Bicycle Facilities, 4th Edition Section 5.2.10***~~ and the discussion of grade-separated crossings in the ***AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities***.

9.3.6.2 ~~C.6.b~~ Sidepath Crossings

Sidepath crossings have unique operational and design challenges. One key factor that must be addressed is intersection sight distance. Given their proximity to motor vehicle intersections, sidepath intersection sight distance requirements must consider both what is needed for the drivers of motor vehicles crossing in each direction as well as bicyclists and pedestrians.

In cases where a shared use path is located parallel to and within the roadway corridor, the traffic control on the sidepath shall be consistent with that on the parallel roadway. The path shall be aligned to allow the placement of the stop bar on side streets a minimum of 4 feet in advance of the crosswalk, and crosswalks shall be marked. The crosswalk width shall be equal to or greater than the approach width of the path.

Where a shared use path is located parallel to a high speed roadway and crossing an access or exit ramp or lane, moving the crossing away from the intersection to a midblock location may be considered. This allows for motorists to first enter or exit the high speed roadway and then turn attention to the pathway crossing. When this is done, care should be taken to insure the midblock location is clearly outside the functional area of the intersection and designed accordingly.

See the ***AASHTO Guide for the Development of Bicycle Facilities (2024, 5th Edition), Section 7.9*** ~~***AASHTO Guide to Bicycle Facilities, 4th Edition, Sections 5.2.2 and 5.3.4***~~ which covers these operational issues in detail and provides several factors to be considered for proper design for further information.

9.3.6.3 ~~C.6.c~~ Midblock Shared Use Path Crossings

The design of a midblock shared use path crossing is similar in many ways to designing a multi-leg intersection. As with sidepath crossings, a key design element is intersection sight distance. The basic criteria for establishing intersection sight distance for shared use path crossings is based on the same methodology presented in the AASHTO Greenbook for conventional intersections but with adjustments to account for the design vehicle and design speed of the shared use path. As with conventional intersections, the dimensions of the clear sight triangle are dependent on the type of traffic control.

The ***AASHTO Guide for the Development of Bicycle Facilities (2024, 5th Edition), Section 6.7.7*** ~~***AASHTO Guide to Bicycle Facilities, 4th Edition Section 5.3.2***~~ provides additional information on the details and methodology for the proper design of midblock crossings including several examples.

9.3.6.3.1 ~~C.6.c.1~~ Intersections with Yield Control

The ***AASHTO Guide for the Development of Bicycle Facilities*** ~~***AASHTO Guide to Bicycle Facilities***~~ indicates that it is preferable to provide shared use path intersection sight distance based on yield control for all midblock crossings. See **Figure 9 – 28 Yield Sight Triangles** and **Table 9 – 2 Formulas for Lengths of Roadway and Path Legs – Yield Condition** and the formulas to compute the lengths of the roadway leg (a) and path leg (b) for yield control**. Table 9 – 3 Intersection Sight Distance Calculated Lengths of Roadway and Path Lengths** provides calculated sight distance values based on **Figure 9 – 28 and Table 9 – 2** for a range of roadway design speeds and a shared use path design speed of 18 mph.

Figure 9-28 Yield Sight Triangles

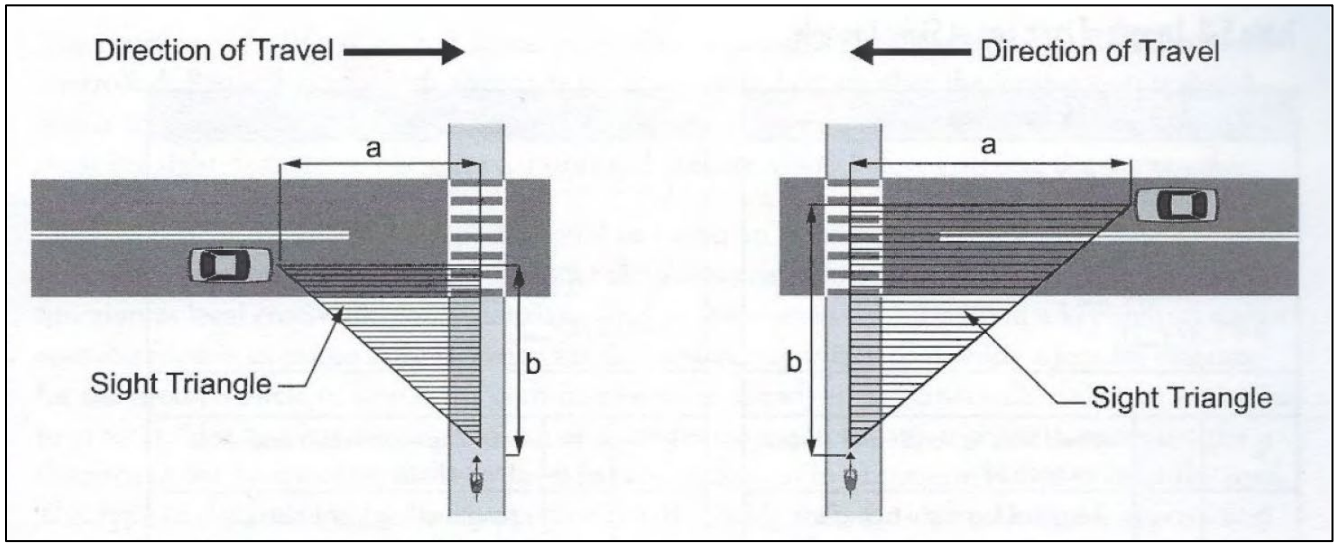


Table 9-2 Formulas for Lengths of Roadway and Path Legs – Yield Condition

Length of Roadway Leg (a)

$$t_a = \frac{S}{1.47\ V_{path}}$$

$$t_g = t_a + \frac{w + L_a}{1.47\ V_{path}}$$

$$a = 1.47\ V_{road}\ t_g$$

t_g	=	Travel time to reach and clear the path (s)
a	=	length of leg sight triangle along the path approach (ft)
t_a	=	Travel time to reach the road from the decision point for a path user that does not stop (s)
w	=	Width of the intersection to be crossed (ft)
L_a	=	Typical bicycle length = 6 ft (see AASHTO Guide for other design users)
V_{path}	=	Design speed of the path (mph)
V_{road}	=	Design speed of the road (mph)
S	=	Stopping sight distance for the path user traveling at design speed.

Length of Path Leg (b)

$$t_a = \frac{1.47\ V_e\ -\ 1.47\ V_b}{a_i}$$

$$t_g = t_a + \frac{w + L_a}{0.88\ V_{road}}$$

$$b = 1.47\ V_{path}\ t_g$$

t_g	=	Travel time to reach and clear the path (s)
b	=	Length of leg sight triangle along the path approach (ft)
t_a	=	Travel time to reach the path from the decision point for a motorist that does not stop (s).
V_e	=	Speed at which the motorist would enter the intersection after deceleration (mph) (assumed 0.60 x road design speed)
V_b	=	Speed of which braking by the motorist begins (mph) (same as road design speed)
a_i	=	Motorist deceleration rate (ft/s^2) on intersection approach when braking to a stop not initiated (assume 5.0 ft/s^2)
w	=	Width of intersection to be crossed.
L_a	=	Length of the design vehicle (ft)
V_{path}	=	Design speed of the path
V_{road}	=	Design speed of the road (mph)

Table 9-3 Intersection Sight Distance Calculated Lengths of Roadway and Path Lengths

Roadway Design Speed (mph)	Length of Roadway Leg a (feet)		Length of Path Leg b (feet)
	Length for Crossing 2 Roadway Traffic Lanes	Additional Length for each Additional Traffic Lane Crossed	
20	182	13	109
25	228	17	115
30	273	20	124
35	319	23	136
:40	364	27	148
45	410	30	161
50	456	33	174
55	501	37	188
60	547	40	202

Notes:

1. Above lengths a and b based on:
   a. Design Speed of Path = 18 mph
   b. Stopping Sight Distance for path user = 134 feet
   c. Shared Use Path Width at Roadway Crossing = 12 feet
   d. Path Design Vehicle Length = 6 feet (bicycle)
   e. Road Width = 2 traffic lanes @ 12 feet each = 24 feet
   f. Roadway Design Vehicle Length = 19 feet (passenger vehicle)
   g. Roadway Approach Grade ≤ 3.0%
   h. Path Approach Grade = 0.0%

   For other design conditions see **AASHTO Guide for the Development of Bicycle Facilities** ~~AASHTO Guide to Bicycle Facilities~~.
2. The line of sight is measured 2.7 feet above the surface of the path and roadway.

9.3.6.3.2 ~~C.6.c.2~~ Intersections with Signal Control or Stop Control

Where intersection sight distance based on yield control cannot be provided, signal control or stop control should be considered. For midblock crossings with signal control or stop control on either the roadway or the path, the roadway and path approaches shall provide the minimum stopping sight distance to obey the control and execute a stop before entering the intersection. An unobstructed view of a path user located at the stopped position on the path should be visible to the motorist and vice versa. The ***AASHTO Guide for the Development of Bicycle***

Facilities provides additional details for the proper design of signal control and stop control intersections.

9.3.7 ~~C.7~~ Structures

The minimum clear width on structures shall be the same as the approach width of the shared use path, plus a minimum 2 foot wide clear area on each side should be provided. Access by emergency, patrol and maintenance vehicles should be considered in establishing the design clearances of structures on shared use paths. Where practical, a path vertical clearance of 10 feet (on the structure) is desirable for adequate vertical shy distance.

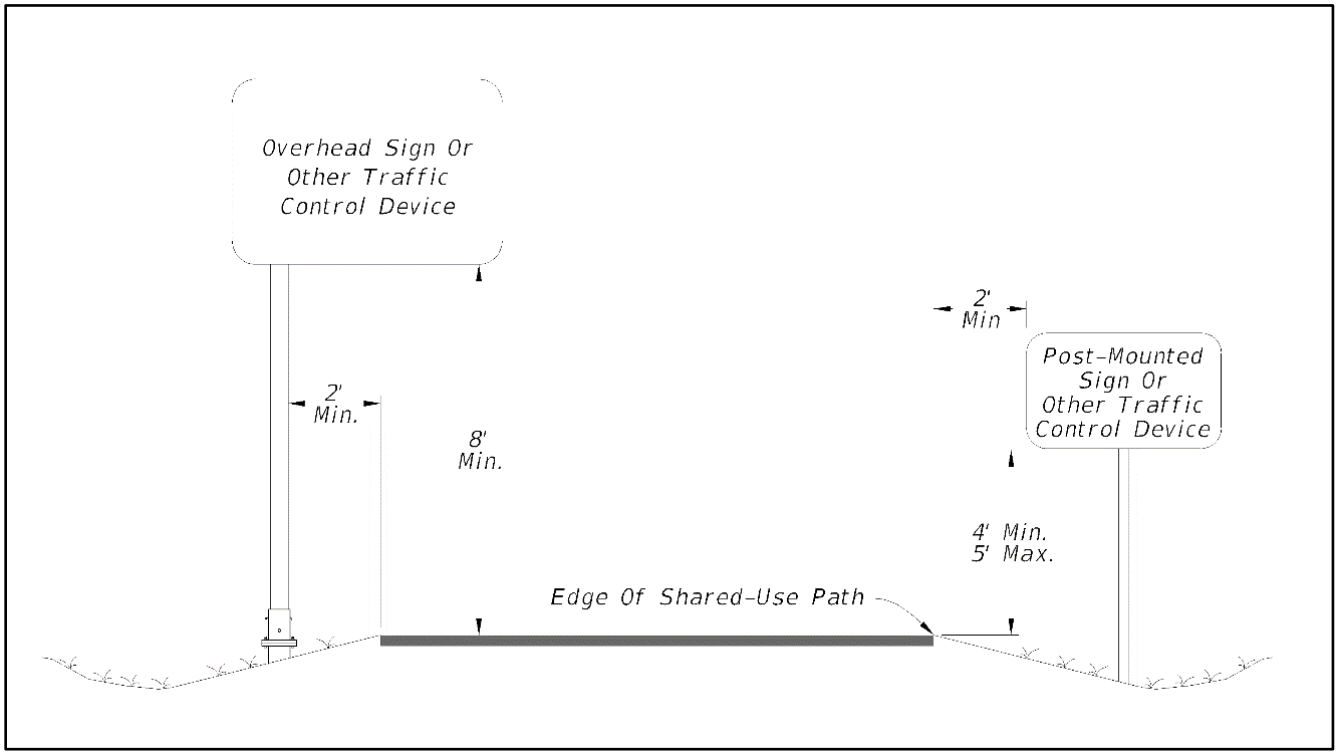
Where compliance with the requirement for a maximum running slope of 5% is not practicable due to existing terrain or infrastructure, right-of-way availability, a notable natural feature, or similar existing physical constraints, compliance is required to the extent practicable.

Ramps on new structures that are part of a shared use path and serve as the accessible route shall have a running slope between 5% minimum and 8.3% maximum. The cross slope of ramp runs shall be 2% maximum. Landings are required at the top and the bottom of each ramp run.

9.3.8 ~~C.8~~ Pavement Markings and Signage

The **MUTCD** regulates the design and use of all traffic control devices on shared use paths. **Figure 9 – 29 Sign Placement on Shared Use Paths** provides the minimum criteria for the placement of signs along or over a shared use path. The maximum height from the outside edge of the path to the bottom elevation of a sign is five feet. Signs on shared use paths should follow the dimensions provided in **MUTCD Table 9A-1** ~~**Table 9B-1**~~ **Bicycle Sign and Plaque Sizes, MUTCD**. Guidance on the placement of stop or yield lines and crosswalks on roadways intersecting with shared use paths is provided in the ***Part 3*** of the ***MUTCD*** ~~***MUTCD, Part 3***~~.

Figure 9-29 Sign Placement on Shared Use Paths



9.4 ~~D~~ Railroad Crossings

Railroad-highway grade crossings should ideally be at a right angle to the rails. This can be accomplished either as a separate path or a widened shoulder. The greater the crossing deviated from this ideal crossing angle, the greater is the potential for a bicyclist's front wheel to be trapped in the flangeway, causing loss of steering control. If the crossing angle is less than approximately 45 degrees, an additional paved shoulder of sufficient width should be provided to permit the bicyclist to cross the track at a safer angle, preferable perpendicularly. Where this is not possible, and where train speeds are low, commercially available compressible flangeway fillers may enhance bicyclist operation. It is also important that the roadway approach be at the same elevation as the rails. For more information, see **Figure 5 – 40** ~~**Figure 4 – 28**~~ **Correction for Skewed Railroad Grade Crossing – Separate Pathway** in the ***AASHTO Guide for the Development of Bicycle Facilities***.

9.5 ~~E~~ Structures

All new bridges over roadways and shared use paths shall be designed to meet the vertical clearance standards specified in **Chapter 3, Section 3.3.7.10.4.2** ~~**Section C.7.j.4.(b)**~~, and **Chapter 17, Section 17.3.3.2** ~~**Section C.3.b**~~.

All bridges that include provisions for pedestrians shall provide pedestrian accommodations and design considerations that meet the provisions of the ADA.

Bridges over roadways should be covered or screened to reduce the likelihood of objects being dropped or thrown below. If the bridge is enclosed, the visual tunnel effect may require widening the bridge to provide a feeling of security for all bridge users. The area adjacent to overpasses may be fenced to prevent unsafe crossings and to channel pedestrians to the vertical separation structure.

9.6 ~~F~~ References for Informational Purposes

- USDOT/FHWA ADA Standards for Accessible Design (ADAAG)
  https://www.fhwa.dot.gov/programadmin/pedestrians.cfm
- AASHTO – Guide for the Development of Bicycle Facilities, 2024 ~~2012~~, 5~~4~~th Edition
  https://store.transportation.org/Item/CollectionDetail?ID=267
  ~~***https://store.transportation.org/Common/DownloadContentFiles?id=1096***~~
- NACTO Urban Streets Design Guide
  http://nacto.org/usdg
- FHWA Policy Memo for Flexibility in Pedestrian and Bicycle Facility Design
  https://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/
- Drainage Handbooks, Florida Department of Transportation,
  https://www.fdot.gov/roadway/drainage/manualsandhandbooks.shtm
- Manual on Uniform Traffic Control Devices, 11th Edition ~~May 2012~~
  https://mutcd.fhwa.dot.gov/ ~~***http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/pdf_index.htm***~~
- NACTO, Urban Bikeway Design Guide
  https://nacto.org/publication/urban-bikeway-design-guide/cycle-tracks/