

## CHAPTER 9

### BICYCLE FACILITIES

<u>A</u>	<u>INTRODUCTION</u> .....	<u>9-19</u>	<u>19</u>	<u>39</u>	<u>1</u>
<u>B</u>	<u>ON-STREET FACILITIES</u> .....	<u>9-19</u>	<u>19</u>	<u>39</u>	<u>1</u>
	<u>B.1</u> <u>Bicycle (Bike Lanes)</u> .....	<u>9-39</u>	<u>39</u>	<u>39</u>	<u>2</u>
	<u>B.2</u> <u>Paved Shoulders</u> .....	<u>9-59</u>	<u>49</u>	<u>3</u>	
	<u>B.3</u> <u>Wide Curb Lanes</u> .....	<u>9-59</u>	<u>59</u>	<u>3</u>	
	<u>B.4</u> <u>Shared Lane Markings</u> .....	<u>9-59</u>	<u>59</u>	<u>39</u>	<u>4</u>
<u>C</u>	<u>SHARED USE PATHS</u> .....	<u>9-89</u>	<u>89</u>	<u>39</u>	<u>6</u>
	<u>C.1</u> <u>Separation Between Shared Use Paths and Roadways</u> .....	<u>9-99</u>	<u>99</u>	<u>39</u>	<u>6</u>
	<u>C.2</u> <u>Width</u> .....	<u>9-109</u>	<u>109</u>	<u>39</u>	<u>8</u>
	<u>C.3</u> <u>Horizontal Clearance</u> .....	<u>9-119</u>	<u>119</u>	<u>39</u>	<u>8</u>
	<u>C.4</u> <u>Vertical Clearance</u> .....	<u>9-129</u>	<u>129</u>	<u>39</u>	<u>9</u>
	<u>C.5</u> <u>Design Speed</u> .....	<u>9-129</u>	<u>129</u>	<u>39</u>	<u>9</u>
	<u>C.6</u> <u>Structures</u> .....	<u>9-129</u>	<u>129</u>	<u>39</u>	<u>9</u>
	<u>C.7</u> <u>Ramp Widths</u> .....	<u>9-129</u>	<u>129</u>	<u>39</u>	<u>9</u>
<u>D</u>	<u>Railroad Crossings</u> .....	<u>9-139</u>	<u>139</u>	<u>39</u>	<u>10</u>
<u>E</u>	<u>Structures</u> .....	<u>9-139</u>	<u>139</u>	<u>39</u>	<u>10</u>
<u>A</u>	<u>INTRODUCTION</u> .....	<u>9</u>	<u>1</u>		
<u>B</u>	<u>ON STREET FACILITIES</u> .....	<u>9</u>	<u>1</u>		
	<u>B.1</u> <u>Paved Shoulders</u> .....	<u>9</u>	<u>1</u>		
	<u>B.2</u> <u>Bike Lanes</u> .....	<u>9</u>	<u>1</u>		
	<u>B.3</u> <u>Curb Lanes</u> .....	<u>9</u>	<u>1</u>		
<u>C</u>	<u>SHARED USE PATHS</u> .....	<u>9</u>	<u>1</u>		
	<u>C.1</u> <u>Separation Between Shared Use Paths and Roadways</u> .....	<u>9</u>	<u>1</u>		
	<u>C.2</u> <u>Width</u> .....	<u>9</u>	<u>1</u>		
	<u>C.3</u> <u>Horizontal Clearance</u> .....	<u>9</u>	<u>1</u>		

<u>C.4</u>	<u>Vertical Clearance</u> .....	<u>9-1</u>
<u>C.5</u>	<u>Design Speed</u> .....	<u>9-1</u>
<u>C.6</u>	<u>Structures</u> .....	<u>9-1</u>
<u>C.7</u>	<u>Ramp Widths</u> .....	<u>9-1</u>
<u>D</u>	<u>Railroad Crossings</u> .....	<u>9-1</u>

## FIGURES

FIGURE 9 – 1	MINIMUM WIDTHS FOR BIKE LANES.....	<del>9-149-149-39-119-1</del>
FIGURE 9 – 2	MAJOR INTERSECTION WITH SEPARATE RIGHT TURN LANE URBAN TYPICAL SECTION (CURB AND GUTTER)	<del>9-169-169-39-139-1</del>
FIGURE 9 – 3	MAJOR INTERSECTION NO RIGHT TURN LANE PLUS BUSBAY URBAN TYPICAL SECTION (CURB AND GUTTER)	<del>9-179-179-39-149-1</del>
FIGURE 9 – 4	MAJOR WITH LOCAL STREET INTERSECTION NO RIGHT TURN LANE URBAN TYPICAL SECTION (CURB AND GUTTER)	<del>9-189-189-39-159-1</del>
FIGURE 9 – 5	MAJOR WITH LOCAL STREET INTERSECTION NO RIGHT TURN LANE ON STREET PARKING URBAN TYPICAL SECTION (CURB AND GUTTER).....	<del>9-199-199-39-169-1</del>
FIGURE 9 – 6	MAJOR INTERSECTION WITH DESIGNATED SHOULDER SEPARATE RIGHT TURN LANE RURAL TYPICAL SECTION (PAVED SHOULDER).....	<del>9-209-209-39-179-1</del>
FIGURE 9 – 7	MAJOR WITH LOCAL STREET INTERSECTION DESIGNATED SHOULDER NO RIGHT TURN LANE RURAL TYPICAL SECTION (PAVED SHOULDER) .....	<del>9-219-219-39-189-1</del>
FIGURE 9 – 8	MAJOR INTERSECTION SEPARATE RIGHT TURN LANE 3' OR 4' UNDESIGNATED BIKE LANE URBAN TYPICAL SECTION (CURB AND GUTTER).....	<del>9-229-229-39-199-1</del>
FIGURE 9 – 9	MAJOR INTERSECTION RIGHT TURN DROP LANE DESIGNATED OR UNDESIGNATED BIKE LANE URBAN TYPICAL SECTION (CURB AND GUTTER).....	<del>9-239-239-39-209-1</del>
FIGURE 9 – 10	"TEE" INTERSECTION SEPARATE RIGHT TURN LANE URBAN TYPICAL SECTION (CURB AND GUTTER)	<del>9-249-249-39-219-1</del>
FIGURE 9 – 11	"TEE" INTERSECTION RIGHT TURN DROP LANE URBAN TYPICAL SECTION (CURB AND GUTTER).....	<del>9-259-259-39-229-1</del>
FIGURE 9 – 12	INTERCHANGE RAMPS RURAL TYPICAL SECTION (PAVED SHOULDER) .....	<del>9-269-269-39-239-1</del>
FIGURE 9 – 13	DETAIL OF DESIGNATED BIKE LANE AND BIKE SHOULDER MARKINGS .....	<del>9-279-279-39-249-1</del>



## CHAPTER 9

### BICYCLE FACILITIES

#### A INTRODUCTION

Bicycle facilities should be given full consideration in the planning and development of transportation facilities, including the incorporation of such ways into state, regional, and local transportation plans and programs under the assumption that transportation facilities will be used by cyclists. Bicycle ways 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.

Appropriately designed and located bicycle facilities play an important role in supporting bicycle travel. Bicyclists should be considered in all phases of transportation planning, design, construction and maintenance activities. Particular emphasis should be given to new construction, reconstruction, intersection capacity improvement projects, and transit projects. All projects, particularly intersection modifications, should be designed to accommodate bicyclists. Bicycle safe design practices, as described in this Manual, should be followed during initial roadway design to avoid costly subsequent improvements. Bicycle facilities can include bicycle lanes, paved shoulders, wide curb lanes, shared lanes (pending 2009 MUTCD), shared use paths, traffic control devices<sup>[tip1]</sup>, and bicycle parking facilities. Within any given transportation corridor, bicyclists should be provided with more than one option to meet the travel and access needs of all potential users.

#### B ON-STREET FACILITIES

Provisions for bicycle traffic should be incorporated in the original roadway highway design. All New roadway highways, except where bicycle use is prohibited by law limited access highways, should be designed, and constructed and maintained under the assumption they will be used by bicyclists. Roadway conditions should be favorable for bicycling, with smooth pavement, limited changes in elevation along edge lines, and that drainage inlets and utility covers that which cannot be moved out of the travel way are should be designed flush with grade, well seated, and make use of bicycle-compatible grates and covers. This requires special care in preparing the roadway surface to accommodate 1¼ inch tires. Attention needs to be given to include safe drainage grates and minimize gaps include

~~crossing surface material at railroad crossings, smooth pavements, and provide signals responsive to bicycles.~~ [mak22] Railroad-highway grade crossings for bicycle facilities should be perpendicular to the rail. This can be accomplished as a separate path, widened shoulder or bicycle lane. Attention needs to be given to include crossing surface material at railroad crossings and provide signals responsive to bicycles [RQ3]. Consideration should be given to the crossing surface materials and the flangeway depth and width.

~~In addition, the desirability of adding facilities, such as bicycle lanes, paved shoulders, wide curb lanes, and/or shared lanes and shoulder improvements, should be included to the fullest extent feasible. The appropriate selection of a bicycle facility depends on many factors, including motor vehicle~~ [mak34] and bicycle traffic characteristics, adjacent land use and expected growth patterns. Specifically, All new or reconstructed rural arterial and major collector roadways sections in and within and one mile beyond of an urbanized [mak35] area should include be given consideration for the construction of 4 to 5 foot paved shoulders, and all urban arterial and collector sections should be given consideration for either undesignated 4 foot lanes or marked accommodations for [mak36] bicycle lanes. Beyond one mile of an urban area boundary, paved shoulders may serve as an alternate to bicycle lanes. The provision of for bicycle facilities is also desirable for resurfacing, restoration & rehabilitation (RRR) projects., any project on a minor collector street, or as needed to build a comprehensive bicycle network for a community.

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.

## **B.1 — Paved Shoulders**

~~In rural areas, or on sections without curb and gutter, adding or improving paved shoulders often can be the best way to accommodate bicyclists. Paved shoulders also benefit motor vehicle traffic.~~

~~Paved shoulders should be at least 4 feet wide to accommodate bicycle travel. The measurement of shoulder width does not include the width of any gutter pan. Paved shoulder width of 5 feet is recommended from the face of guardrail, curb, or other roadside barrier. Additional shoulder width is desirable if motor vehicle speeds exceed 50 mph, or the percentage of trucks, buses, or recreational vehicles is high.~~

~~If paved shoulders 4 feet wide cannot be provided, consider adding 3 foot shoulders.~~

~~The only practical difference in the operation of a 3 foot shoulder and wider shoulders, as they relate to bicyclists, is a slight decrease in motorist bicyclist separation distances. Other operational characteristics, such as motorist encroachment into adjacent lanes while passing and changes in the motorist position within the lane while passing are not significantly impacted.~~

## **B.12 Bicycle (Bike Lanes)**

~~Bicycle lanes should be considered when it is desirable to delineate available road space from motorist for preferential use by bicyclists providing more predictable movements by each and motorists, and to provide for more predictable movements by each. Bicycle lanes also help increase the total capacities of highways carrying mixed bicycle and motor vehicle traffic. Bicycle lanes shall have a minimum functional width of 4 feet, and be marked with the bicycle symbol and arrow in accordance with the MUTCD. 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 speeds exceed 50 mph. Bicycle lanes markings help to legitimize the cyclists travel in the roadway, reinforce that bicycle lanes are one way facilities, and provide the foundation for a community wide bicycle network. can increase bicyclists' confidence that motorists will not stray into their path of travel. Likewise, passing motorists are less likely to swerve to the left out of their lane to avoid bicyclists on the right.~~

~~Bicycle lanes are should be one-way facilities and carry bicycle traffic in the same direction as the adjacent motor vehicle traffic lane. A bicycle lane should be delineated from the motor vehicle travel lanes with a 6-inch solid white line and pavement markings. A through bicycle lane shall not be positioned to the right of a right turn lane only lane or to the left of a left turn only lane. For new construction, reconstruction, and traffic operations projects, at locations with right turn lanes, bus bays or parking lanes, a 5-foot bicycle lane shall be provided between the through lane and right turn lane, bus bay or parking lane. For bicycle lanes adjacent to parking lanes, if the parking volume is substantial or the turnover is high and additional 1-2 feet of width should be provided for the bicycle lane of where right of way is adequate.~~

~~In most cases, bike lanes will be through lanes and be located to the right of the right most through lane.~~

~~Two-way bike lanes on one side of the roadway are not recommended when they result in riding against the flow of motor vehicle traffic. Wrong-way riding is a major cause of bicycle crashes and violates the Rules of the Road as stated in the Uniform Vehicle Code and Chapter 316, Florida Statutes. Bicycle specific wrong-way signing may be used to discourage wrong-way travel. There may be special situations where a two-way bike lane for a short distance can eliminate the need for bicyclists to make a double crossing of a busy street. This should be considered after a careful evaluation of the risks.~~

On one-way streets, ~~bike~~ 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 provided~~considered when a bicycle lane on the left if it~~ Bike lanes on the left side are unfamiliar and unexpected for most motorists. This should only be considered when a bicycle lane on the left will substantially decrease the number of conflicts, such as those caused by frequent heavy bus traffic, heavy right turning movements, high-turnover parking lanes or unusually heavy movements to the right, or if there are a significant number of left turning left turning bicyclists.

~~Thus, left side bike lanes should only be considered after careful evaluation. Similarly, two-way bike lanes on the left side of a one-way street with a suitable separation from the motor vehicle should only be considered after a complete engineering study of other alternatives and relative risks.~~

For new construction, reconstruction, and traffic operations projects, at locations with right turn lanes, bus bays or parking lanes, a 5-foot bicycle lane shall be provided between the through lane and right turn lane, bus bay or parking lane. For bicycle lanes adjacent to parking lanes, if the parking volume is substantial or the turnover is high and additional 1-2 feet of width should be provided for the bicycle lane of right of way is adequate. Bicycle lanes should provide bicycle-safe drainage inlet grates, pavement surfaces should be smooth, and traffic signal should be responsive to bicyclists. Regular maintenance of bicycle lanes should be a top priority, since bicyclists are unable to use a lane with potholes, debris or broken glass. The overall minimum width of a travel lane and a bicycle lane is 14 feet. 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 MUTCD.

One-way Bbicycle lanes are illustrated should be designed with the minimum width given in Figure 9 - 1. The 4 foot bike lane shown in the flush shoulder section assumes the shoulder provides emergency maneuvering room.



## **B.2 Paved Shoulders**

A paved shoulder is a portion of the roadway which has been delineated by edge line striping, but generally does not include special pavement markings for the preferential use by bicyclists. In some non-urbanized areas, adding or improving paved shoulders often can be the best acceptable way to accommodate bicyclists.— Paved shoulders may be marked as bicycle lanes, also benefit motor vehicle traffic.

A paved shoulder at least 4 feet in width is considered to be a bicycle facility. Additional shoulder width is desirable if motor vehicle the posted speeds exceed 50 mph, or the percentage of trucks, buses, or recreational vehicles is high (>10%). A minimum 5-foot clear width between the traveled way and the face of curb, guardrail or other roadside barrier is also required.

## **B.3 Wide Curb Lanes**

Wide outside curb lanes are through lanes which provide a minimum of fourteen feet in width. lane wider than 12 feet to accommodate both bicycles and motor vehicles in the same lane. a minimum of 14 feet' in width. Fourteen feet is the minimum width that will allow for passenger cars to safely pass bicyclists within a single lane. This width allows most motor vehicles to pass cyclists within the travel lane, which lane which is not possible on more typical 10-foot to 12-foot wide lanes. On stretches of roadway with steep grades where bicyclists need more maneuvering space, the wide curb lane should be slightly wider where practical. In restricted urban conditions on arterial and major collector roadways, where it is not possible to include bike bicycle lanes or paved shoulders or on minor lower volume collector streets, a wide curb lane may be a practical option for a bicycle facility. However, in situations where more than 15 feet of pavement width exists, bicycle lanes or paved shoulders should be provided. n outside lane wider than 12 feet can help accommodate both bicycles and motor vehicles in the same lane. Fourteen feet is the recommended lane width for shared use in a wide curb lane, and is the minimum width that will allow passenger cars to safely pass bicyclists within a single lane. [jp28]

## **B.4 Shared Lane Markings**

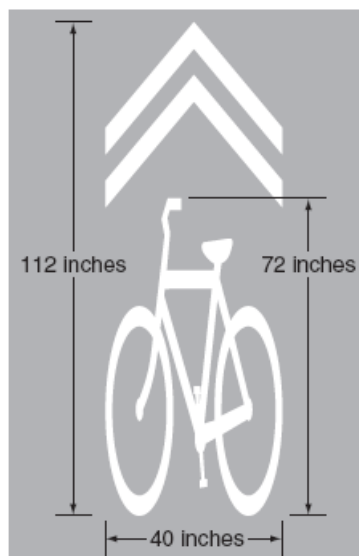
Shared lane markings, as shown in Figure XXX 9-14 [jtp9] may be used in travel lanes to indicate the optimum alignment for a bicyclist within the lane and to inform road

users that bicyclists might occupy the travel lane. They Shared Lane Markings may shall not be placed in bicycle lanes or on paved shoulders. Shared Lane Markings should not be placed on roadways that have a posted speed limit above 35 mph. The Shared Lane Markings may be used to:

- Assist bicyclists with lateral positioning in a shared lane with on-street parallel parking in order to reduce the chance of a bicyclist's impacting the open door of a parked vehicle.
- Assist bicyclists with lateral positioning in lanes that are too narrow for a motor vehicle and a bicycle to travel side by side within the same travel lane.
- Alert road users of the lateral location bicyclists are likely to occupy within the traveled way.
- Encourage safe passing of bicyclists by motorists, and
- Reduce the incidence of wrong-way bicycling.

(Revise Figure numbering) [RQ10]

**Figure 9C-9. Shared Lane Marking**



The shared lane markings shall be placed in accordance with the standards established in the standards established in MUTCD.

- If used in a shared lane with on-street parallel parking, the Shared Lane Markings should be placed so that the centers of the markings are at least 11 feet from the face of the curb, or from the edge of the pavement where there is no curb.
- If used on a street without on-street parking that has an outside travel lane that is less than 14 feet wide, the centers of the Shared Lane Markings should be at least 4 feet from the face of the curb, or from the edge of the pavement where there is no curb.
- If used, the Shared Lane Markings should be placed immediately after an intersection and spaced at interval not greater than 250 feet thereafter.

## C SHARED USE PATHS

Shared use paths are facilities intended for non-motorized travel, and may be located adjacent to a transportation facility or usually on an exclusive right of way ; with minimal cross flow by motor vehicles. They are almost always used by pedestrian, joggers, in-line skaters, bicyclists, and in some cases equestrians. Users are non-motorized and may include, but are not limited to, the following<sup>[jtp11]:</sup>

### Bicyclists

Pedestrians (walkers, runners, and people with disabilities, baby strollers, or walking dogs, etc.)<sup>[jtp12]:</sup>

- 
- In-line and roller skaters
- Roller skaters
- Skateboarders
- Equestrians<sup>[jtp13]</sup>
- Wheelchair users
- Pedestrians (walkers, runners, people with baby strollers, people walking dogs, etc.)

Shared use paths can 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. users with a shortcut through a residential neighborhood.

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 in-on-street facilities, but, rather, as a supplement.

For a discussion of shared path design beyond what is in this chapter, refer to the AASHTO Guide for the Development of Bicycle Facilities Florida Bicycle Facilities Planning and Design Handbook.

## C.1 Separation Between Shared Use Paths and Roadways

Shared use paths should be separated from the roadway. In some cases, paths along highways for short sections are permissible, given an appropriate level of separation between facilities. Some problems with paths located immediately adjacent to the roadways are as follows:

- Unless separated, they require one direction of bicycle traffic to ride against motor vehicle traffic, contrary to normal rules of the road.
- When paths end, bicyclists going against traffic will tend to continue to travel on the wrong side of the street. Likewise, bicyclists approaching a path often travel on the wrong side of the street to get to the path. Wrong-way travel by bicyclists is a major cause of bicycle/automobile crashes and should be discouraged at every opportunity.
- At intersections, motorists entering or crossing the roadway often will not notice bicyclists coming from the right, as they are not expecting or looking for contra-flow vehicles. Motorists turning to exit the roadway may likewise fail to notice the bicyclists. Even bicyclists coming from the left (the expected direction) often go unnoticed, especially when sight distances are limited.
- When constructing a two-way path within a narrow right of way, sacrificing the shoulder on the adjacent roadway would be a detriment to both the motorist and the bicyclists and should be avoided if at all possible.
- Many bicyclists will use the roadway instead of the shared use path because they have found the roadway to be safer, less congested, more convenient, or better maintained. Bicyclists using the roadway are often subjected to harassment by motorists who feel that, in all cases, bicyclists should be on the path instead.
- Although the shared use path should be given the same priority through intersections as the parallel highway, motorists falsely expect bicyclists to stop or yield at all cross streets and driveways. Efforts to require or encourage bicyclists to yield or stop at each cross street and driveway are inappropriate and frequently ignored by bicyclists<sup>[tp14]</sup>.
- Stopped cross street motor vehicle traffic or vehicles exiting side streets or driveways may block the path crossing.

- Because of the proximity of motor vehicle traffic to opposing bicycle traffic, barriers are often necessary to keep motor vehicles out of shared use paths and bicyclists out of traffic lanes. These barriers can represent an obstruction to bicyclists and motorists, can complicate maintenance of the facility, and cause other problems.

When it is decided to construct a shared use path adjacent to a roadway, the following should be considered.

- Conflict points should be limited to as few as possible.
- Conflicts should occur at as low a speed as possible. Consider reducing turning radii to reduce the speeds of motorists turning toward the shared use path. Kinks in the path alignment can reduce the speed of path users approaching the conflict.
- Maintain adequate sight distances for both motorists and path users to perceive and react to potential conflicts.

When the distance between the shared use path and the highway shoulder is less than 5 feet, a physical barrier is recommended. Where used, the barrier should be a minimum of 42 inches high, to prevent cyclists from toppling over it. A barrier between a shared use path and an adjacent highway should not impair sight distance at intersections, and should be designed to not be a hazard to errant motorists.

## **C.2 Width**

The paved width and operating width required for a shared use path are primary design considerations. The minimum recommended width for a paved two-way path is 10 feet. In many cases, it is desirable to increase the minimum width to 12 feet. The width should be increased if there is expected substantial use by bicyclists, probable shared use with joggers and in-line skaters, steep grades, and locations where bicyclists are likely to ride two abreast.

In a few cases, it may be acceptable to decrease the trail width to 8 feet. This width

should only 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.
- There will be good horizontal and vertical alignment, providing safe and frequent passing opportunities.
- During normal maintenance activities, the path will not be subjected to maintenance vehicles causing pavement edge damage.

For further discussion of shared use path design, refer to the Florida Bicycle Facilities Planning and Design Handbook.

### **C.3 Horizontal Clearance**

A minimum 2 foot wide graded area with a maximum 1:6 slope should 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. 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 dense shrubbery, railing or chain link fence, may need to be provided. If a railing or barrier must be placed closer than 2 feet from the path, flare the end of the railing or barrier so that the end treatment of the barrier does not constitute a hazard.

## **C.4 Vertical Clearance**

Vertical clearance to obstructions should be a minimum of 8 feet. However, vertical clearance may need to be greater to permit passage of maintenance and emergency vehicles. In undercrossings and tunnels, 10 feet<sup>[tip15]</sup> is desirable.

## **C.5 Design Speed**

A design speed of 20 mph should be used for shared use paths.

## **C.6 Structures**

The minimum clear width on structures should be the same as the approach shared use path, plus the minimum 2 foot wide clear areas.

Grades on structures to be used by pedestrians shall comply with the requirements of the ADA Accessibility Guidelines (as described in the Federal Register) and the Florida Accessibility Code For Building Construction as given in CHAPTER 3 – GEOMETRIC DESIGN.

## **C.7 Ramp Widths**

Ramps for curbs at intersections should be at least the same width as the shared use path. Curb cuts and ramps should provide a smooth transition between the shared use path and the roadway. A 5 foot radius or flare may be considered to facilitate right turns for bicyclists.



## 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 27 in the AASHTO Guide for the Development of Bicycle Facilities (1999).

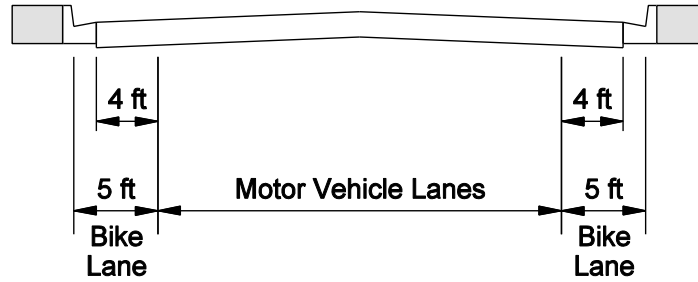
## E Structures

The design of shared use bridges or overpasses should meet current requirements for vertical clearance. The minimum vertical clearance for a shared use bridge over a roadway is 17 feet – 6 inches. The minimum vertical clearance for a shared use bridge over a railroad is 23 feet – 6 inches. Overpasses should either provide elevator access or meet ADA ramp criteria for maximum slopes, level landings, and handrails on both sides. The minimum clear width of a shared use bridge should be the same as the approach paved shared use path, plus the minimum 2 foot wide clear areas. 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 of all bridge users. The area adjacent to overpasses may be fenced to prevent unsafe crossings and to channel pedestrians to the vertical separation structure. Access by emergency, patrol and maintenance vehicles should be considered in establishing the design clearances of structures on shared use paths. Where practical a vertical clearance of 10 feet is desirable for adequate vertical shy distance.

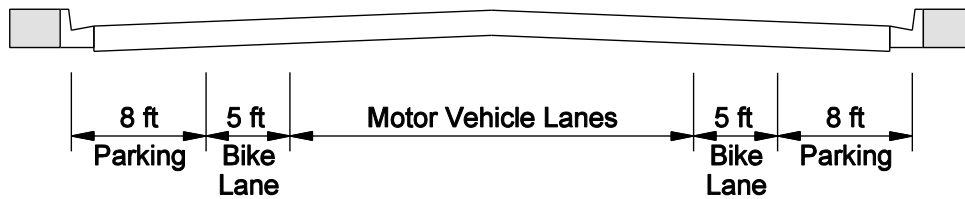
**FIGURE 9 – 1**

**MINIMUM WIDTHS FOR BIKE LANES (Revise a to show travel lane, rather than motor vehicle lane, revise b and c to show 7-8' wide parking)**

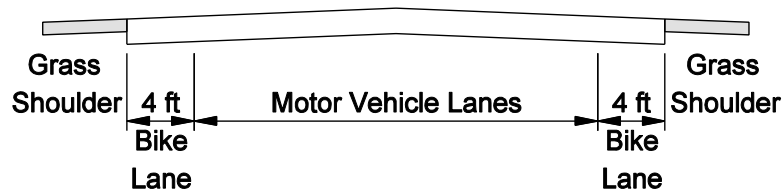
### a) Curbed Street without Parking



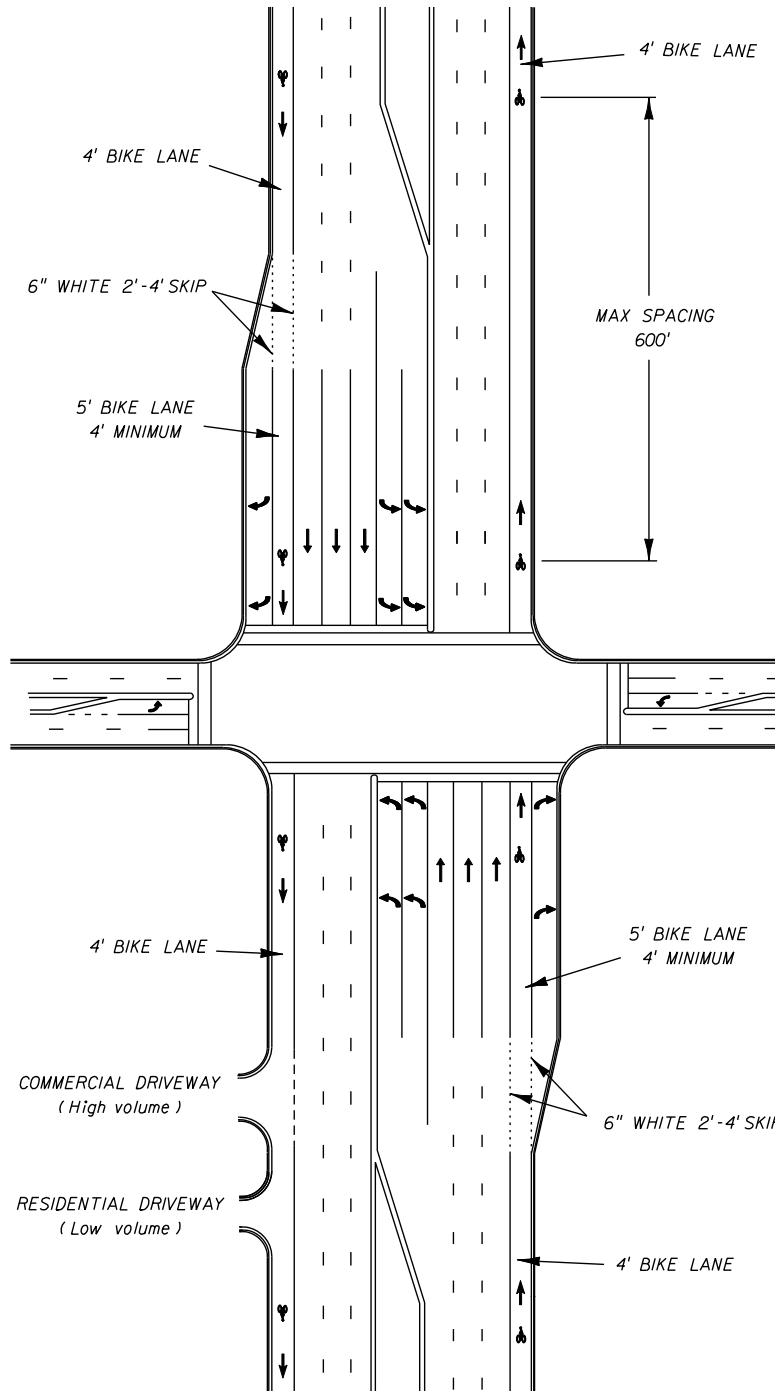
### b) Curbed Street with Parking



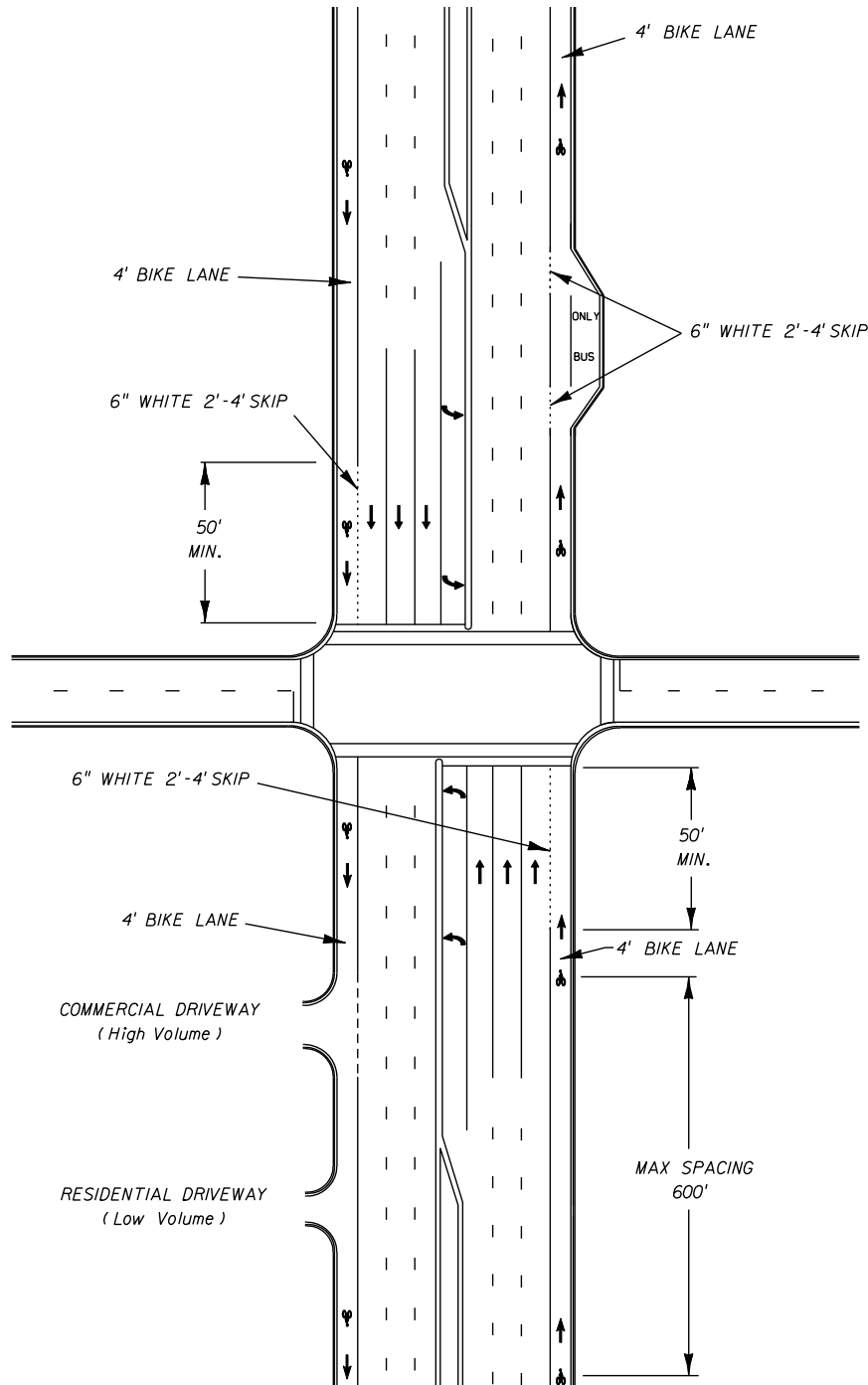
### c) Roadway without Curb and Gutter



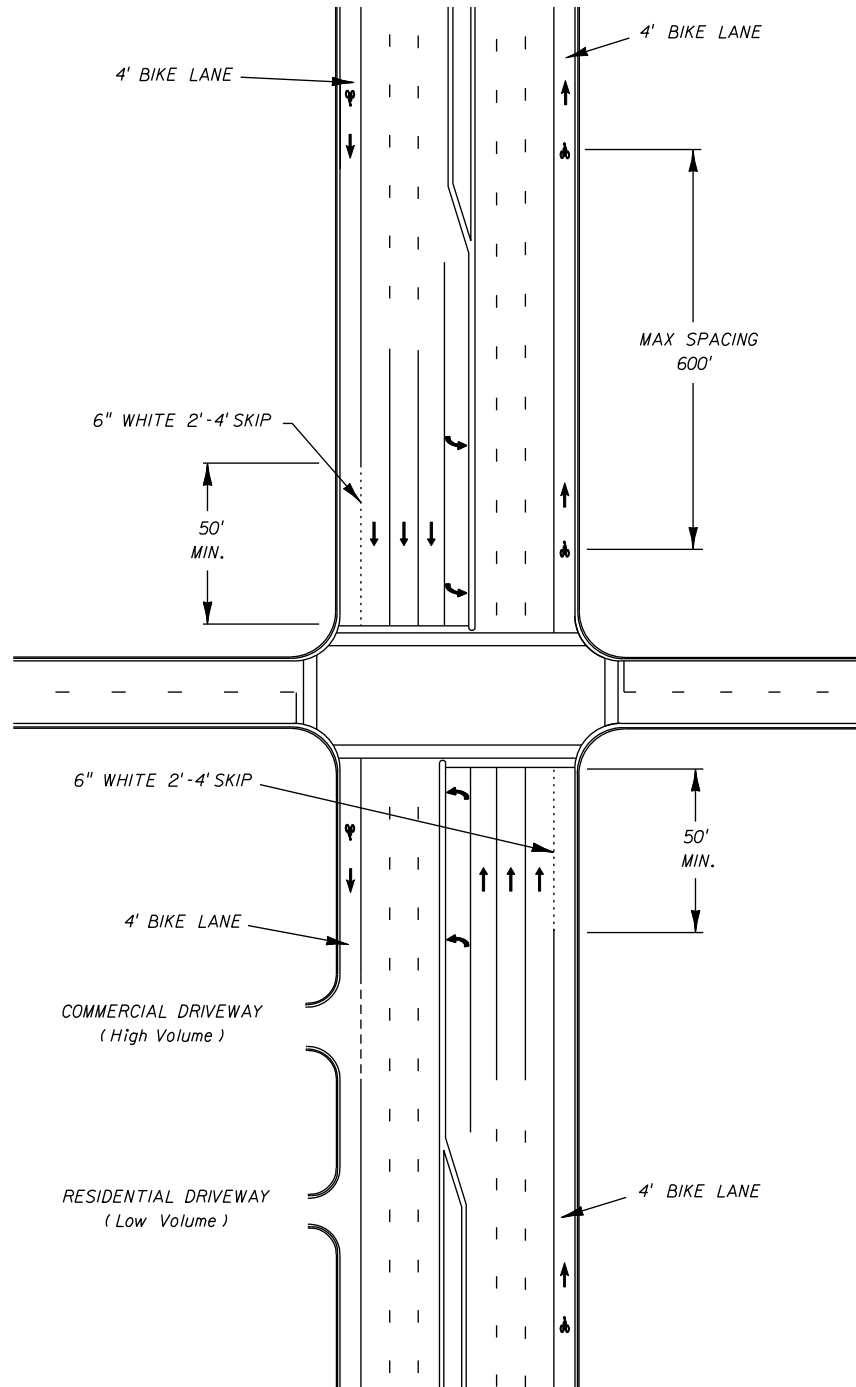
**FIGURE 9 – 2**  
**MAJOR INTERSECTION WITH SEPARATE**  
**RIGHT TURN LANE URBAN TYPICAL SECTION (CURB AND GUTTER)**



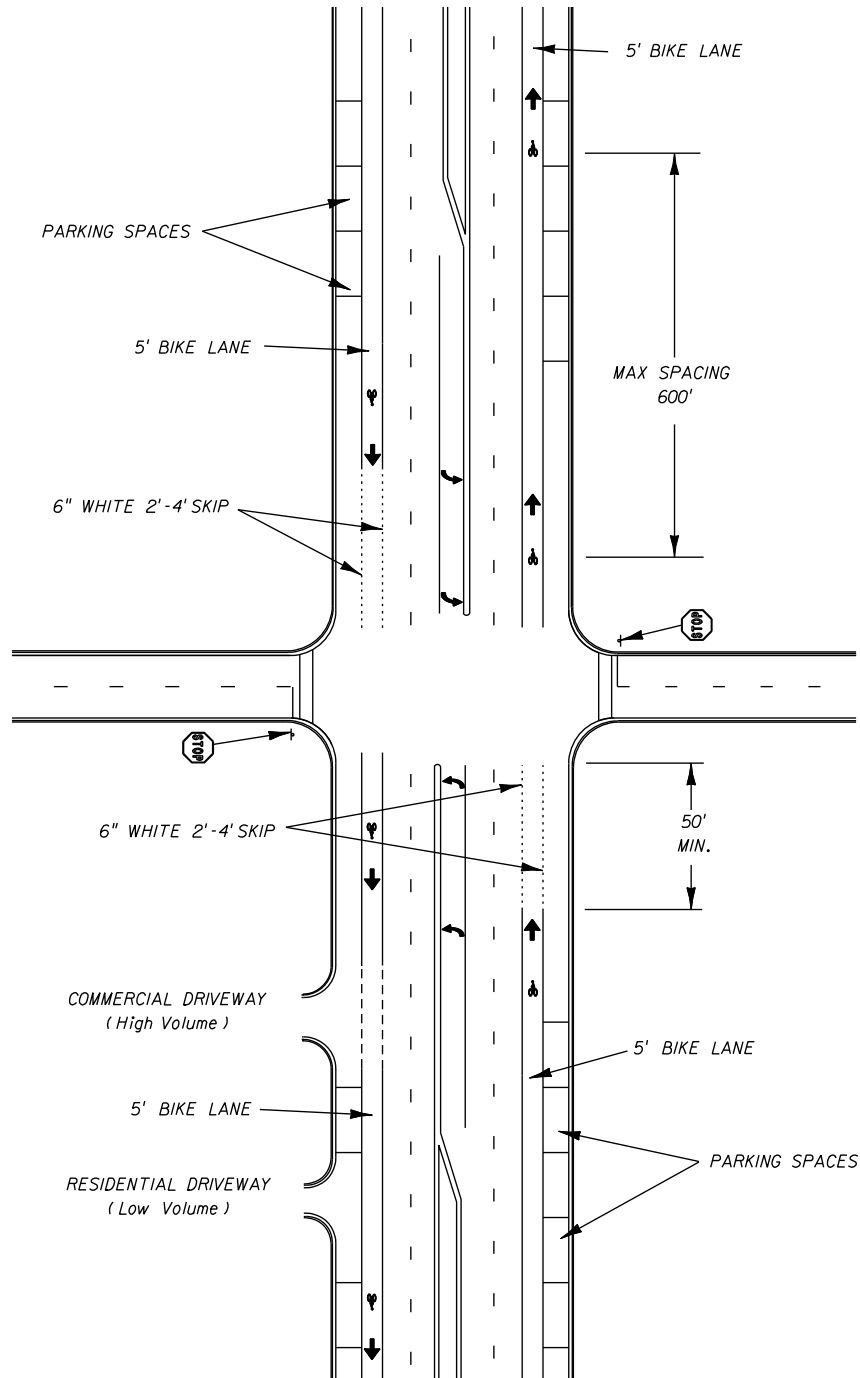
**FIGURE 9 – 3**  
**MAJOR INTERSECTION NO RIGHT TURN LANE PLUS BUSBAY**  
**URBAN TYPICAL SECTION (CURB AND GUTTER)**



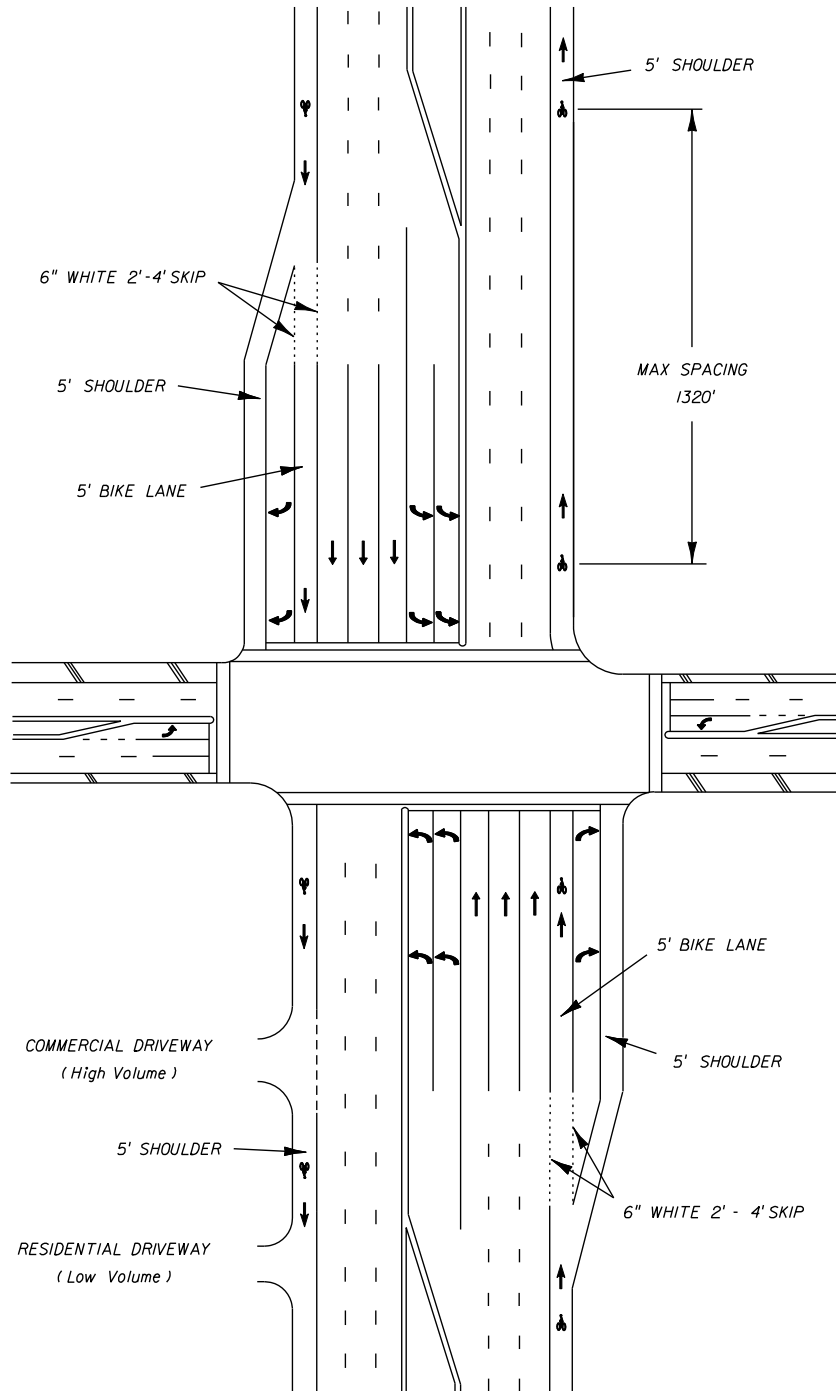
**FIGURE 9 – 4**  
**MAJOR WITH LOCAL STREET INTERSECTION NO RIGHT TURN LANE**  
**URBAN TYPICAL SECTION (CURB AND GUTTER)**



**FIGURE 9 – 5**  
**MAJOR WITH LOCAL STREET INTERSECTION NO RIGHT TURN LANE**  
**ON STREET PARKING URBAN TYPICAL SECTION (CURB AND GUTTER)**

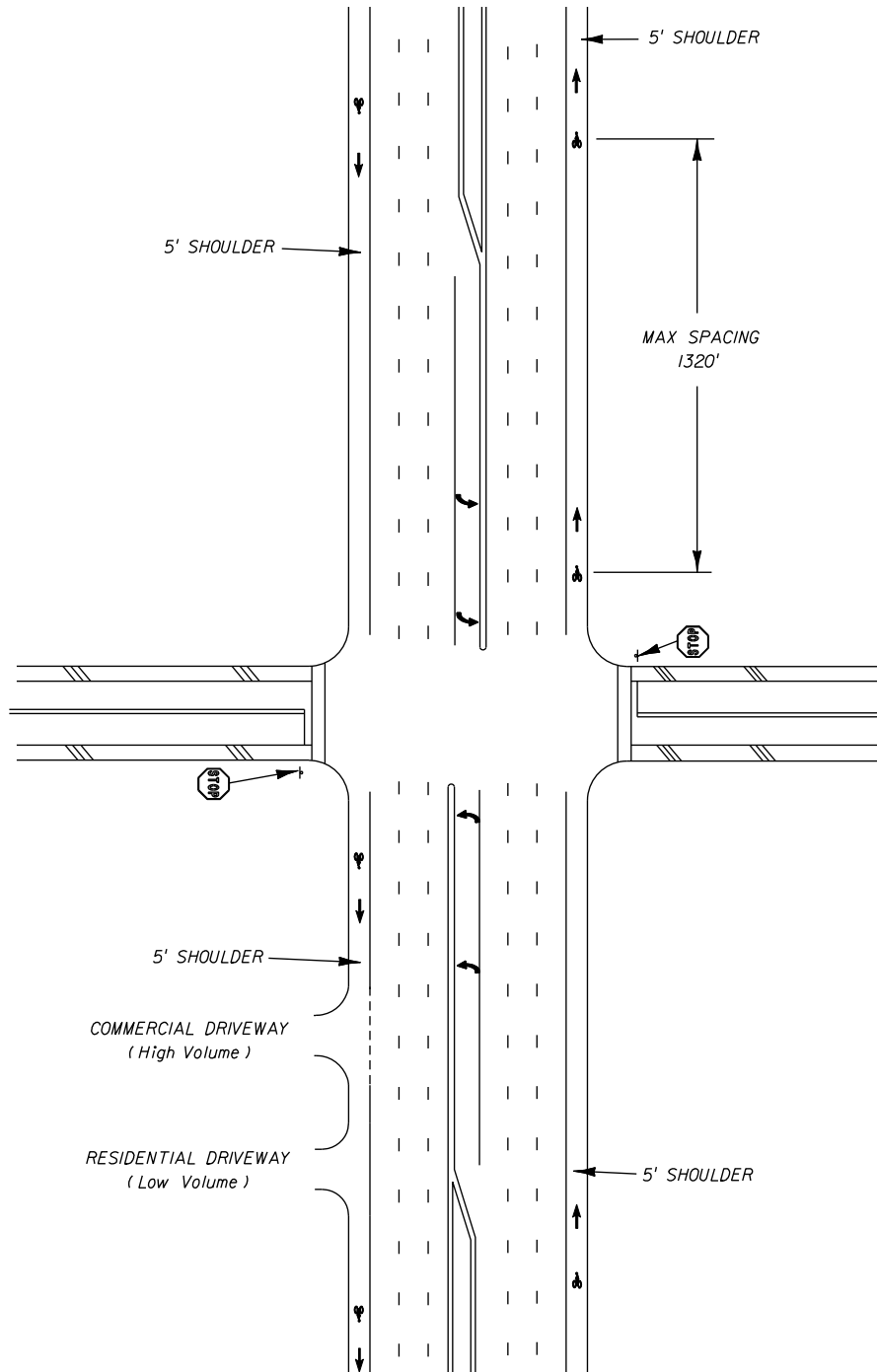


**FIGURE 9 – 6**  
**MAJOR INTERSECTION WITH DESIGNATED SHOULDER SEPARATE**  
**RIGHT TURN LANE RURAL TYPICAL SECTION (PAVED SHOULDER)**

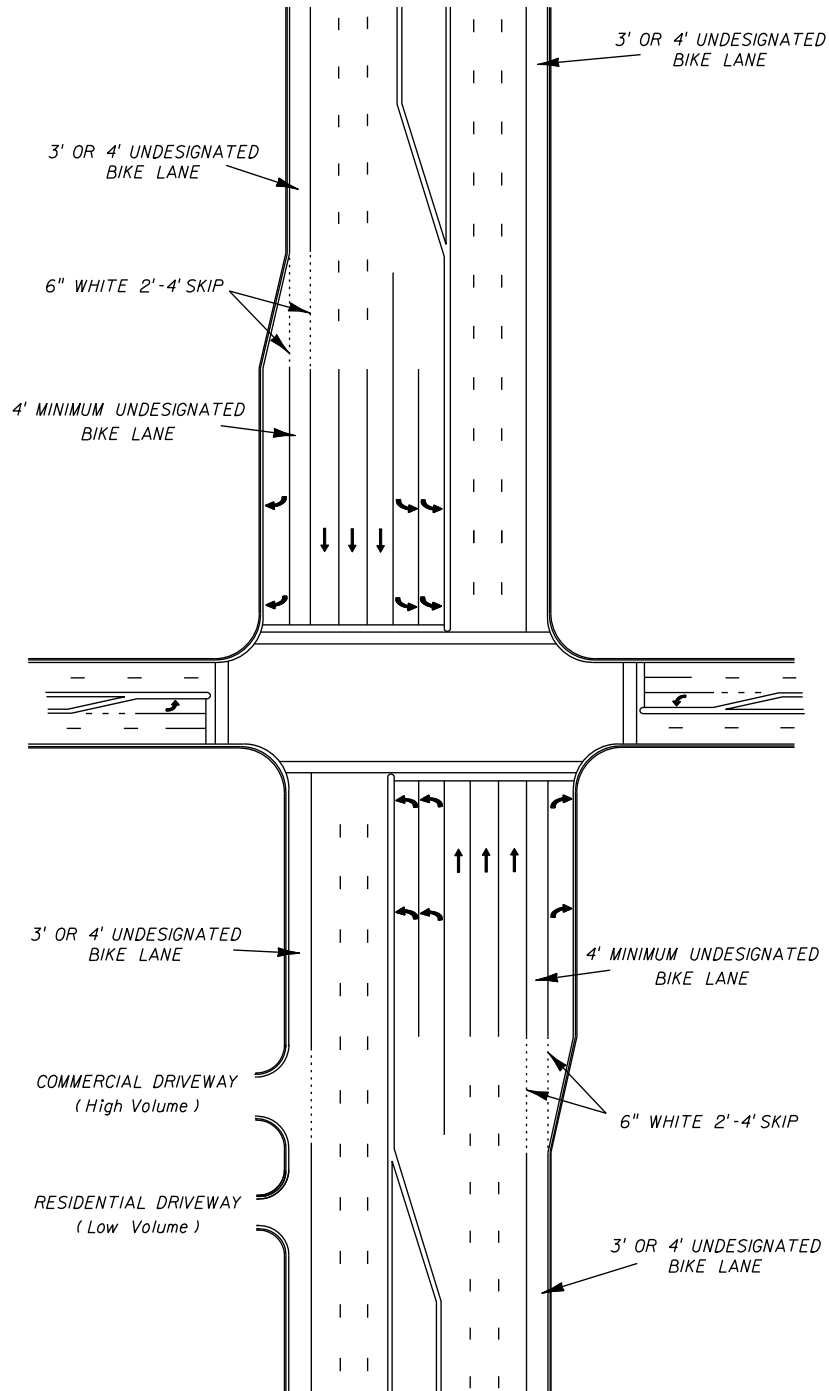




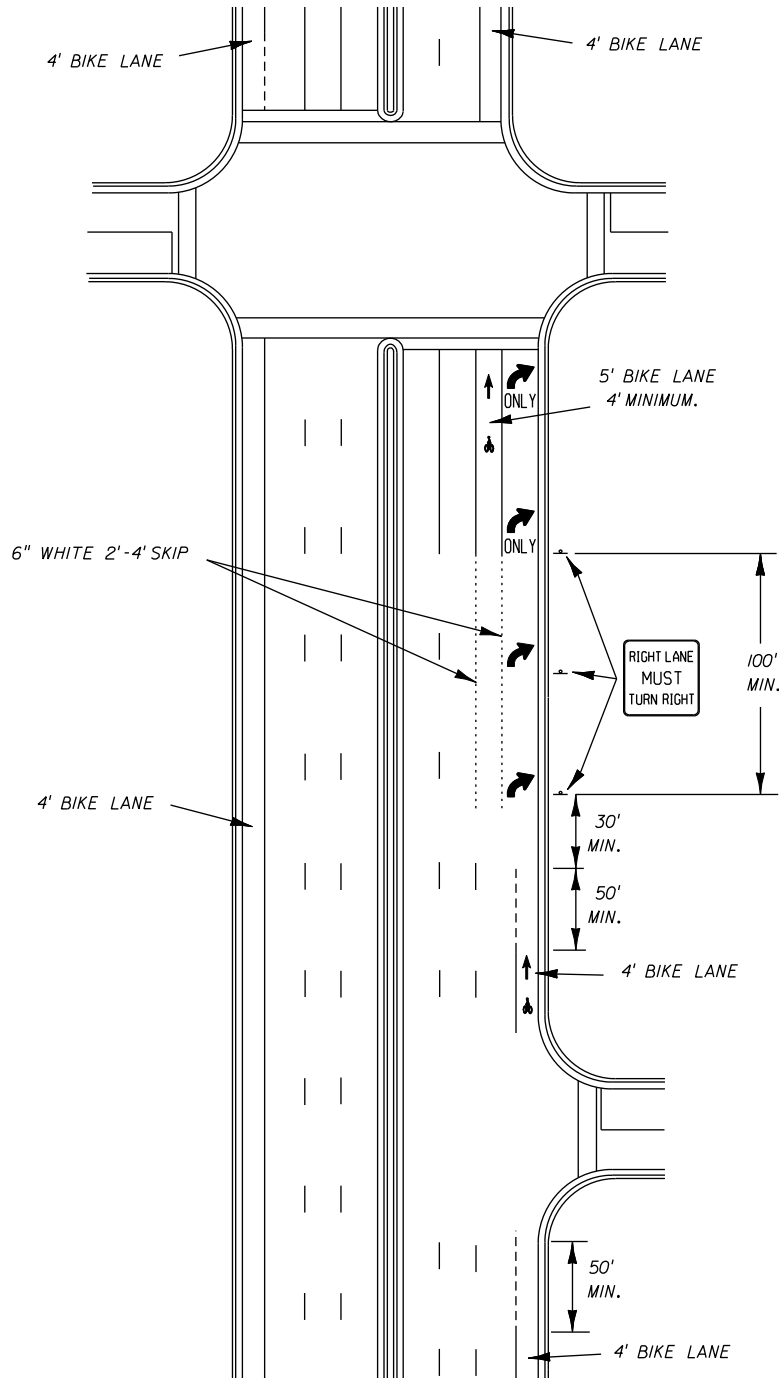
**FIGURE 9 – 7**  
**MAJOR WITH LOCAL STREET INTERSECTION DESIGNATED SHOULDER**  
**NO RIGHT TURN LANE RURAL TYPICAL SECTION (PAVED SHOULDER)**



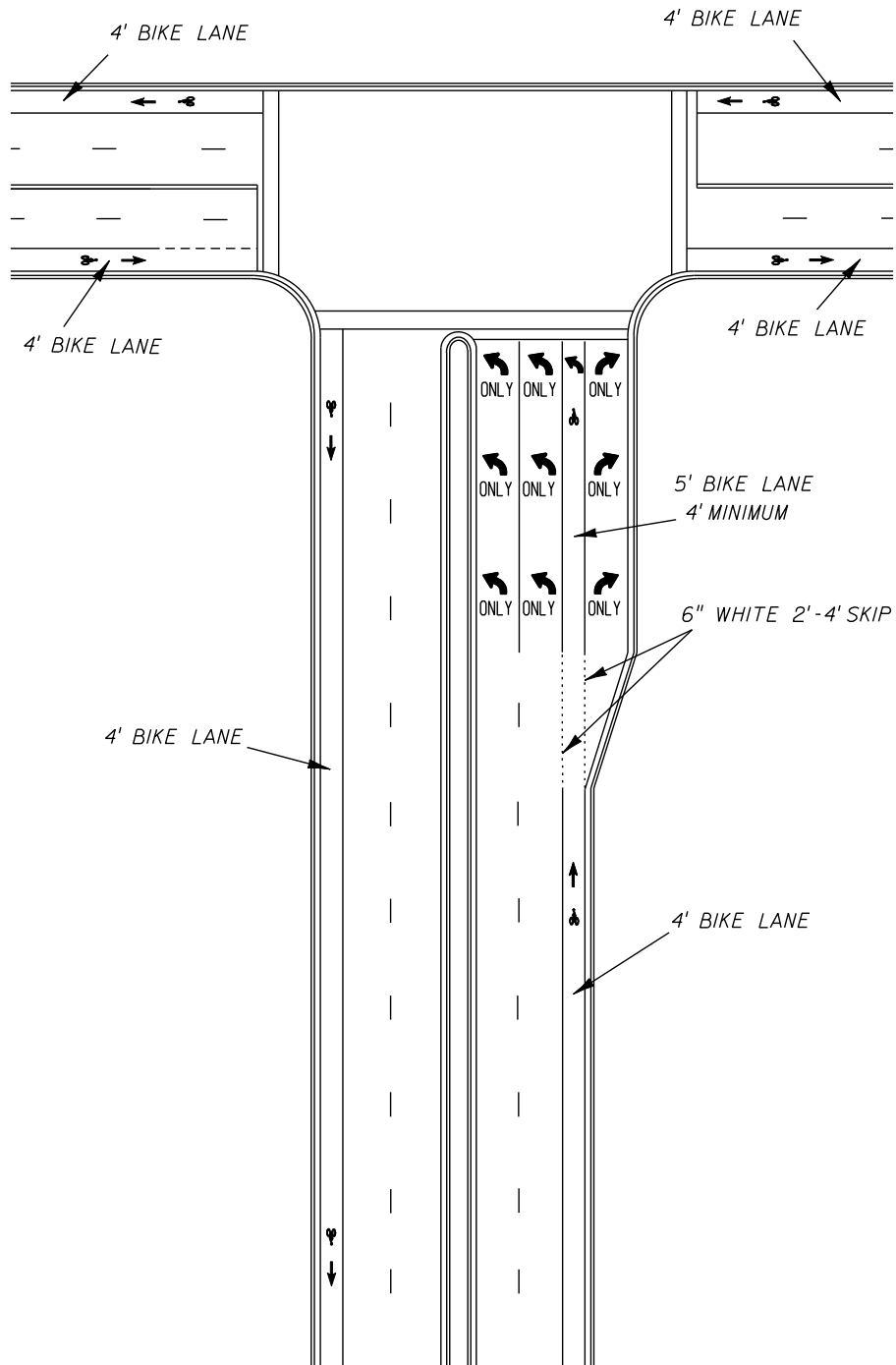
**FIGURE 9 – 8**  
**MAJOR INTERSECTION SEPARATE RIGHT TURN LANE 3' OR 4' UNDESIGNATED BIKE LANE URBAN TYPICAL SECTION (CURB AND GUTTER)**



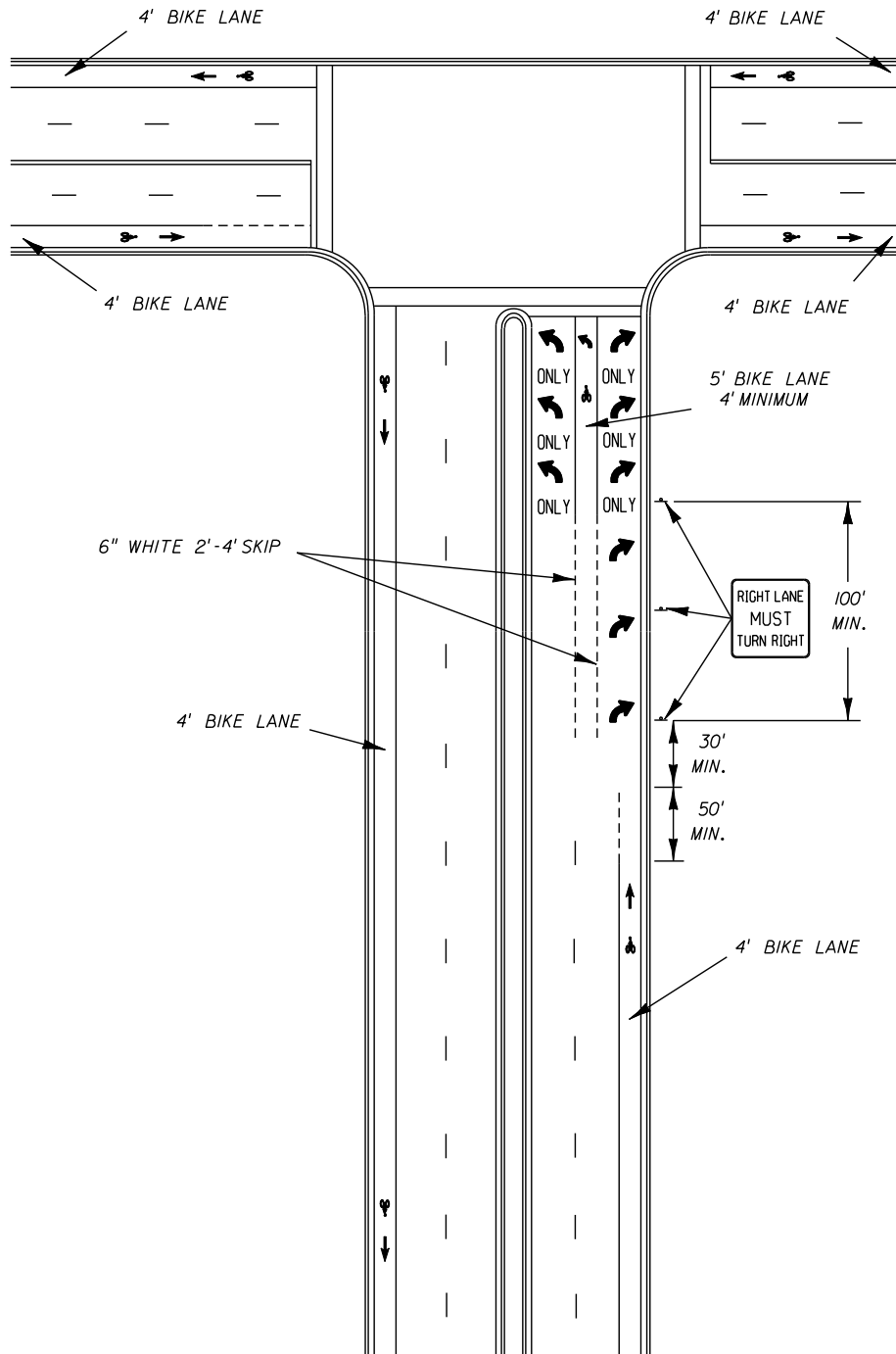
**FIGURE 9 – 9**  
**MAJOR INTERSECTION RIGHT TURN DROP LANE DESIGNATED OR**  
**UNDESIGNATED BIKE LANE URBAN TYPICAL SECTION (CURB AND GUTTER)**



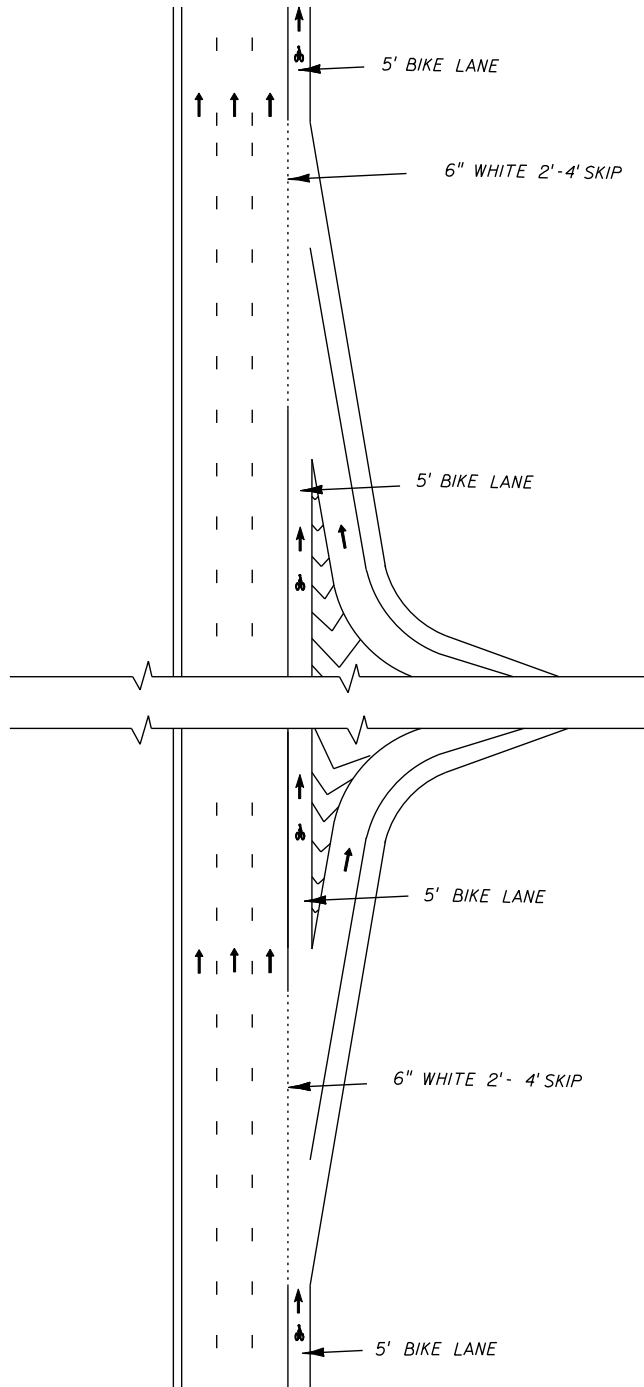
**FIGURE 9 – 10**  
**"TEE" INTERSECTION SEPARATE RIGHT TURN LANE**  
**URBAN TYPICAL SECTION (CURB AND GUTTER)**



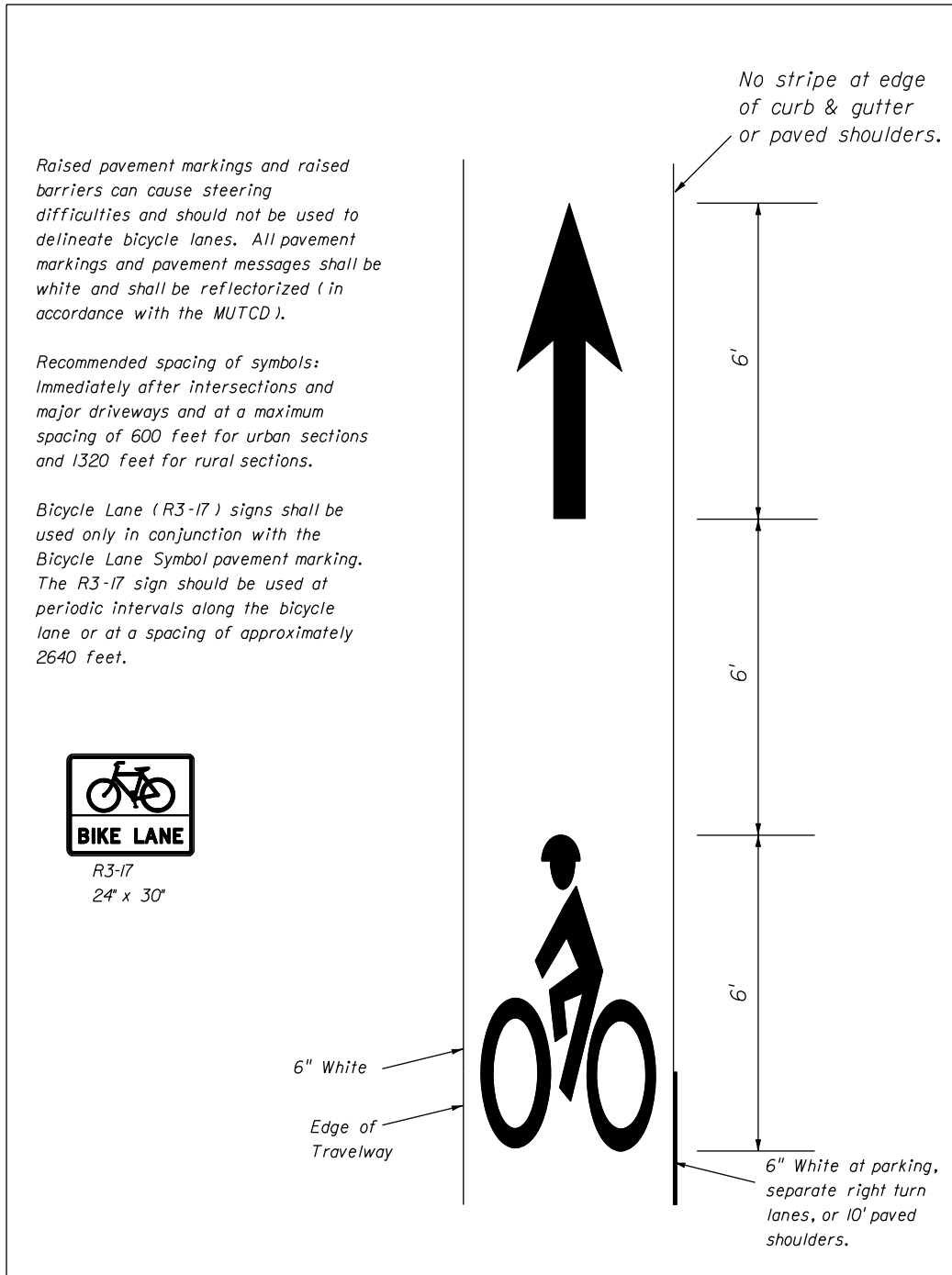
**FIGURE 9 – 11**  
**"TEE" INTERSECTION RIGHT TURN DROP LANE**  
**URBAN TYPICAL SECTION (CURB AND GUTTER)**



**FIGURE 9 – 12**  
**INTERCHANGE RAMP**  
**RURAL TYPICAL SECTION (PAVED SHOULDER)**



**FIGURE 9 – 13  
 DETAIL OF DESIGNATED BIKE  
 LANE AND BIKE SHOULDER MARKINGS**



**THIS PAGE INTENTIONALLY LEFT BLANK**