

## CHAPTER 2: PAVED SHOULDERS

### 2.1 General Purpose of Shoulders

Throughout Maryland, roadway shoulders may be constructed of any material from the same high grade paving as the roadway to unconsolidated aggregate. All shoulders add structural support to the traveled way (thus extending pavement life), provide part of the system to discharge rainwater, and increase the space between the traveled way and roadside obstacles. They are used by motorized vehicles for parking, emergency stopping, emergency maneuvers, and bypassing left turning vehicles. They also provide a place for bicycle travel outside the area used by motorized vehicles and a place for pedestrian travel where there is no sidewalk.

### 2.2 Interpretation of Maryland Code Related to Bicycling on Shoulders

According to §21-1205.1 of the Transportation Article, Annotated Code of Maryland, a person may not ride a bicycle on any roadway where the posted speed limit is greater than 50 MPH. Therefore, bicycles are prohibited on roads with posted speed limits of 55 MPH or higher unless there is a continuous paved shoulder or designated bicycle lane.

§21-1205.1 further stipulates that on any roadway where there is *a bike lane paved to a smooth surface or a shoulder paved to a smooth surface, a person operating a bicycle or a motor scooter shall use the bike lane or shoulder and may not ride on the roadway*. It goes on to enumerate the circumstances under which a bicyclist may ride outside of the shoulder. They are:

- When passing;
- When preparing for a left turn;
- In order to avoid debris or some other hazardous condition;
- When the continuity of the shoulder is broken by a turn lane.

In light of these provisions, it is imperative that smoothly paved shoulders be provided along Maryland's roads wherever possible. Any shoulder where a bicyclist is required to ride (**a mandatory use shoulder**) shall have the following characteristics:

- A surface constructed of either bituminous or Portland cement concrete;
- A smooth surface with *a texture equal to or better than the adjacent roadway*;
- A minimum width of four feet;
- Bicycle safe drainage grates and structures

### 2.3 Conflicts on Shoulders

The traditional arrangement of pavement markings at intersections can result in conflicts between motorists and bicyclists (see Figure 2.1). Chapter 3 of this manual, **Bike Lane Design**, provides guidance to address these conflicts.

Shoulders that end at an intersection give bicyclists no guidance on how to position themselves in order to avoid being cut-off by right-turning motorized vehicles. The striping pattern actually implies that the bicyclist does not have the right of way at the intersection.

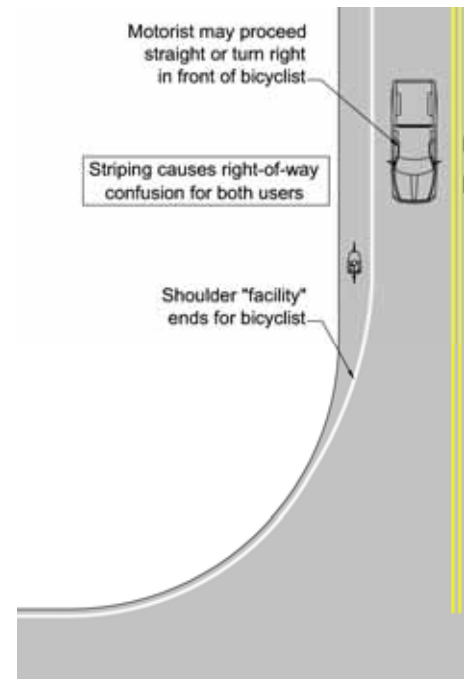
## 2.4 Shoulder Design for Bicycle Use

When designing shoulders for use by bicyclists, it is important to consider the conflicts that can occur when both motorized and non-motorized vehicles are using the same space. This section provides guidelines for the design of shoulders at and between intersections.

### Between Intersections

The preferred width of a paved shoulder intended for bicycle use depends on the speed and volume of traffic on the adjacent road. A roadway with operating speeds higher than 45 mph and volumes that exceed 10,000 vehicles per day should be a minimum of 5-foot wide, and may need to be 6-10 feet wide in locations with higher traffic volumes. In retrofit conditions, however, any additional width at the roadway edge is better than none at all. A shoulder may be striped as narrow as four feet on closed section roadways or as narrow as three feet on open section roadways. The shoulder must provide a minimum 3-foot smooth operating space, exclusive of the gutter pan, for a bicyclist to safely operate. On roadways where retrofitting shoulders would result in a paved shoulder that provides less than a 3-foot smooth surface, it is preferable to maintain a wide-outside lane (See Chapter 5 for further discussion).

In some retrofit locations, it may be possible to provide paved shoulders for bicycle use by reducing the width of existing travel lanes. This can serve to improve comfort level of bicyclist by increasing the degree of lateral separation between bicyclists and adjacent motor vehicle traffic (see Figure 2.2).



**Figure 2.1** – Problems caused when shoulder ends at intersection

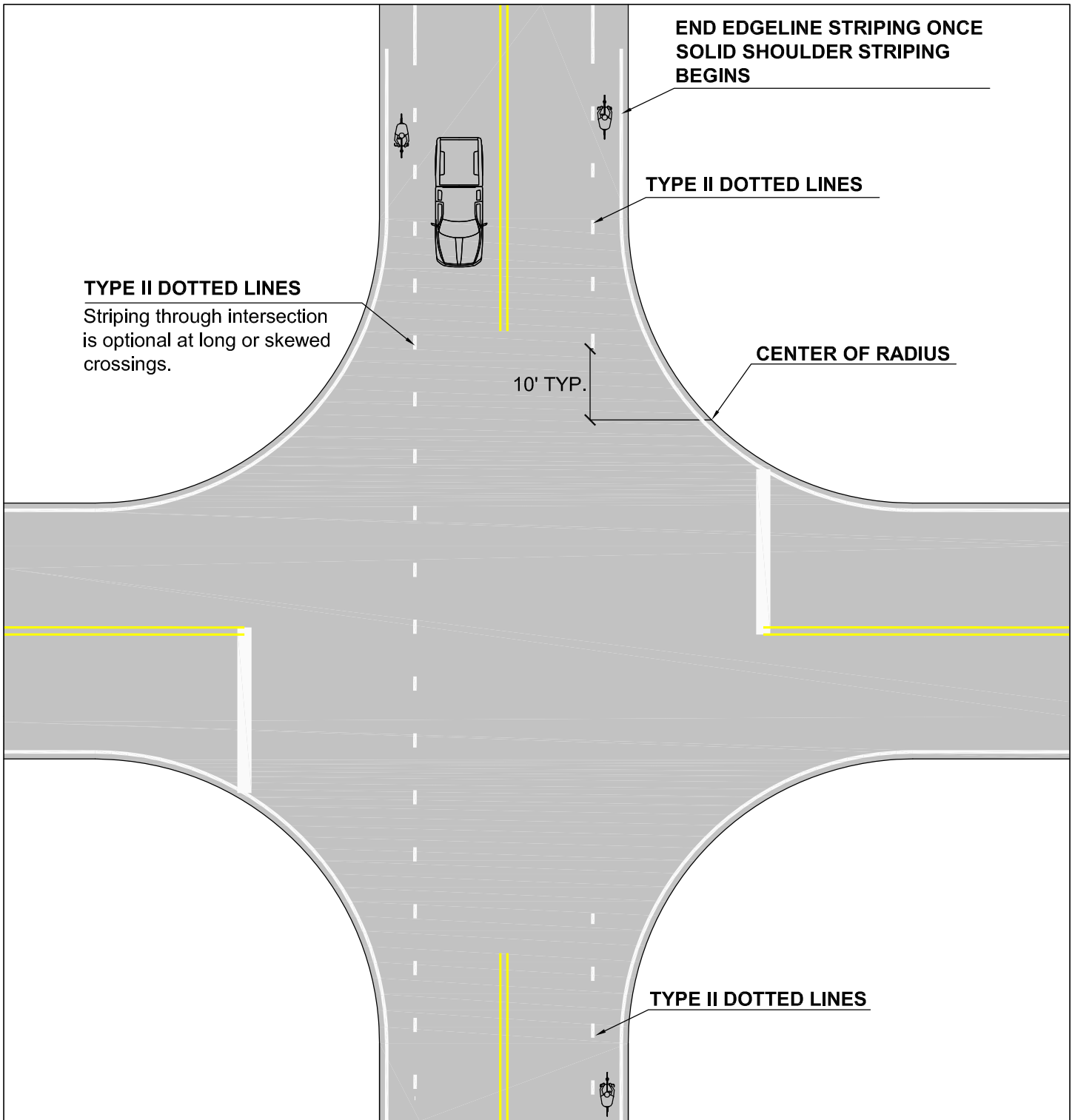


**Figure 2.2** - Example of roadway retrofit to provide additional shoulder space for bicycles (3' operating space, 1' gutter)

On roadways where bicyclists can be expected to frequently enter the traveled lane to avoid potentially hazardous conditions, SHARE THE ROAD warning signage should be provided (see Chapter 4).

### Intersections

Research has found that over 70 percent of bicyclist crashes occur at roadway or driveway intersections (Hunter et al, 1996 79). On roadways where bicycle use is expected and encouraged, shoulder striping should not taper to the curb at intersections. Figure 2.3 shows the preferred design for these intersections.



**DESIGN OF SHOULDERS AT INTERSECTIONS:**

- Shoulder striping should be dashed at intersections (as shown) on roadways designated as bicycle routes or in areas where bicycle use is common.
- The length of the dashing should correspond to the observed area of use by right turning motorists.
- It is preferable to stripe dedicated right turn lanes at locations with high volumes of right turning vehicles.
- Refer to pedestrian chapters of this manual for the design and configuration of all required pedestrian facilities

**Figure 2.3 - Striping of Shoulders at Intersections to Accommodate Bicycle Travel**

In locations with wide paved shoulders (i.e. 10 foot wide or more), where the shoulder is intended to serve as a right turn lane at intersections, the R4-4 BEGIN RIGHT TURN LANE YIELD TO BIKES sign may be used (See Figure 2.4).



**Figure 2.4** - R4-4 Sign.  
Source: MD MUTCD

In some cases, it is preferable to introduce bicycle lanes on approaches to intersections in which right-turn lanes eliminate the shoulder. This may require alterations to turn lane configurations, reductions in turn lane widths, and reduced bicycle lane widths (See Chapter 3).

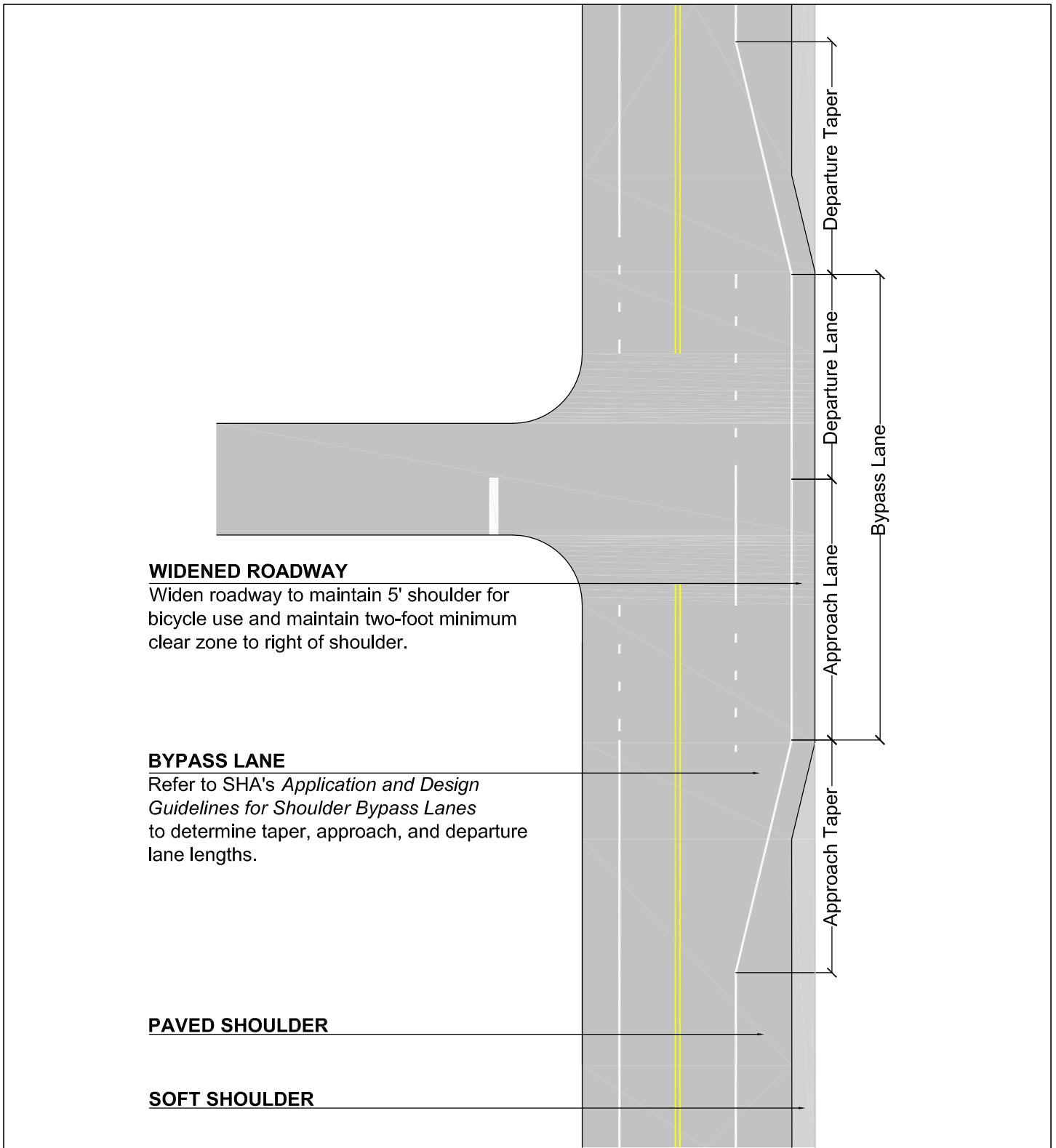
### Shoulder Bypass Lanes

Motorists commonly drive on shoulders when passing left turning vehicles, effectively using them as bypass lanes. Using warrants established in SHA's *Application and Design Guidelines for Shoulder Bypass Lanes*, some T-intersections have been restriped to facilitate this movement. On roadways where bicyclists are encouraged or expected to operate, careful consideration should be given to providing continuous shoulders that do not end at intersections. An example of the preferred bypass lane treatment is shown in Figure 2.6.

For locations where the roadway is posted at 55 mph or greater, the SHA bypass lane guidelines require the striping of a separate shoulder to maintain bicycle facility continuity.



**Figure 2.5** – Bypass lanes that eliminate the shoulder can impede bicycle travel  
Source: SHA's *Application and Design Guidelines for Shoulder Bypass Lanes*



**DESIGN OF SHOULDER BYPASS LANES FOR BICYCLE ACCOMMODATION:**

- For roadways with speed limits over 50 mph, a shoulder to the right of the bypass lane should be provided, otherwise bicycle access is severed and an appropriate engineering measure should be sought.
- Refer to pedestrian chapters of this manual for the design and configuration of all required pedestrian facilities.

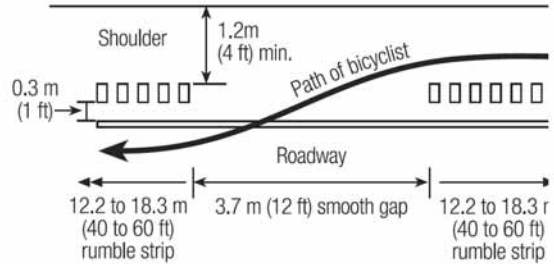
**Figure 2.6 - Bicycle Accommodation for Shoulder Bypass Lanes**

### 2.5 Shoulder Area Rumble Strips

Rumble strips provide a safe, inexpensive and efficient way to reduce run-off-road crashes for motorists on high 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, cyclists will be forced into the roadway requiring them to share the travel lane with motorists. If rumble strips are used on wide shoulders, their placement should be such that a minimum 4 foot wide space remains to their right throughout the corridor to accommodate bicycle access.

Where appropriate, periodic gaps should be provided in the rumble strips to accommodate left turning/merging movements and to enable bicyclists to avoid debris in the shoulder or to pass other bicyclists. Initial research indicates that a minimum opening of 12-feet should be considered to allow bicyclist to cross over without riding on the rumble strip. To allow for frequent opportunities for bicyclists to leave the shoulder area, the gap should be provided at regular intervals (such as every 40-80 feet), see Figure 2.7.



**Figure 2.7: Rumble Strip Pattern**  
 Source: VT Pedestrian and Bicycle Facility Planning and Design Manual

SHA's Bicycle and Pedestrian Coordinator should be consulted prior to the installation of rumble strips on roadways where cyclists are permitted.

### 2.6 Shoulder Edge Treatment

It is important to avoid sudden drop-offs at the edge of existing open sections of roadway (Figure 2.8) as they represent a hazard to 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 is anticipated, the edge of the pavement should be milled to a 45 degree angle.



**Figure 2.8 - Shoulder Drop Off**  
 Source: FHWA "Safety Edge" Brochure