



*A SunCam online continuing education course*

# Manual on Uniform Traffic Control Devices (MUTCD): Overview of Pavement Markings



by

Scott S. Washburn, Ph.D., P.E.

Leslie D. Washburn, P.E.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

**COURSE DESCRIPTION**

The Manual on Uniform Traffic Control Devices (MUTCD) (1) provides national standards and guidance with respect to location, shape, size, and color for roadway signs, markings, and signals. Such guidance and standards are intended to enhance transportation safety and efficiency and provide uniformity of such devices to drivers across the United States.

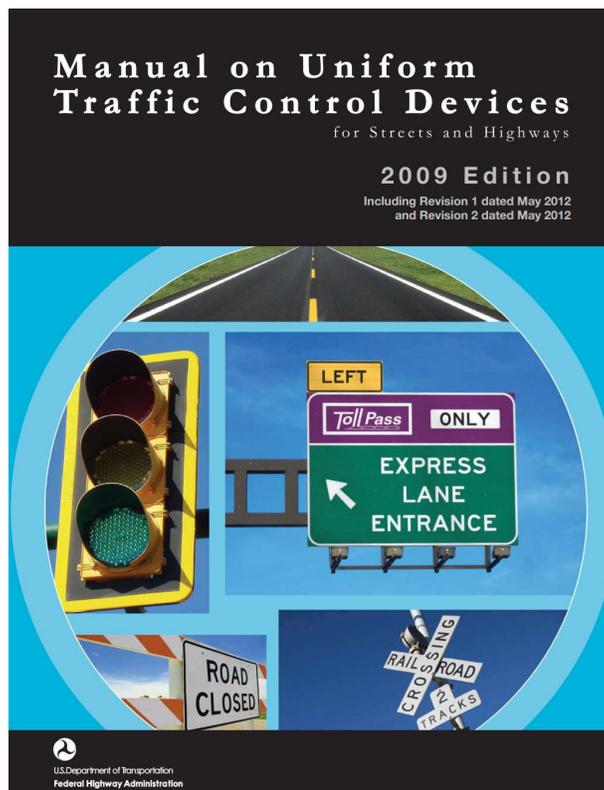


Figure 1. Manual on Uniform Traffic Control Devices 2009 Edition Cover

In this course, you will learn about:

- General guidelines for pavement markings
- Pavement marking functions and purposes
- Pavement marking types and designs

*Sources of artwork in this document: MUTCD 2009 Edition, denoted in figure caption; otherwise, Scott or Leslie Washburn. All photos taken by Scott or Leslie Washburn.*



MUTCD: Overview of Pavement Markings  
A SunCam online continuing education course

**Contents**

Course Description..... 2

Introduction and History ..... 6

    Definitions of Headings, Words, and Phrases in the MUTCD (Section 1A.13)..... 7

3A. General..... 8

    3A.01 Functions and Limitations ..... 8

    3A.02 Standardization of Application..... 8

    3A.03 Maintaining Minimum Pavement Marking Retroreflectivity..... 8

    3A.04 Materials ..... 8

    3A.05 Colors ..... 9

    3A.06 Function, Width, and Patterns of Longitudinal Pavement Markings ..... 12

3B. Pavement and Curb Markings ..... 13

    3B.01 Yellow Center Line Pavement Markings and Warrants ..... 13

    3B.04 White Lane Line Pavement Markings and Warrants..... 15

        Broken White Line ..... 15

        Solid White Line..... 16

        Dotted White Line ..... 18

    3B.06 Edge Line Pavement Markings & 3B.07 Warrants for Use of Edge Lines ..... 20

    3B.08 Extensions Through Intersections or Interchanges..... 20

    3B.11 Raised Pavement Markers-General ..... 22

    3B.13 Raised Pavement Markers Supplementing Other Markings..... 23

    3B.15 Transverse Markings ..... 24

    3B.16 Stop and Yield Lines ..... 25

    3B.18 Crosswalk Markings ..... 28

    3B.20 Pavement Word, Symbol and Arrow Markings ..... 30

    3B.24 Chevron and Diagonal Crosshatch Markings ..... 31

3C. Roundabout Markings ..... 33

3D. Markings for Preferential Lanes ..... 35

3E. Markings for Toll Plazas ..... 37

3F. Delineators ..... 38

3G. Colored Pavements ..... 41

3H. Channelizing Devices Used for Emphasis of Pavement Marking Patterns ..... 42

3I. Islands ..... 43

3J. Rumble Strip Markings ..... 45



MUTCD: Overview of Pavement Markings  
A SunCam online continuing education course

**List of Figures**

Figure 1. Manual on Uniform Traffic Control Devices 2009 Edition Cover ..... 2

Figure 2. Route shield markings at freeway junctions..... 12

Figure 3. Broken white line pavement..... 16

Figure 4. Solid white lane line ..... 17

Figure 5. Double solid white line..... 17

Figure 6. Dotted line deceleration lane ..... 18

Figure 7. Wide dotted line exit lane drop marking ..... 19

Figure 8. Dotted-edge lines extended through intersection ..... 21

Figure 9. Dotted-edge line for bike path across driveway access point..... 21

Figure 10. Bidirectional raised pavement marker depicting right and wrong directions of travel 22

Figure 11. Yellow double line markings with pairs of RPMs ..... 23

Figure 12. Stop line..... 25

Figure 13. Yield line ..... 26

Figure 14. Recommended yield line layouts (MUTCD Figure 3B-16) ..... 26

Figure 15. Transverse markings of stop line and crosswalk..... 27

Figure 16. Crosswalk marking..... 28

Figure 17. Examples of crosswalk markings (MUTCD Figure 3B-19)..... 29

Figure 18. Word and arrow pavement marking ..... 30

Figure 19. Chevron marking..... 32

Figure 20. Crosshatch marking ..... 32

Figure 21. Roundabout approach marking..... 33

Figure 22. Bicycle lane roundabout termination..... 34

Figure 23. HOV preferential lane marking ..... 36

Figure 24. Bike lane preferential lane marking ..... 36

Figure 25. Toll plaza (ETC) account-only lanes divided from cash payment lanes..... 37

Figure 26. Delineators..... 38

Figure 27. Truck escape ramp with red post-mounted delineators ..... 39

Figure 28. Examples of delineator placement (MUTCD Figure 3F-1) ..... 40

Figure 29. Yellow pavement color on raised median island separating traffic ..... 41

Figure 30. Center line channelizing devices ..... 42

Figure 31. Lane divide channelizing devices..... 43

Figure 32. Pedestrian median refuge ..... 44

Figure 33. Pedestrian detectable warning surfaces ..... 45

Figure 34. Longitudinal rumble strip with edge line not on rumble strip..... 46

Figure 35. Examples of longitudinal rumble strip markings (MUTCD Figure 3J-1.)..... 46



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

**List of Tables**

Table 1. MUTCD Chapter 3B section overview list.....	13
Table 2. Center line marking warrants.....	15
Table 3. Edge line warrant usage.....	20
Table 4. Word, symbol, and arrow markings use .....	31
Table 5. Preferential lane use lane markings .....	35



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

## INTRODUCTION AND HISTORY

With the arrival of the automobile, people and goods started to travel farther on roadways. In order to keep the automobile method of travel safe and efficient, traffic control devices were developed. A centerline pavement marking was first painted in Michigan in 1911 and the first stop sign was erected in Detroit in 1915. (2) Before long, a national need to standardize these devices led to the first edition of the Manual on Uniform Traffic Control Devices (MUTCD), published in 1935. Ten editions over 80 years followed as the dynamic document changed from research, implementation, and experiment. Traffic control devices today include signs, signals, markings, and other devices used to regulate, warn, or guide traffic, placed on, over, or adjacent to a street, highway, pedestrian facility, bikeway, or private road open to public travel (see definition in MUTCD Section 1A.13.) While private roadways are exempt from regulation by the MUTCD, it is recommended that its guidance be followed.

In accordance with 23 U.S.C. 109(d) and 402(a), the MUTCD is incorporated by reference in 23 Code of Federal Regulations (CFR), Part 655, Subpart F (3) and shall be recognized as the national standard for all traffic control devices and can be found on the U.S. Department of Transportation Federal Highway Administration website at [https://mutcd.fhwa.dot.gov/htm/2009r1r2/html\\_index.htm](https://mutcd.fhwa.dot.gov/htm/2009r1r2/html_index.htm). Since the MUTCD is a federal regulation, it has legal authority, which guides government agencies such as states, counties, and cities to prevent or limit liability in a crash. In 1979 the Federal Highway Administration (FHWA) took over management of the MUTCD and established a formal amendment process. The National Committee on Uniform Traffic Control Devices (4) advises the FHWA on the content of the MUTCD and its interpretation.

The manual is structured into nine parts:

- Part 1. General
- Part 2. Signs
- Part 3. Markings
- Part 4. Highway Traffic Signals
- Part 5. Traffic Control Devices for Low-Volume Roads
- Part 6. Temporary Traffic Control
- Part 7. Traffic Control for School Areas
- Part 8. Traffic Control for Railroad and Light Rail Transit Grade Crossings
- Part 9. Traffic Control for Bicycle Facilities



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

This course focuses on Part 3 Markings. Also available is the course “Manual on Uniform Traffic Control Devices (MUTCD): Introduction and Overview of Signs.”

**Definitions of Headings, Words, and Phrases in the MUTCD (Section 1A.13)**

Text headings in the MUTCD have specific meaning based on the following wording:

**Standard (Shall)**—is a standard statement that is required, mandatory or a specifically prohibitive practice typically using the verb shall. The verbs “should” and “may” are not used in standard statements. All standard statements are labeled, and the text appears in bold type.

**Guidance (Should)**—is a guidance statement of recommendation, but not mandatory, practice in typical situations, with deviations allowed if justified by engineering judgment or study typically using the verb should. The verbs “shall” and “may” are not used in guidance statements.

**Option (May)**—is a statement of practice that is a permissive condition and carries no requirement or recommendation typically using the verb may. Option statements sometime contain allowable modifications to a standard or guidance statement. The verbs “shall” and “should” are not used in option statements.

**Support**—a support statement is informational and does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. The verbs “shall,” “should,” and “may” are not used in support statements.



MUTCD: Overview of Pavement Markings  
A SunCam online continuing education course

**3A. GENERAL**

**3A.01 Functions and Limitations**

Markings provide a definite and important function to perform in a proper scheme of traffic control. Sometimes they are used to supplement the regulations or warnings of other devices such as signs or signals. Other times they are used alone to produce results that cannot be obtained by the use of any other device. Markings have the advantage of conveying warnings or information to the driver without diverting his/her attention from the roadway.

Pavement markings have definite limitations. They might not be clearly visible when wet, can be fully obscured by snow, and may not be very durable when subjected to heavy traffic.

- |                      |
|----------------------|
| Marking types:       |
| Pavement             |
| Curb                 |
| Object               |
| Delineators          |
| Colored Pavements    |
| Barricades           |
| Channelizing Devices |
| Islands              |

**3A.02 Standardization of Application**

All necessary markings should be in place before a facility is opened. Markings no longer applicable and which may create confusion in the mind of the motorist shall be removed or wiped out as soon as practicable. Markings required by road conditions or restrictions should be removed or destroyed when those conditions cease to exist or the restrictions are withdrawn. Markings that must be visible at night shall be reflectorized unless ambient illumination assures adequate visibility. All markings on Interstate highways shall be retroreflective.

**3A.03 Maintaining Minimum Pavement Marking Retroreflectivity**

This section is currently empty but reserved for future use in the MUTCD.

**3A.04 Materials**

Typically, the material used for markings is paint and thermoplastics for pavement and curbs. Raised pavement markers and colored pavements are also common. Marking material used near pedestrian or bicycle activity should not present tripping or loss of traction hazards. Object markers and delineators should not present a vertical or horizontal clearance obstacle for pedestrians.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

**3A.05 Colors**

The colors for markings shall be yellow, white, red, blue, or purple—the highway standard colors. Black may be used in combination with yellow, white, red, blue, or purple when a light-colored pavement does not provide enough contrast with markings of the standard colors alone.

***Yellow***

<p>Delineate longitudinal lines for:</p> <ul style="list-style-type: none"> <li>• separation of traffic travel in opposite directions,</li> <li>• the left-edge of a divided highway, one-way street and ramp, or</li> <li>• differentiate two-way left-turn lanes and reversible lanes from other lanes</li> </ul>	
---	---

***White***

<p>Delineate longitudinal lines separating traffic flow in the same direction or the right edge of the roadway</p>	
--	--

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

**Red**

Used for raised pavement markings or delineators for truck escape ramps or one-way roadways, ramps, or travel lanes that shall not be entered



**Blue**

Used only to supplement white markings for handicap parking spaces



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

**Purple**

Shall supplement lane-line or edge-line markings for toll plaza approach lanes



**Black**

Black may be used in combination with the colors above but is not considered a marking color. Black is used for contrast.



Official route shield markings on the pavement may be used if they replicate the same color scheme as the shield roadway signs as shown in Figure 2.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 2. Route shield markings at freeway junctions

### 3A.06 Function, Width, and Patterns of Longitudinal Pavement Markings

Longitudinal pavement markings typically run parallel to traffic and provide guidance to roadway users. They shall conform to the following basic functions:

- Broken lines are permissive in character (e.g., a lane change across the line is allowed)
- Dotted lines provide guidance or warning of a downstream change in lane function (e.g., a bicycle lane ending)
- Solid lines are restrictive in character (e.g., a lane change across the line is not allowed)
- Double lines indicate maximum or special restrictions (e.g., a buffer between an automobile lane and a bicycle lane)

Widths and patterns shall be:

- A normal line is 4 in to 6 in wide.
- A wide line is at least twice the width of a normal line.
- A double line consists of two normal lines separated by a discernible space.
- A broken line consists of normal line segments separated by gaps.
- A dotted line shall consist of noticeably shorter line segments separated by shorter gaps than those used for a broken line. The width of a dotted line shall be at least the same as the width of the line it extends. (I)



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3B. PAVEMENT AND CURB MARKINGS

Table 1 includes a comprehensive list of all the sections from Chapter 3B of the MUTCD. As this course is an overview, not all sections are covered. Gray shading indicates the subject is not covered and reader is instead referred to the MUTCD for this content.

**Table 1. MUTCD Chapter 3B section overview list**

3B.01 Yellow Center Line Pavement Markings and Warrants
3B.02 No-Passing Zone Pavement Markings and Warrants
3B.03 Other Yellow Longitudinal Pavement Markings
3B.04 White Lane Line Pavement Markings and Warrants
3B.05 Other White Longitudinal Pavement Markings
3B.06 Edge Line Pavement Markings
3B.07 Warrants for Use of Edge Lines
3B.08 Extensions Through Intersections or Interchanges
3B.09 Lane-Reduction Transition Markings
3B.10 Approach Markings for Obstructions
3B.11 Raised Pavement Markers-General
3B.12 Raised Pavement Markers as Vehicle Positioning Guides with Other Longitudinal Markings
3B.13 Raised Pavement Markings Supplementing Other Markings
3B.14 Raised Pavement Parkers Substituting for Pavement Markings
3B.15 Traverse Markings
3B.16 Stop and Yield Lines
3B.17 Do Not Block Interection Markings
3B.18 Crosswalk Markings
3B.19 Parking Space Markings
3B.20 Pavement Word, Symbol, and Arrow Markings
3B.21 Speed Measurement Markings
3B.22 Speed Reduction Markings
3B.23 Curb Markings
3B.24 Chevron and Diagonal Crosshatch Markings
3B.25 Speed Hump Markings
3B.26 Advance Speed Hump Markings

#### 3B.01 Yellow Center Line Pavement Markings and Warrants

The center-line pavement marking separating traffic traveling in opposite directions shall be yellow and may be placed in a location other than the geometric center of the roadway.

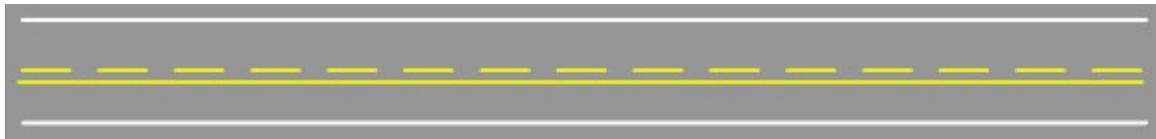
MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

For a two-lane and two-way roadway the following conditions shall be met (1).

1. Two-direction passing zone markings consisting of a normal broken yellow line where crossing the center line markings for passing with care is permitted for traffic traveling in either direction.



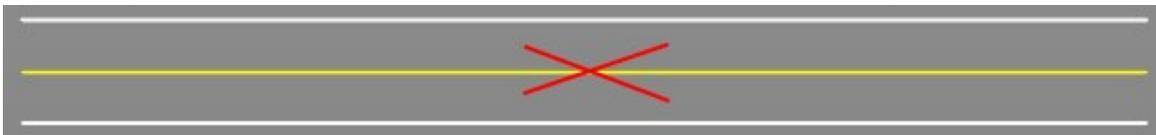
2. One-direction no-passing zone markings consisting of a double yellow line, one of which is a normal broken yellow line and the other is a normal solid yellow line, where crossing the center line markings for passing with care is permitted for the traffic traveling adjacent to the broken line, but is prohibited for traffic traveling adjacent to the solid line.



3. Two-direction no-passing zone markings consisting of two normal solid yellow lines where crossing the center line markings for passing is prohibited for traffic traveling in either direction.



4. A single solid yellow line shall not be used as a center line marking on a two-way roadway.



Undivided two-way roadways with four or more lanes shall have double yellow lines for a center line indicating a two-direction no-passing zone.

Center line markings shall, should, or may be placed on pavement according to the guidelines in Table 2. If average daily traffic (ADT) counts are not available, then engineering judgement should be used.



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

Table 2. Center line marking warrants

Roadway	Shall	Should
Paved urban arterials and collectors	Traveled way of 20 feet or more and an ADT of 6,000 veh/day or greater	Traveled way of 20 feet or more and an ADT of 4,000 veh/day or greater
Paved two-way streets or highways	Three or more lanes	
Rural arterial and collectors		Traveled way of 18 feet or more and an ADT of 3,000 veh/day or greater

Two-way traveled ways that are 16 feet or more may have a center line marking. When less than 16 feet, engineering judgement must take into consideration traffic encroachment from such things as parked vehicles and encroachment on traffic in the opposing traffic lane. Center line markings should also be used when an engineering study indicates one is needed.

### 3B.04 White Lane Line Pavement Markings and Warrants

White lane lines shall delineate lanes for traffic moving in the same direction and shall be used on all freeways and interstate highways. There are three different types of white lane lines:

1. broken
2. solid
3. dotted

#### Broken White Line

A broken white-line pavement marking shall be used where crossing lane-line markers is permitted with care (see Figure 3).

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 3. Broken white line pavement

### Solid White Line

There are two conditions where a solid white line shall be used:

- a single white line where traffic is discouraged from crossing into another lane, as shown in Figure 4, and
- a double white line where traffic is prohibited from crossing into another lane, as shown in Figure 5.

A solid white line should be used on approaches to intersections to separate a through lane from an added mandatory turn lane.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 4. Solid white lane line



Figure 5. Double solid white line

MUTCD: Overview of Pavement Markings  
 A SunCam online continuing education course

A solid white line may be used:

- to separate through traffic lanes from auxiliary lanes, such as an a truck climbing lane or a preferential lane (see section 3D),
- to replace a portion of, but not all of the length of the wide dotted white lane line in the case of a lane drop at an exit ramp or intersection,
- to separate adjacent through lanes or adjacent mandatory turn lanes from each other on approaches to intersections, and
- to form channelizing islands where the median width allows the left-turn lanes to be separated from the through lanes to give drivers on opposing approaches a less obstructed view of opposing through traffic.

A normal width or wide (dimensions provided in section 3A.06) solid white lane line may extend upstream from an intersection where lane changes might cause a conflict. A wide solid white line may be used where it is intended to discourage lane changing on the approach to an exit ramp. A wide solid white line may also be used where greater emphasis is desired.

#### Dotted White Line

“A dotted white line marking shall be used as the lane line to separate a through lane that continues beyond the interchange or intersection from an adjacent lane for any of the following conditions:

- A. deceleration or acceleration lane (example in Figure 6),
- B. a through lane that becomes a mandatory exit or turn lane,
- C. an auxiliary lane 2 miles or less in length between an entrance ramp and an exit ramp, and
- D. an auxiliary lane 1 mile or less in length between two adjacent intersections.” (I)

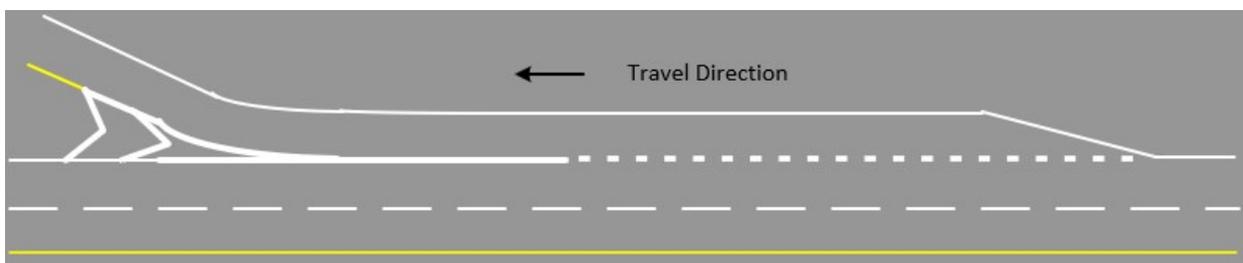


Figure 6. Dotted line deceleration lane

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

*Normal Width Dotted White Line*

Normal dotted white line markings shall be used in the following two situations.

1. For exit ramps with a parallel deceleration lane, a normal width dotted white lane line shall be installed from the upstream end of the full-width deceleration lane to the theoretical gore or to the upstream end of a solid white lane line, if used, that extends upstream from the theoretical gore
2. For entrance ramps with a parallel acceleration lane, a normal width dotted white lane line shall be installed from the theoretical gore or from the downstream end of a solid white lane line, if used, that extends downstream from the theoretical gore, to a point at least one-half the distance from the theoretical gore to the downstream end of the acceleration taper.

A normal width dotted white lane line may be used under several other conditions as well—refer to the MUTCD for more information.

*Wide Dotted White Line*

“A wide dotted white lane line shall be used:

- A. as a lane drop marking in advance of lane drops at exit ramps to distinguish a lane drop from a normal exit ramp (example in Figure 7),
- B. in advance of freeway route splits with dedicated lanes,
- C. to separate a through lane that continues beyond an interchange from an adjacent auxiliary lane between 1 an entrance ramp and an exit ramp,
- D. as a lane drop marking in advance of lane drops at intersections to distinguish a lane drop from an intersection through lane, and
- E. to separate a through lane that continues beyond an intersection from an adjacent auxiliary lane between two intersections.” (I)

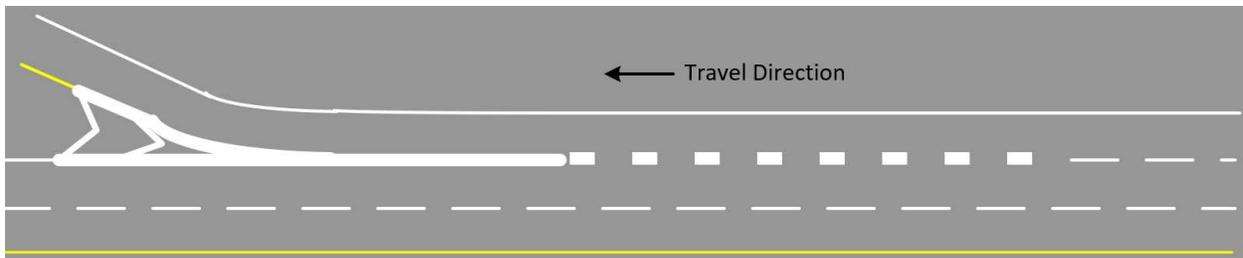


Figure 7. Wide dotted line exit lane drop marking

Many white lane line scenario examples are illustrated in section 3B-04 of the MUTCD.



MUTCD: Overview of Pavement Markings  
A SunCam online continuing education course

**3B.06 Edge Line Pavement Markings & 3B.07 Warrants for Use of Edge Lines**

Edge-line pavement markings shall delineate the right and left edges of roadways, as a guide to help roadway users during difficult visibility conditions. A solid yellow line shall be used to delineate the left edge of a divided highway, one-way street, any ramp in the direction of travel, or to identify driving or passing restrictions to the left of the yellow line. A solid white line shall be used to delineate the far right edge of the roadway. Warrant conditions for edge-line applications are listed in Table 3.

Table 3. Edge line warrant usage

Shall	Should	May
Freeways (a divided highway with full control of access)	Be placed where engineering study indicates a need	Be placed on streets and highways with or without center line markings
Expressways (a divided highway with partial control of access)	Not be placed where engineering study determines it would decrease safety	Be excluded from streets and highways based on engineering judgment
Rural arterial with traveled way of 20 feet or more in width and ADT of 6,000 veh/day or greater	Rural arterial with traveled way of 20 feet or more in width and ADT of 3,000 veh/day or greater	be used where edge delineation is desirable to minimize unnecessary driving on paved shoulders

**3B.08 Extensions Through Intersections or Interchanges**

Solid lines shall not be used through intersections or major driveways, but dotted-edge line extensions may be used. Dotted-edge lines that extend through intersections (as shown Figure 8) and major driveways (as shown in Figure 9) shall remain the same color and width as the lines they connect.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 8. Dotted-edge lines extended through intersection



Figure 9. Dotted-edge line for bike path across driveway access point

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3B.11 Raised Pavement Markers-General

The casing of raised pavement markers (RPMs) shall, in daylight and nighttime conditions, be the color of the marking they are being used to substitute for or supplement. To display the applicable color for the direction of travel, raised pavement markers can be mono-directional or bidirectional. The side of a raised pavement marker that is visible to traffic proceeding in the wrong direction may be red, as shown in Figure 10. All internally illuminated markers must be steadily illuminated and not flash when used.

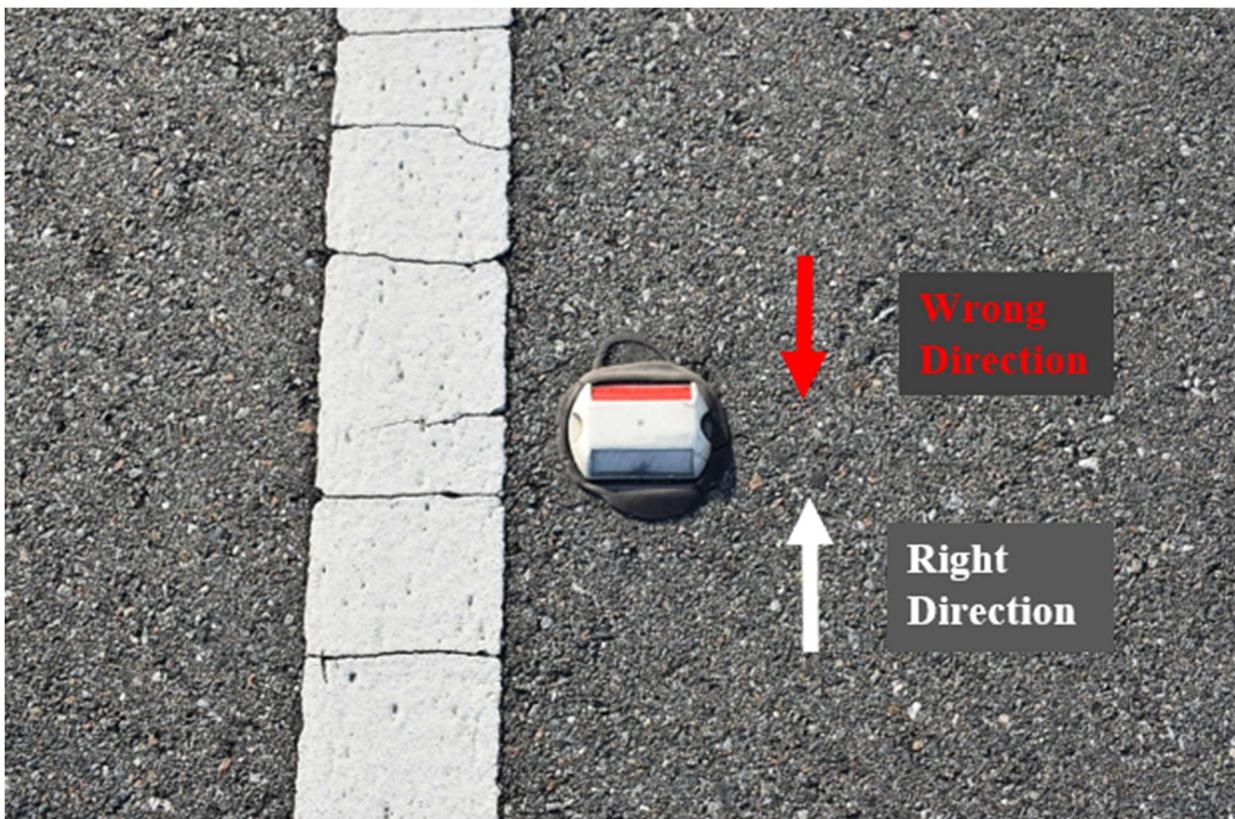


Figure 10. Bidirectional raised pavement marker depicting right and wrong directions of travel

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3B.13 Raised Pavement Markers Supplementing Other Markings

Supplementing longitudinal line markings with retroreflective or internally illuminated RPMs should comply with the following lateral positioning.

1. “When supplementing double line markings, pairs of raised pavement markers placed laterally in line with or immediately outside of the two lines should be used, as shown in Figure 11.
2. When supplementing wide line markings, pairs of raised pavement markers placed laterally adjacent to each other should be used.” (1)



Figure 11. Yellow double line markings with pairs of RPMs



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

The longitudinal spacing of raised pavement markers ( $N$ ) shall equal the length of one line segment plus one gap of the broken lines used on the highway.

1. When supplementing solid line markings, RPMs should be spaced no greater than  $N$ , except when supplementing channelizing lines or edge line markings, then a spacing of no greater than  $0.5N$  should be used.
2. When supplementing broken line markings, RPMs should be spaced no greater than  $3N$ . However, when supplementing broken line markings that identify reversible lanes, a spacing of no greater than  $N$  should be used.
3. When supplementing dotted lane line markings, a spacing appropriate for the application should be used.
4. When supplementing longitudinal line extension markings through at-grade intersections, one RPM for each short line segment should be used.
5. When supplementing line extensions through freeway interchanges, RPMs should be spaced no greater than  $N$ . (*I*)

### **3B.15 Transverse Markings**

Transverse markings are markings that typically run perpendicular or cross direction to the travel direction. They shall be white, unless otherwise provided in the MUTCD. Transverse markings include but are not limited to:

- Shoulder markings,
- Stop and yield lines,
- Crosswalk lines,
- Parking space markings,
- Word, symbol, and arrow markings,
- Speed measurement and reduction markings, and
- Speed hump markings.

Several of these items are discussed in the following sections, 3B.16, 3B.18 - 3B.20.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3B.16 Stop and Yield Lines

Stop and yield lines are transverse pavement markings that let the driver know where to stop or yield at an intersection or a crosswalk. They are typically white and perpendicular to the travel path, such as the stop line shown in Figure 12.



Figure 12. Stop line

Stop lines shall be a solid white line extending across the approach lanes and should be 12 to 24 inches wide. Stop lines at midblock signalized locations should be placed at least 40 feet in advance of the nearest signal indication.

Yield lines shall be a row of solid white isosceles triangles pointing toward the approaching vehicles and extending across the approaching lanes, as shown in Figure 13. The required dimensions are illustrated in Figure 14. Yield lines are typically used at an intersection or roundabout controlled by a yield sign. Yield lines shall not be used where the roadway user is required to stop.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 13. Yield line

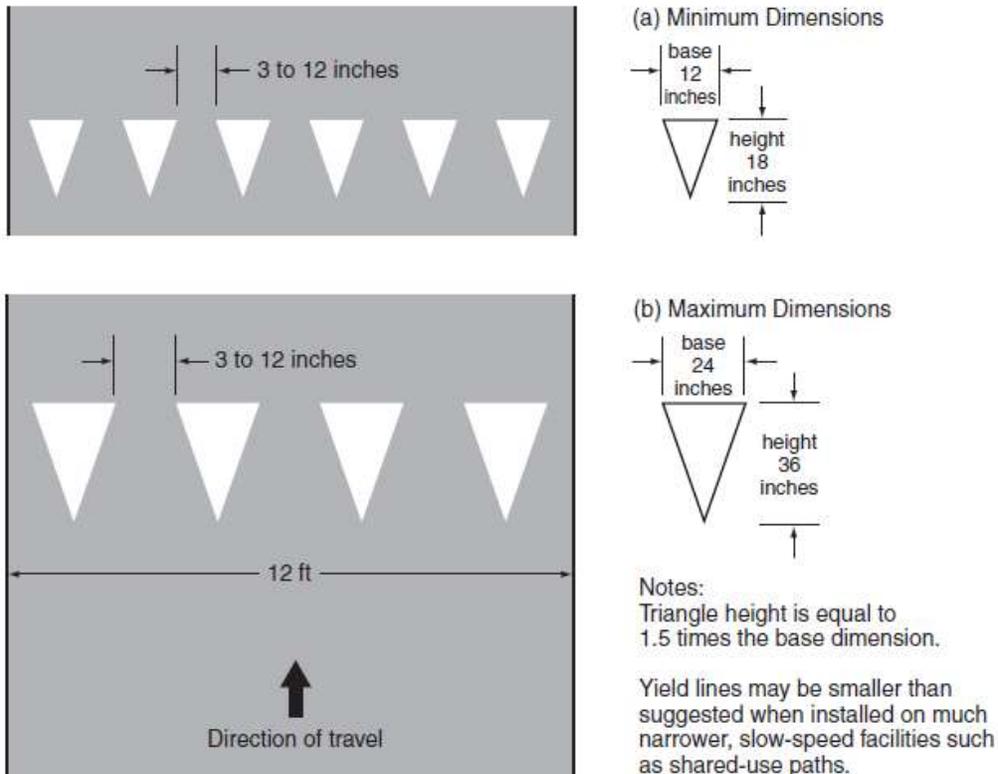


Figure 14. Recommended yield line layouts (MUTCD Figure 3B-16)

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

Stop and yield lines should be placed a minimum of 4 feet in advance of the nearest crosswalk line at controlled intersections (see example in Figure 15), except for yield lines at roundabouts as provided for in Section 3C.04 and at midblock crosswalks. In the absence of a marked crosswalk, the stop line or yield line should be placed at the desired stopping or yielding point but should not be placed less than 4 feet or more than 30 feet from the nearest edge of the intersecting traveled way.



Figure 15. Transverse markings of stop line and crosswalk

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3B.18 Crosswalk Markings

Crosswalk markings identify designated pedestrian crossing locations to roadway users, as demonstrated in Figure 16. Crosswalk lines shall be solid white lines not less than 6 inches or greater than 24 inches wide. To discourage diagonal walking between crosswalks, crosswalk markings should extend across the full width of pavement or to the edge of the intersecting crosswalk.



Figure 16. Crosswalk marking

If transverse lines are used to mark a crosswalk (see crosswalks [a] and [b] of Figure 17), the gap between the lines should not be less than 6 feet. If diagonal (see crosswalk [b] of Figure 17) or longitudinal lines (see crosswalk [c] of Figure 17) are used without transverse lines to mark a crosswalk, the crosswalk should be not less than 6 feet wide.

MUTCD: Overview of Pavement Markings  
 A SunCam online continuing education course

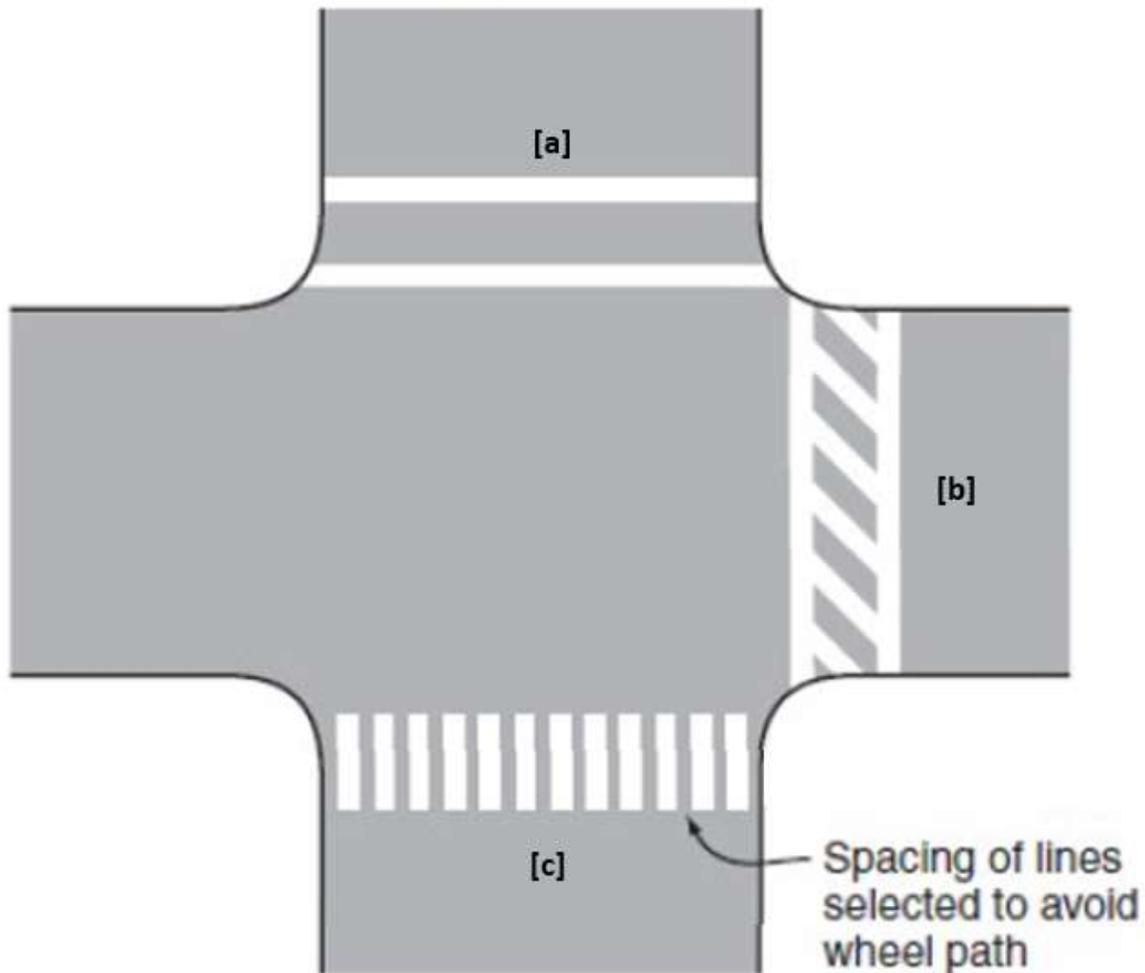


Figure 17. Examples of crosswalk markings (MUTCD Figure 3B-19)

In locations with traffic control signals or stop or yield signs, crosswalk lines should be installed as directed by engineering judgement for best pedestrian use. However, in a location without a traffic control signal or stop or yield sign, an engineering study should be conducted. Crosswalks should not be installed across uncontrolled roadways where the posted speed limit exceeds 40 mi/h, as well as when:

- “A. The roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater: or
- B. The roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT of 15,000 vehicles per day or greater.” (1)

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

**3B.20 Pavement Word, Symbol and Arrow Markings**

“Word, symbol, and arrow markings on the pavement are used for the purpose of guiding, warning, or regulating traffic. These pavement markings can be helpful to road users in some locations by supplementing signs and providing additional emphasis for important regulatory, warning, or guidance messages, because the markings do not require diversion of the road user’s attention from the roadway surface. Symbol messages are preferable to word messages.” (1) Figure 18 provides an example of regulatory left-turn-only pavement wording and symbol marking.



Figure 18. Word and arrow pavement marking

Words, symbols, and arrow markings shall be white in color. Letters and numbers should be 6 feet or more in height and words and symbols should not exceed three lines of information. Word messages should read in the direction of travel, e.g., with STOP AHEAD a driver passes over ‘STOP’ before ‘AHEAD’. Word, symbol, and arrow markings may be used as outlined in Table 4.



MUTCD: Overview of Pavement Markings  
A SunCam online continuing education course

Table 4. Word, symbol, and arrow markings use

Regulatory	Warning	Guide
1. STOP	1. STOP AHEAD	1. Route numbers (route shield pavement marking symbols)
2. YIELD	2. YIELD AHEAD	2. Cardinal directions (NORTH, SOUTH, EAST, or WEST)
3. RIGHT (LEFT) TURN ONLY	3. YIELD AHEAD triangle symbol (see MUTCD Figure 3B-26)	3. TO
4. 25 MPH	4. SCHOOL AHEAD	4. Destination names or abbreviations thereof
5. Lane-use and wrong-way arrows	5. SIGNAL AHEAD	
6. Diamond symbol for HOV lanes	6. PED XING	
7. Other preferential lane word markings	7. SCHOOL	
	8. RXR	
	9. BUMP	
	10. HUMP	
	11. Lane-reduction arrows	

### 3B.24 Chevron and Diagonal Crosshatch Markings

Chevron and diagonal crosshatch markings are utilized in many situations to discourage roadway users from traveling in paved areas. Chevron and diagonal crosshatch marking applications:

- Shoulders,
- Gore areas,
- Flush median areas between solid double yellow line marking,
- Between white channelizing lines approaching obstructions in roadway,
- Between solid double yellow center line markings forming flush medians or channelized travel paths at intersections,
- Buffer space between preferential lanes and general-purpose lanes, and
- Grade crossings.

Chevrons shall be white and point toward approaching traffic in paved areas separating traffic flow in the same direction as shown in Figure 19. Crosshatch markings shall be yellow and slant away from traffic flow in adjacent travel lanes, as shown in Figure 20.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 19. Chevron marking



Figure 20. Crosshatch marking

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

Paved shoulder diagonal crosshatch markings shall be slanted away from traffic in the adjacent travel lane. The markings shall be yellow for left-hand shoulders of divided highways and one-way streets or ramps. The markings shall be white for right-hand shoulders.

### 3C. ROUNDABOUT MARKINGS

Roundabouts are a circular patterned intersection designed to control speed with specific traffic control features. Pavement markings and signs should correspond and be compatible with the geometric design to provide a consistent message to the roadway user. A user should not need to change lanes within the roundabout to exit the roundabout in the same direction. Multi-lane roundabouts should have lane line markings for approaching roadways to channelize traffic to, through, and exiting the roundabout. Figures 3C-3 through 3C-14 in the MUTCD can be referred to for several examples of roundabout markings.



Figure 21. Roundabout approach marking

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

White lane line pavement markings shall be used for multi-lane approaches and within the roundabout to channelize travel to the exit lanes. A white edge line pavement marking should be used on the outer side (right) of the circulatory roadway and should be solid adjacent to the entry splitter island and a wide dotted line across the lanes entering the roundabout. Edge lines and edge line extensions shall not be placed across the exit legs from the circulatory roadway.

A yellow edge line may be placed on the inner (left) side of the circulatory roadway and used to channelize traffic. A yield line may be used to identify the location a vehicle should yield on the entrance leg before entering the roundabout. A yield line is not required because a yield sign is required for entrance to a roundabout (see section 3B.08 of MUTCD). Pedestrian crosswalks shall not be marked to or from the central island of roundabouts. Bicycle lanes shall not be provided in a roundabout and must be terminated at least 100 feet prior to the roundabout crosswalk (see section 9C.04 or MUTCD). Figure 22 shows an example of a bike lane terminating prior to roundabout entry.



Figure 22. Bicycle lane roundabout termination



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3D. MARKINGS FOR PREFERENTIAL LANES

Preferential lanes are utilized in a wide variety of applications for a class of vehicles. Pavement markings for such lanes shall end where the preferential lane ends. Regulatory signs shall be used in combination with the pavement markings (also see sections 2G.03 to 2G.07 of the MUTCD). Pavement word and symbol markings shall be white and positioned laterally in the center of the lane. If more than one preferential lane use is permitted in the same lane, each use shall be marked with symbol or word markings.

Where a preferential lane is contiguous to a general-purpose (GP) lane or is separated from the GP lane by a flush buffered space that can be traversed by motor vehicles, the preferential lane shall be marked with one or more of the symbol or word markings as specified in Table 5.

Table 5. Preferential lane use lane markings

Preferential lane use	Lane markings
HOV lane	shall consist of white lines formed in a diamond shape symbol or the word message HOV. The diamond shall be at least 2.5 feet wide and 12 feet in length. The lines shall be at least 6 inches in width.
HOT lane or ETC Account-only lane	shall consist of a word marking using the name of the ETC payment system required for use of the lane, such as E-Z PASS ONLY
Bicycle lane	shall consist of a bicycle symbol or the word marking BIKE LANE
Bus only lane	shall consist of the word marking BUS ONLY
Taxi only lane	shall consist of the word marking TAXI ONLY
Light rail transit lane	shall consist of the word marking LRT ONLY
Other type of preferential lane	shall consist of a word marking appropriate to the restriction

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 23. HOV preferential lane marking



Figure 24. Bike lane preferential lane marking

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3E. MARKINGS FOR TOLL PLAZAS

To provide payment for a toll road, toll plazas are needed to collect funds. Electronic Toll Collection (ETC) account-only lanes are restricted to vehicles with a payment account. Open-Road Tolling (ORT) systems are typically managed lanes that provide electronic toll collection and do not require vehicles to stop to pay tolls. Pavement markings are needed to channelize movements into the appropriate lanes. Lanes restricted to ETC accounts shall use word markings and the preferential lane longitudinal markings (covered in Section 3D.02 of the MUTCD).

“For a toll plaza approach lane that is restricted to use only by vehicles with registered ETC accounts, the solid white lane line or edge line on the right-hand side of the ETC Account-Only lane and the solid white lane line or solid yellow edge line on the left-hand side of the ETC Account-Only lane may be supplemented with purple solid longitudinal markings placed contiguous to the inside edges of the lines defining the lane.” (1) The purple marking shall be a minimum of 3 inches in width and a maximum width equal to the width of the line it supplements.

Where the ORT lanes are immediately adjacent the toll plaza but not separated by a barrier from cash payment lanes, channelization or pavement markings should be used.



Figure 25. Toll plaza (ETC) account-only lanes divided from cash payment lanes

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

“This separation should begin on the approach to the mainline toll plaza at approximately the point where the vehicle speeds in the adjacent cash lanes drop below 30 mph during off-peak periods and should extend downstream beyond the toll plaza approximately to the point where the vehicles departing the toll plaza in the adjacent cash lanes have accelerated to 30 mph.” (I)

### 3F. DELINEATORS

Delineators are light-retroreflecting devices mounted at the side of the roadway, in series, to indicate the roadway alignment. They are effective aids for night driving and are to be considered as guidance rather than warning devices. Delineators are also advantageous in areas with heavy precipitation (rain, snow, ice).

“Delineators shall consist of retroreflective devices that are capable of clearly retroreflecting light under normal atmospheric conditions from a distance of 1,000 feet when illuminated by the high beams of standard automobile lights. Retroreflective elements for delineators shall have a minimum dimension of 3 inches.” (I) They shall be the same color as the edge line. They shall be white on the left-hand side of a two-way ramp. They may also be used for long continuous roadway sections, short stretches of roadway, or roadways with changes in horizontal alignment.



Figure 26. Delineators

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

Red delineators shall be used for truck escape ramps and may be used to identify wrong-way driving.



Figure 27. Truck escape ramp with red post-mounted delineators

Delineator placement guidance is illustrated in Figure 28.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

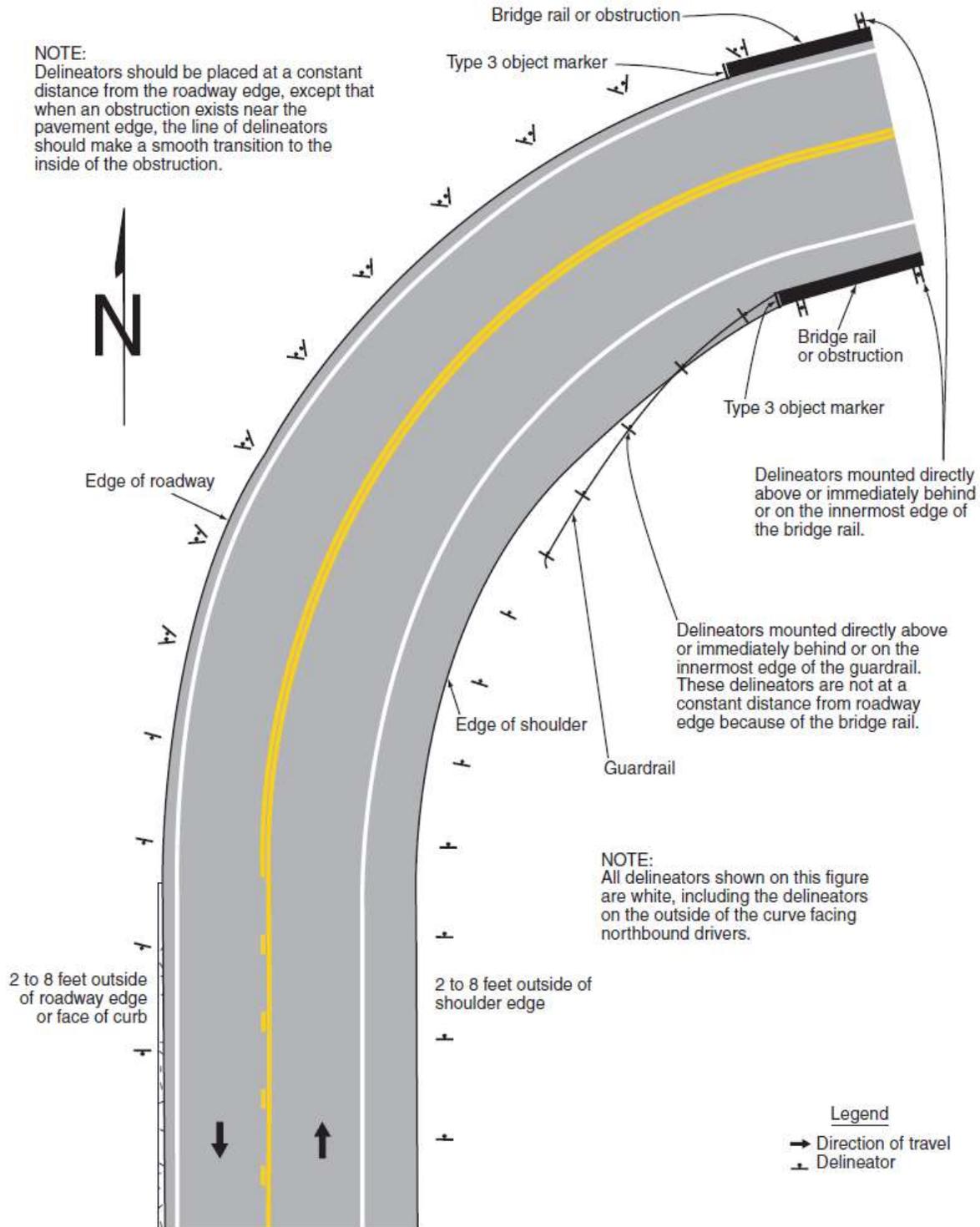


Figure 28. Examples of delineator placement (MUTCD Figure 3F-1)

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3G. COLORED PAVEMENTS

Colored pavement can refer to colored concrete or asphalt. When a non-reflective colored pavement is used, it is not intended to provide a regulatory, warning, or guidance message to the roadway user and is not subject to specific colors. Non-reflective colored pavement in a crosswalk is not considered a traffic control device.

When a reflective colored pavement is used in traveled ways, on flush or raised islands, or on shoulders to regulate, warn, or guide traffic, the colored pavement is considered a traffic control device. In these situations, the colored pavement shall be the yellow or white in the following conditions.

- A. “Yellow pavement color shall be used only for flush or raised median islands separating traffic flows in opposite directions or for left-hand shoulders of roadways of divided highways or one-way streets or ramps (see Figure 29).
- B. White pavement color shall be used for flush or raised channelizing islands where traffic passes on both sides in the same general direction or for right-hand shoulders.” (1)



Figure 29. Yellow pavement color on raised median island separating traffic

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

### 3H. CHANNELIZING DEVICES USED FOR EMPHASIS OF PAVEMENT MARKING PATTERNS

Channelizing devices may be used for traffic control to draw attention to channelizing lanes, islands, and reversible lane delineation. They may also be used in a center line as shown in Figure 30, to preclude turns and along center lines to preclude changing lanes as demonstrated in Figure 31. Channelizing devices shall either be orange or the same color as the pavement markings the devices supplement.

Channelizing devices include:

- Cones
- tubular markers,
- vertical panels,
- drums,
- lane separators, and
- raised islands.



Figure 30. Center line channelizing devices

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 31. Lane divide channelizing devices

“For nighttime use, channelizing devices shall be retroreflective or internally illuminated. On channelizing devices used outside of temporary traffic control zones, retroreflective sheeting or bands shall be white if the devices separate traffic flows in the same direction and shall be yellow if the devices separate traffic flows in the opposite direction or are placed along the left-hand edge line of a one-way roadway or ramp.” (1) Refer to the MUTCD Chapter 6F for further design requirements.

### 3I. ISLANDS

Islands as traffic control devices may be:

- curbs,
- pavement edges,
- pavement markings,
- channelizing devices, and
- delineators.

“The ends of islands first approached by traffic should be preceded by diverging longitudinal pavement markings on the roadway surface, to guide vehicles into desired paths of travel along

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

the island edge. Channelizing devices, when used in advance of islands having raised curbs, shall not be placed in such a manner as to constitute an unexpected obstacle.” (I)

“Islands outlined by curbs or pavement markings should be marked with retroreflective white or yellow material as determined by the direction or directions of travel they separate. The retroreflective area should be of sufficient length to denote the general alignment of the edge of the island along which vehicles travel, including the approach end, when viewed from the approach to the island.” (I)

Island delineators shall be the same color as the related edge lines but shall be red for traffic facing the wrong way. Pedestrian island and medians can provide midblock or intersection refuge for pedestrians. The “Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)” (5) provide design elements such as minimum widths for accessible refuge islands (see Figure 32) and for design and placement of detectable warning surfaces (see Figure 33.)



Figure 32. Pedestrian median refuge

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 33. Pedestrian detectable warning surfaces

### 3J. RUMBLE STRIP MARKINGS

Rumble strips are intended to draw the attention of roadway users that lose attention and drift outside of the edges of the travel way. A tire traveling over the rumble strip causes a vehicle vibration and unique sound to alert the driver. Rumble strips may either be rough-textured pavement or a depressed road surface. Longitudinal rumble strips are typically placed along roadway shoulders as depicted in the images of Figure 34 and Figure 35.

MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*



Figure 34. Longitudinal rumble strip with edge line not on rumble strip

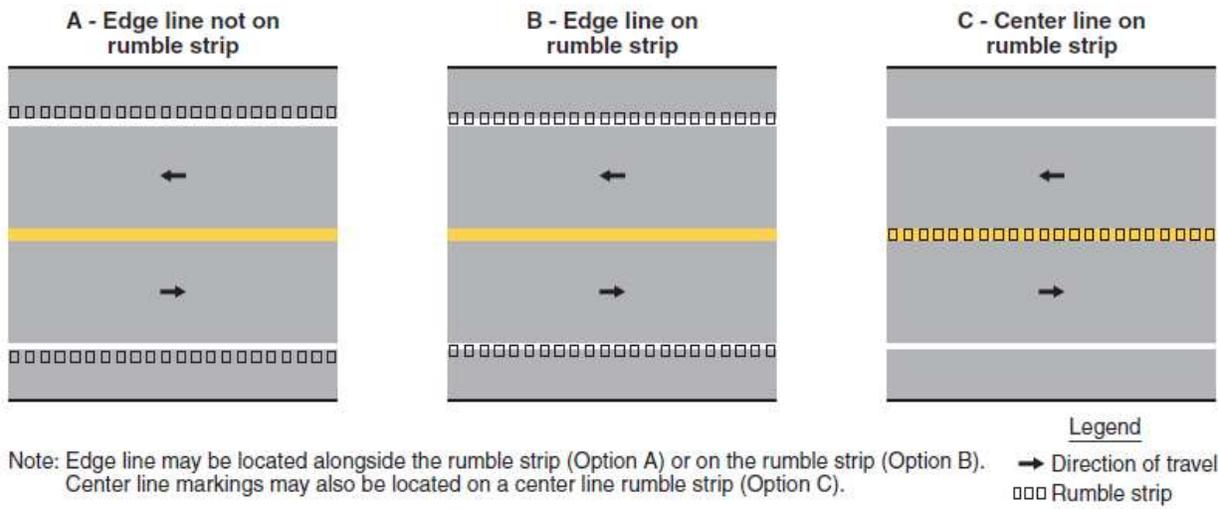


Figure 35. Examples of longitudinal rumble strip markings (MUTCD Figure 3J-1.)



MUTCD: Overview of Pavement Markings  
*A SunCam online continuing education course*

**REFERENCES**

1. Federal Highway Administration (2009). *Manual on Uniform Traffic Control Devices*, 2009 Edition. U.S. Department of Transportation. Washington, DC.  
[https://mutcd.fhwa.dot.gov/htm/2009r1r2/html\\_index.htm](https://mutcd.fhwa.dot.gov/htm/2009r1r2/html_index.htm).
2. The Evolution of MUTCD. <https://mutcd.fhwa.dot.gov/kno-history.htm>
3. 23 Code of Federal Regulations 655 link. <https://mutcd.fhwa.dot.gov/res-23cfr655.htm>
4. National Committee on Uniform Traffic Control Devices. <https://ncutcd.org/>
5. U.S. Department of Justice, Civil Rights Division (2010). *Americans with Disabilities Act Accessibility Guidelines (ADAAG)*. U.S. Department of Justice. Washington, DC.  
<https://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm>