

TRAVEL BETTER

TRAVEL LONGER

CHAPTER ONE  
Intersections and Interchanges

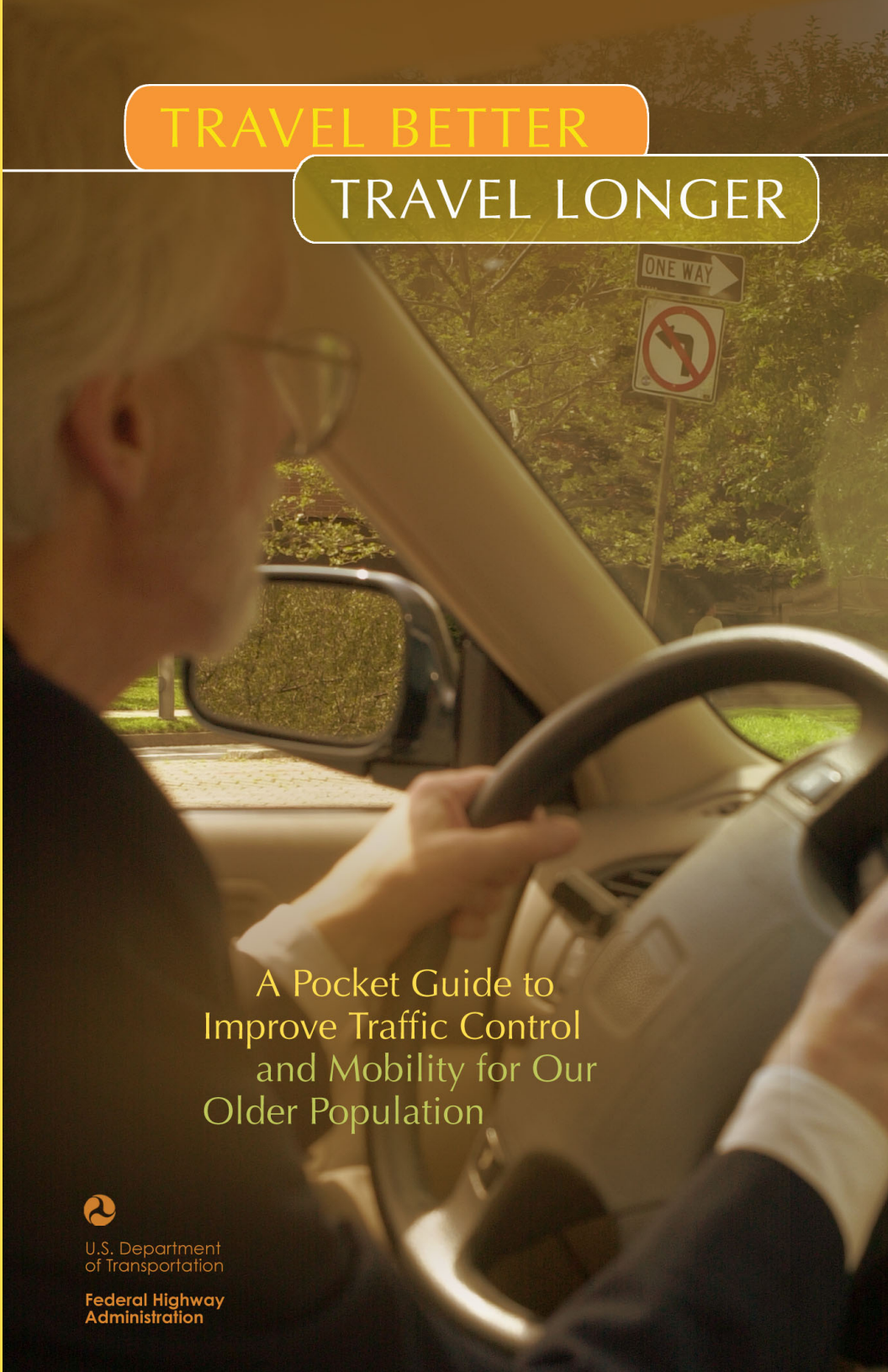
CHAPTER TWO  
Curves

CHAPTER THREE  
Temporary Traffic Control Zones



U.S. Department of  
Transportation  
Federal Highway  
Administration  
400 7th Street, SW  
Washington, DC 20590

FHWA-OP-03-098



A Pocket Guide to  
Improve Traffic Control  
and Mobility for Our  
Older Population



U.S. Department  
of Transportation

Federal Highway  
Administration

# Dear Reader,

I am pleased to present to you *Travel Better, Travel Longer: A Pocket Guide to Improve Traffic Control and Mobility for Our Older Population*. The Federal Highway Administration's Office of Operations prepared this pocket guide to assist transportation professionals in making decisions about the use of traffic control devices, taking into account the unique needs of our Nation's increasingly elderly population. This guide is intended for use by engineers, technicians, construction contractors, researchers, educators, and others involved in traffic control, roadway design and construction, and transportation.

As people age, vision declines, physical fitness and flexibility diminish, the ability to focus attention decreases, and the time necessary to react to unexpected circumstances increases. Each of these changes affects one's ability to drive safely. For our older population to maintain their mobility without compromising safety, transportation professionals must consider these changes when applying traffic control devices. The goal of this pocket guide is to provide transportation professionals with information on the proper use of traffic control devices with the needs of older roadway users in mind.

This guide highlights specific traffic situations that are particularly troublesome for older roadway users, such as left turns and temporary traffic control zones, and provides information on the use of traffic control devices to maximize safety in these circumstances. It is divided into three chapters:

Chapter One. Intersections and Interchanges

Chapter Two. Curves

Chapter Three. Temporary Traffic Control Zones

I hope that you find this pocket guide useful, and that you refer to it often when making decisions about the application of traffic control devices.

Thank you,

Associate Administrator for Operations  
Federal Highway Administration

2003



## Preface

## Introduction

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## Travel Better, Travel Longer: A Pocket Guide to Improve Traffic Control and Mobility for Our Older Population

The elderly population in the United States is growing dramatically. According to the U.S. Census Bureau, the number of Americans over age 65 will increase by more than 50 percent between 2002 and 2020.\* During this time, the overall U.S. population will increase by only about 16 percent. In 2002, about 16 percent of the driving age population was over 65. By 2020, this figure will be about 21 percent. A key component in maintaining a productive and independent lifestyle for our senior population is ensuring that they can safely use our Nation's roadways. As transportation professionals, we must take into account the special needs of senior citizens when making decisions about our transportation systems.

Older people bring with them years of experience as roadway users. Elderly people safely use America's roadways every day. However, as people grow older, changes to their physical health may make driving and walking more difficult. These changes include:

- **Declining vision:** roadway signs, pavement markings, pedestrians, and other drivers are difficult to see. This is particularly problematic at night, when low lighting and glare from headlights interfere with vision.
- **Decreased physical fitness and flexibility:** drivers have difficulties turning their heads to look left and right at intersections and over their shoulders for lane changes. Older people may also have trouble with activities that require quick physical movements such as abrupt turns. Additionally, elderly pedestrians may need more time to cross a roadway.
- **Decreased ability to focus attention:** older drivers may find it difficult to sort through the large amount of information encountered during roadway use. This can be especially problematic in new or complicated situations, such as when navigating through a temporary traffic control zone or in an unfamiliar area.
- **Increased reaction time:** older drivers are slower to respond to traffic control devices and unexpected changes in traffic or roadway conditions.

## Introduction

America's older population wants to travel better and travel longer. The negative effects of aging on mobility can be lessened with careful deployment of traffic control devices—the signs, signals, markings, and other devices used to regulate, warn, or guide traffic. This pocket guide provides information about how to maintain the safety and efficiency of roadways by taking into account the special needs of older roadway users when making decisions about which traffic control devices to use. While this pocket guide focuses on accommodating older drivers, the applications described here will benefit all road users.

This pocket guide is intended for use by state and local transportation officials, manufacturing and engineering organizations, university transportation professionals, and others responsible for the design, selection, installation, and maintenance of traffic control devices, as well as those who conduct training in their use.

### Pocket Guide Content

This pocket guide is divided into three chapters:

**Chapter 1.** Intersections and Interchanges

**Chapter 2.** Curves

**Chapter 3.** Temporary Traffic Control Zones

Each chapter contains design elements that present traffic situations where older drivers may face limitations. Each design element contains specific information on the application of traffic control devices as contained in the Manual on Uniform Traffic Control Devices (MUTCD). The MUTCD, published by the Federal Highway Administration (FHWA) Office of Transportation Operations, is the national standard for the design and application of signs, signals, pavement markings, and other traffic control devices. The references at the end of each design element refer to sections of the MUTCD to which the reader can refer for more details. Currently, both the 2000 and 2003 Editions of the Manual are appropriate for use in applying traffic control devices, depending on the status of adoption of the 2003 Edition in individual States. The references refer to the applicable sections in both versions of the Manual.

The Standard Highway Signs Book, also published by the FHWA Office of Transportation Operations, contains design specifications for roadway signs, pavement markings, and standard alphabets for traffic control devices.

\* See Census Bureau estimates, <http://www.census.gov/population/www/projections/natsum-T3.html>

The applications described in this pocket guide are related to recommendations presented in the Highway Design Handbook for Older Drivers and Pedestrians (hereafter referred to as the Handbook), published by the FHWA Office of Safety, Research, and Development. In some cases, the recommendations in the Handbook are more prescriptive than the provisions in the MUTCD. These instances are highlighted in the pocket guide. While this pocket guide focuses on accommodating older drivers and pedestrians, the applications described here will benefit all road users.

### Further Information

For further information on the design and use of traffic control devices, consult the following documents:

- The Manual on Uniform Traffic Control Devices, 2000 and 2003 Editions – available online at <http://mutcd.fhwa.dot.gov>
- The Standard Highway Signs Book – available online at <http://mutcd.fhwa.dot.gov>
- Highway Design Handbook for Older Drivers and Pedestrians – available online at <http://www.tfhrc.gov/humanfac/01103/coverfront.htm>



# CHAPTER ONE INTERSECTIONS AND INTERCHANGES

Intersections and interchanges are potentially dangerous for all roadway users. However, they pose a particular safety problem for older drivers because of the need for rapid decision making, quick reactions, and accurate judgments of speed-distance relationships, all of which are generally more difficult for older people than for younger people. Research shows that 37 percent of traffic-related fatalities in drivers age 65 and over occur at intersections. In contrast, for drivers age 26-64, only 18 percent of fatalities occur at intersections.\* The numbers for pedestrian fatalities are similar. These figures call for special attention to the needs and limitations of older drivers when choosing traffic control devices for intersections.

There are specific difficulties that older roadway users experience when maneuvering through intersections:

- Slower response to traffic signal changes and unexpected conditions.
- Reading or interpreting pavement markings incorrectly.
- Difficulty reading roadway signs.
- Difficulties in making left turns, such as incorrect positioning in the turn lane and inability to accurately judge the distance of oncoming vehicles.
- Slower gait, shorter steps, and slower reaction time requiring longer time for pedestrian crossing.

The following design elements contain information about the application of traffic control devices to make intersections and interchanges safer for all roadway users, with special attention to the needs of older drivers and pedestrians. This chapter is divided into three sections:

- Section A. Signs
- Section B. Pavement Markings
- Section C. Signals

## Section A. Signs

### Design Element 1.

#### Signing for Left Turns on Green Lights

##### ◆ Problem:

Older drivers experience inordinate difficulties when making left turns and may need extra guidance to know when a left turn is permissible.

##### ▲ Application:

The LEFT TURN YIELD ON GREEN (R10-12) sign may be used to remind drivers of the right-of-way rule for left turns at signalized intersections. The preferred location for this sign is overhead, where it is most likely to be seen and read. It is placed adjacent to the signal face that controls the protected-permissive left turn. To provide additional emphasis at problem locations, an advance LEFT TURN YIELD ON GREEN (R10-12) sign with a supplemental AT SIGNAL plaque can be considered for installation at a 3-second preview distance before the intersection or at the start of the left-turn lane.



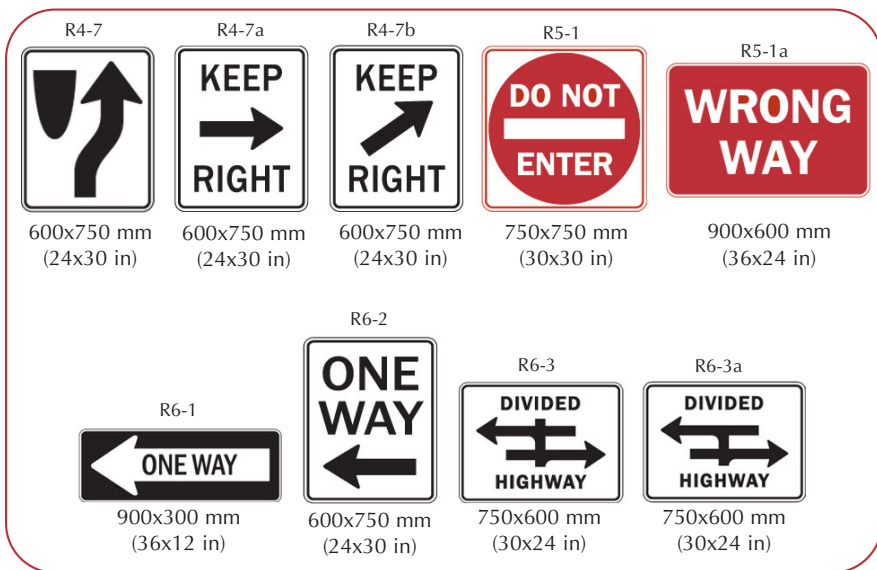
References: MUTCD 2000 Edition Sections 2B.40, 4D.06; MUTCD 2003 Edition Sections 2B.45, 4D.06; Handbook Recommendations I-H-3, I-H-4

\* Hauer, E. 1988. "The Safety of Older Persons at Intersections." *Transportation in an Aging Society*, Volumes 1 and 2, Special Reports 218. Transportation Research Board, Washington, DC.

Note: These are minimum sign sizes. Larger signs should be considered (see the Standard Highway Signs Book).

**Design Element 2.**  
**Sign Sizes for Offset Left-Turn Lanes**

- ◆ **Problem:**  
Confusion and vision problems increase the potential for wrong-way maneuvers on left turns. Small or inconspicuous signs related to wrong-way travel may not provide sufficient guidance.
- ▲ **Application:**  
At intersections with wide medians or offset left-turn lanes, large signs should be used for greater legibility and emphasis for messages warning against wrong-way traffic movements. The signs and recommended minimum sizes are shown below. This does not preclude the use of larger sizes if needed.

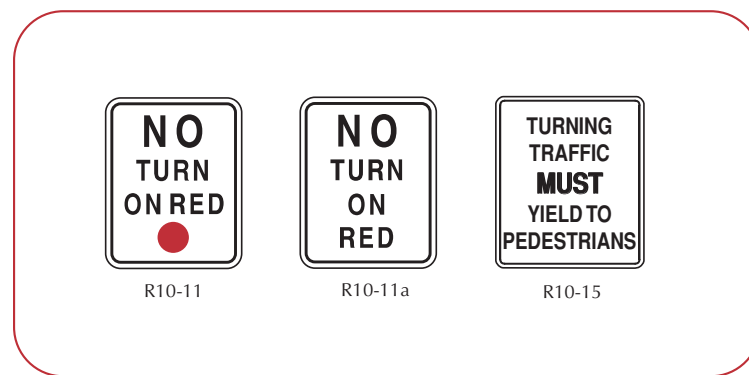


References: MUTCD 2000 Edition Sections 2B.28-2B.30, 2B.32, 2B.33; MUTCD 2003 Edition Sections 2B.33-2B.35, 2B.37, 2B.38; Handbook Recommendation I-E-4a

**Design Element 3.**  
**NO TURN ON RED Signs**

- ◆ **Problem:**  
Older drivers may have physical conditions that make it difficult for them to turn their heads enough to see around corners. In addition, heavy pedestrian traffic may make right-turn/pedestrian conflicts dangerous, especially for older pedestrians who may walk slowly.
- ▲ **Application:**  
The NO TURN ON RED signs (R10-11 series) should be considered when an engineering study finds that geometric or operational characteristics of the intersection might result in unexpected conflicts. An example is a skewed intersection where the approach legs intersect at an angle less than 75 degrees. The TURNING TRAFFIC MUST YIELD TO PEDESTRIANS (R10-15) sign may also be used if pedestrian crosswalks are marked.

Note: The R10-11 and R10-15 signs were added to the MUTCD in Section 2B.45 of the 2003 Edition of the Manual.

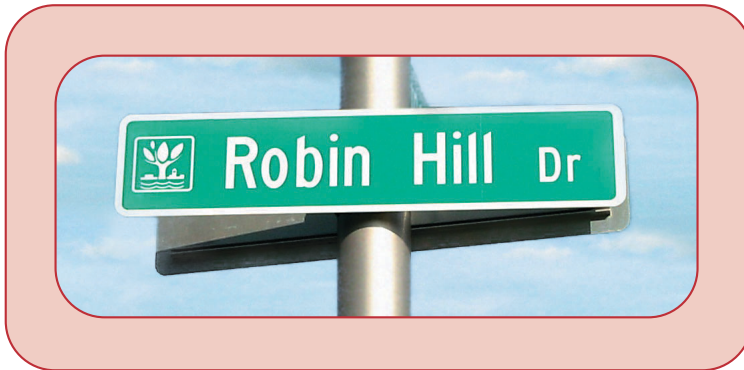


References: MUTCD 2000 Edition Section 2B.40; MUTCD 2003 Edition Section 2B.45; Handbook Recommendations I-A-3, I-I-2, I-I-4

Note: The use of 200 mm (8 in) letters for post-mounted street name signs is a change to Section 2D.38 of the MUTCD introduced in the 2003 Edition of the Manual.

#### Design Element 4. Letter Size for Post-Mounted Street Name Signs

- ◆ **Problem:**  
Poor eyesight may make it difficult for older drivers to read small lettering on post-mounted signs.
- ▲ **Application:**  
On multi-lane streets with speed limits greater than 65 km/h (40 mi/h), the lettering on ground-mounted street name signs should be at least 200 mm (8 in) high in capital letters, or 200 mm (8 in), upper-case letters with 150 mm (6 in) lower-case letters.

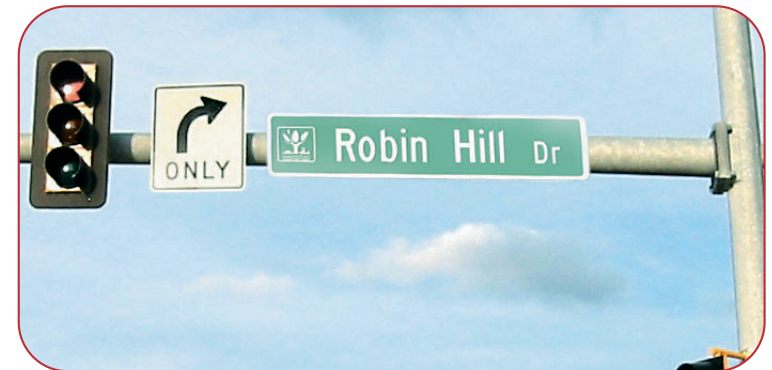


References: MUTCD 2000 and 2003 Editions Section 2D.38; Handbook Recommendation I-J-1

#### Design Element 5. Letter Size for Overhead Street Name Signs

- ◆ **Problem:**  
Poor eyesight can make it difficult for older drivers to read small lettering on overhead street name signs, particularly in complex driving environments.
- ▲ **Application:**  
The use of overhead-mounted street name signs should be considered in urban or suburban areas where advance street name signs are not used. If overhead street name signs are used, the letter height should be at least 300 mm (12 in) in capital letters, or 300 mm (12 in) upper-case letters with 225 mm (9 in) lower-case letters.

Note: The use of 300 mm (12 in) and 225 mm (9 in) letters on overhead street name signs is a change to Section 2D.38 of the MUTCD introduced in the 2003 Edition of the Manual.



References: MUTCD 2000 and 2003 Editions Section 2D.38; Handbook Recommendation I-J-2



Note: Discussion of advance street name signs was introduced in the MUTCD in Section 2D.39 of the 2003 Edition of the Manual.

## Design Element 6. Redundant and Advance Street Name Signs

### ◆ Problem:

Because of slowed reaction time and potential difficulties processing the large amount of information at an intersection, older drivers can benefit from advanced warning of upcoming cross streets.

### ▲ Application:

Redundant street name signs are recommended for major intersections. Advance street name signs (D3-2) placed upstream of the intersection at mid-block locations are also recommended. The letter heights on advance street name signs should be the same as those used for post-mounted street name signs (see Design Element 4 on page 4).



References: MUTCD 2003 Edition Section 2D.39; Handbook Recommendation I-J-5

## Design Element 7. Advance Notice of Cross Street

### ◆ Problem:

Slow reaction time and decreased ability to process a large amount of information can result in older drivers being unable to react in a safe and timely manner when reaching a destination cross street.

### ▲ Application:

Where advance intersection warning signs are installed (W2-1 through W2-6), a plaque with an advance notice of the name of the cross street (W16-8) may be installed on the same post underneath the intersection warning sign. The minimum sign sizes for W16-8 and other supplemental warning plaques are shown in Table 2C.3 of the 2000 and 2003 Editions of the MUTCD.



W2-1 and W16-8

References: MUTCD 2000 Edition Sections 2C.04, 2C.34, 2C.45; 2D.38; MUTCD 2003 Edition Sections 2C.04, 2C.37, 2C.49; Handbook Recommendation I-J-4

**Design Element 8.**  
**Street Name Signs for Streets That Change Names**

- ◆ **Problem:**  
 Older drivers may become confused or disoriented when looking for streets in unfamiliar areas. A street with two different names can be especially confusing.
- ▲ **Application:**  
 Where different street names are used for different directions of travel on a crossroad, the names should be separated and accompanied by directional arrows on both mid-block advance street name signs and intersection street name signs.



References: MUTCD 2000 and 2003 Editions Section 2D.38; Handbook Recommendation I-J-6

**Design Element 9.**  
**CROSS TRAFFIC DOES NOT STOP Sign**

- ◆ **Problem:**  
 Slower reaction time may make it difficult for older drivers to react quickly to unexpected conflicting traffic at stop-controlled intersections.
- ▲ **Application:**  
 The CROSS TRAFFIC DOES NOT STOP (W4-4p) sign may be used for stop-controlled intersections that are not all-way stops. The sign may be installed based on crash experience, sight distance restrictions, or where a four-way stop has been converted to two-way stop operation.



Note: Sign W4-4p was redesigned and included in Section 2C.50 in the 2003 Edition of the Manual.

References: MUTCD 2000 Edition Section 2C.27; MUTCD 2003 Edition Section 2C.50; Handbook Recommendation I-L-3

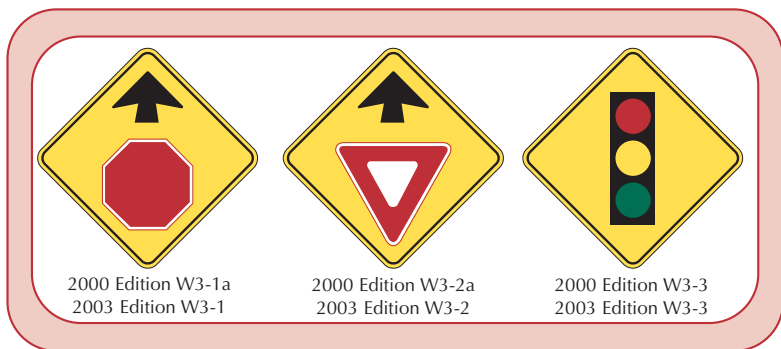
**Design Element 10.**  
**Advance Traffic Control Signs**

◆ **Problem:**

Because of slower reaction time, older drivers may not be able to respond quickly and safely when approaching unexpected traffic conditions at an intersection.

▲ **Application:**

The STOP AHEAD, YIELD AHEAD, and SIGNAL AHEAD signs shall be installed on an approach to a primary traffic control device that is not visible at a distance sufficient to permit the driver to respond to the device. In addition, a plaque with advance notice of the name of the cross street (W16-8, see Design Element 7 on page 7) may be installed on the same post underneath these advance traffic control signs.



References: MUTCD 2000 Edition Sections 2C.26, 2C.45; MUTCD 2003 Edition Sections 2C.29, 2C.49; Handbook Recommendation I-L-4

**Design Element 11.**  
**Intersection Lane Control Signs**

◆ **Problem:**

Older drivers may have trouble processing large amounts of information and may become confused about which lane to use at unfamiliar or complicated intersections.

▲ **Application:**

At intersections where drivers might have trouble positioning themselves in the correct lane, intersection lane control signs (R3-5 through R3-8) should be mounted overhead on a signal mast arm or span wire and each sign should be placed over the lane (or a projection of the lane) to which it applies. Ground-mounted lane-use control signs and additional advance overhead signs should also be considered.

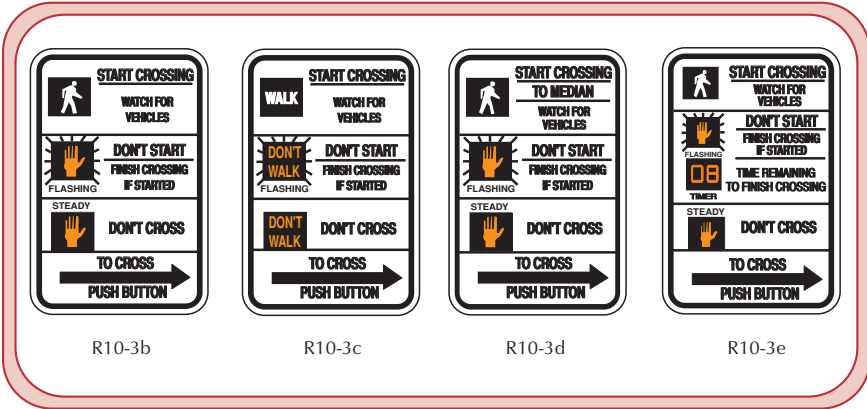


References: MUTCD 2000 Edition Sections 2B.18-2B.21; MUTCD 2003 Edition Sections 2B.20-2B.23; Handbook Recommendation I-M-1

Note: Signs R10-3d and R10-3e are additions to the MUTCD introduced in Section 2B.45 of the 2003 Edition of the Manual.

**Design Element 12.**  
**Educational Plaques for Pedestrians**

- ◆ **Problem:**  
 Older pedestrians may not understand when it is safe to cross the roadway at signalized intersections.
- ▲ **Application:**  
 Educational plaques can be installed at signalized intersections to help explain the traffic signal operation and present a warning to watch for turning vehicles. The following four educational plaques may be installed at signal push-button unit locations:



References: MUTCD 2000 Edition Section 2B-40; MUTCD 2003 Edition Section 2B.45; Handbook Recommendations I-P-3, I-P-4

**Section B. Pavement Markings**

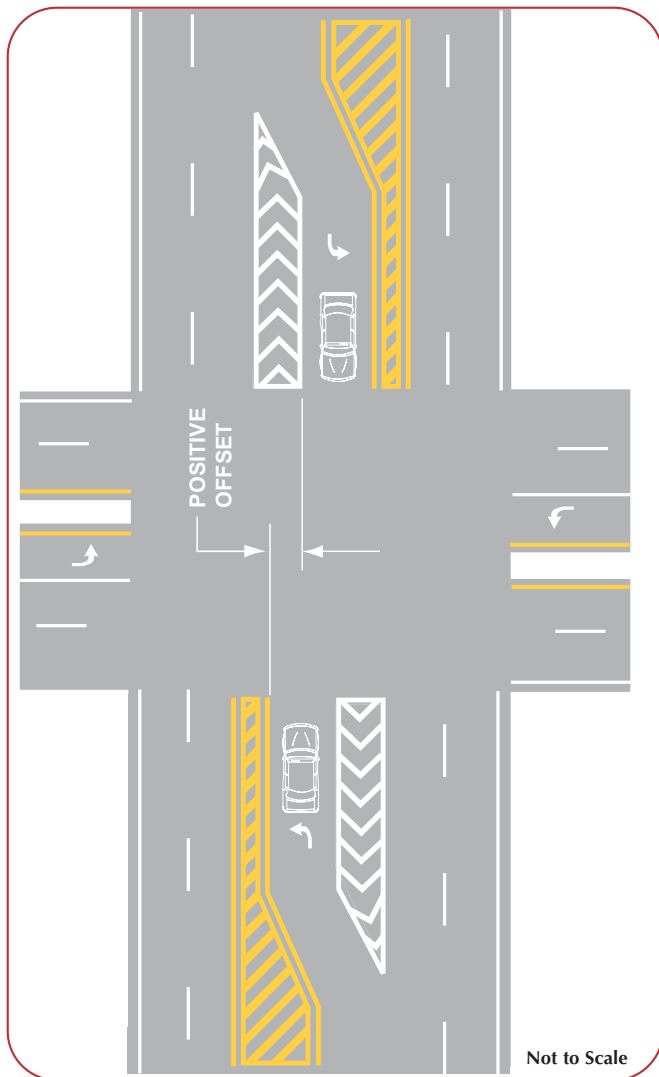
**Design Element 13.**  
**Pavement Markings for Left-Turn Lanes**

- ◆ **Problem:**  
 Older drivers may not position themselves within the intersection when waiting to make a left turn. This can block the sight line to oncoming traffic for drivers waiting to make left turns from the opposite direction.
- ▲ **Application:**  
 Positive offset of opposing left-turn lanes should be used wherever possible to minimize the obstruction of sight distance. On undivided highways where pavement width allows, this positive offset can be provided by the use of solid channelizing lines to form a parallel or tapered island between the left-turn lane and the adjacent through lane, as shown in the diagram on the following page. In some cases, this treatment can be made feasible by the use of reduced-width lanes at the intersection.

See next page for illustration



Positive Offset for Left-Turn Lanes



**Design Element 14.**

**Raised Pavement Markings for Curbs in Medians and Islands**

◆ **Problem:**

Raised curbs without conspicuous markings are difficult to see, especially for older drivers who may have diminished vision. This increases the chances a driver will hit the curb, especially at night or during inclement weather.

▲ **Application:**

To improve the conspicuity of medians and island curbs at intersections, enhanced delineation may be used. In addition to edge lines on the road surface alongside the medians and island curbs, the vertical face of these curbs can be provided with painted curb markings and the top surface of the curbs can be marked with retroreflectorized raised pavement markers, object markers, signs, or delineators.



References: MUTCD 2000 and 2003 Editions Section 3B.05; Handbook Recommendations I-E-1, I-E-2, I-E-3

References: MUTCD 2000 and 2003 Editions Sections 3B.11, 3B.21; Handbook Recommendation I-F-2

**Design Element 15.**

**Delineators at Passive Highway-Rail Grade Crossings**

◆ **Problem:**

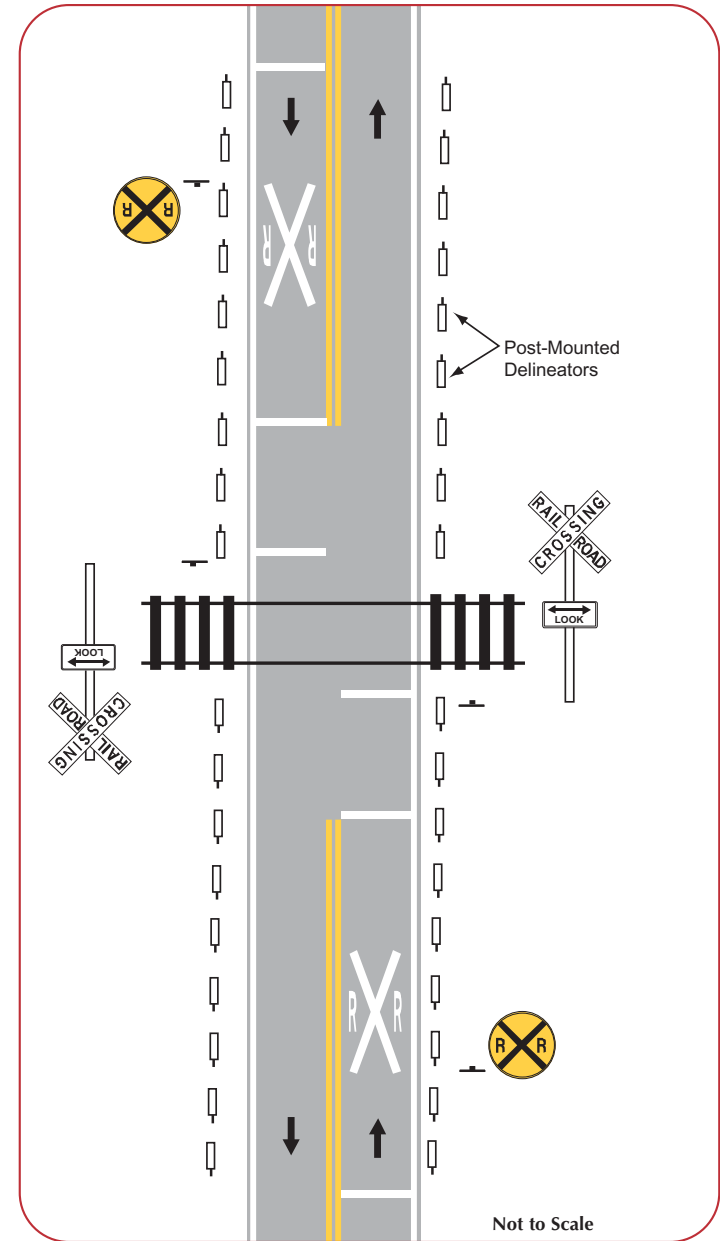
Passive railroad crossings—crossings without lights or gates—are a particular safety problem for older drivers. Older drivers with decreased vision may not see the upcoming railroad crossing or the signs and pavement markings warning of its presence. Further, older drivers may have more trouble understanding and reacting to warnings contained in traffic control devices at railroad crossings.

▲ **Application:**

Where engineering study or judgment indicates the need to improve the conspicuity of passive railroad crossings, post-mounted delineators may be used in combination with at least the minimum signing requirement described in Part 8 of the MUTCD. This enhancement will be particularly useful for crossings located near temporary traffic control zones, in areas prone to inclement weather, for crossings narrower than the approach pavement, and for isolated crossings. Delineators may also be considered as an alternative to illumination. The color of the delineators should be the same as the color of the pavement markings they supplement.

*See next page for illustration*

**Post-Mounted Delineators and Other Traffic Control Devices for Passive Highway-Rail Grade Crossings**



Drawing adapted from Handbook, p.65

References: MUTCD 2000 and 2003 Editions Sections 3D.1-3D.4, Part 8; Handbook Recommendation V-3

**Design Element 16.**  
**Wrong-Way Arrows on Ramps**

◆ **Problem:**

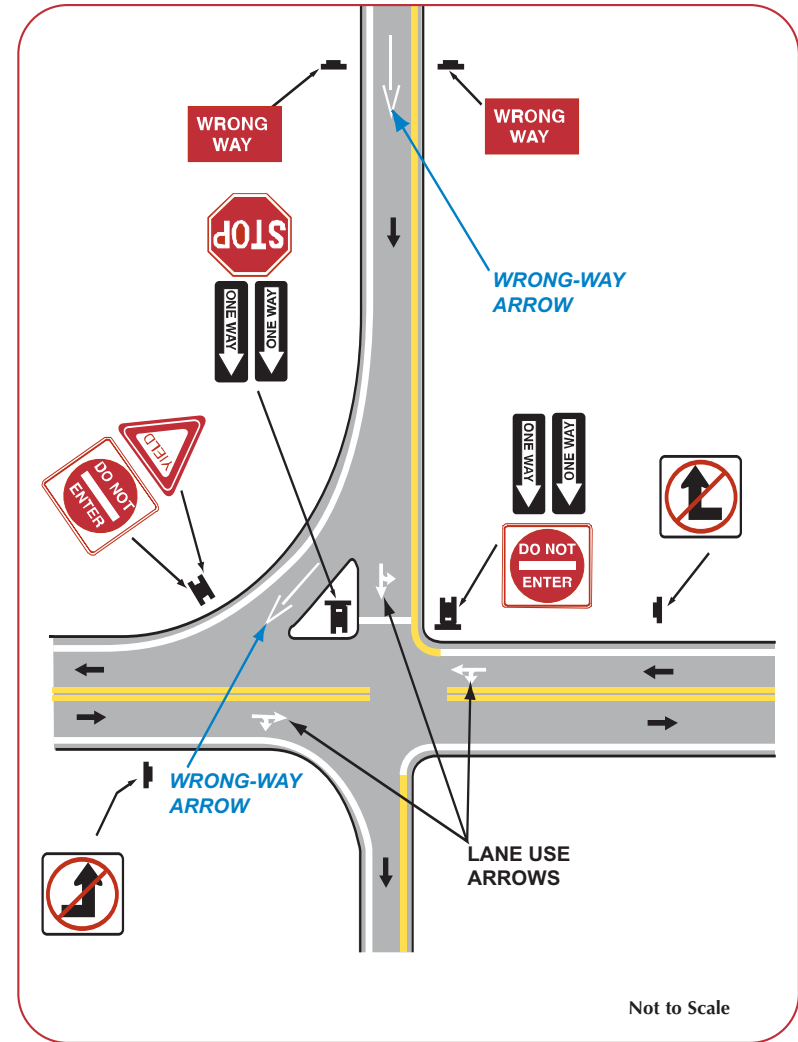
Older drivers can become confused in complex driving situations. They may need extra warnings to avoid driving the wrong way onto a freeway ramp.

▲ **Application:**

To conspicuously indicate the correct direction of traffic flow and discourage wrong-way movements, a wrong-way arrow marking may be used near the terminus of all ramps that do not have lane-use arrows already in place near the terminus.

*See next page for illustration*

**Wrong-Way Arrows and Other Traffic Control Devices to Prevent Wrong-Way Movements on Freeway Exit and Entrance Ramps**



References: MUTCD 2000 and 2003 Editions Section 3B.19; Handbook Recommendation II-D-5

**Design Element 17.**  
**Turning Path Pavement Markings**

◆ **Problem:**

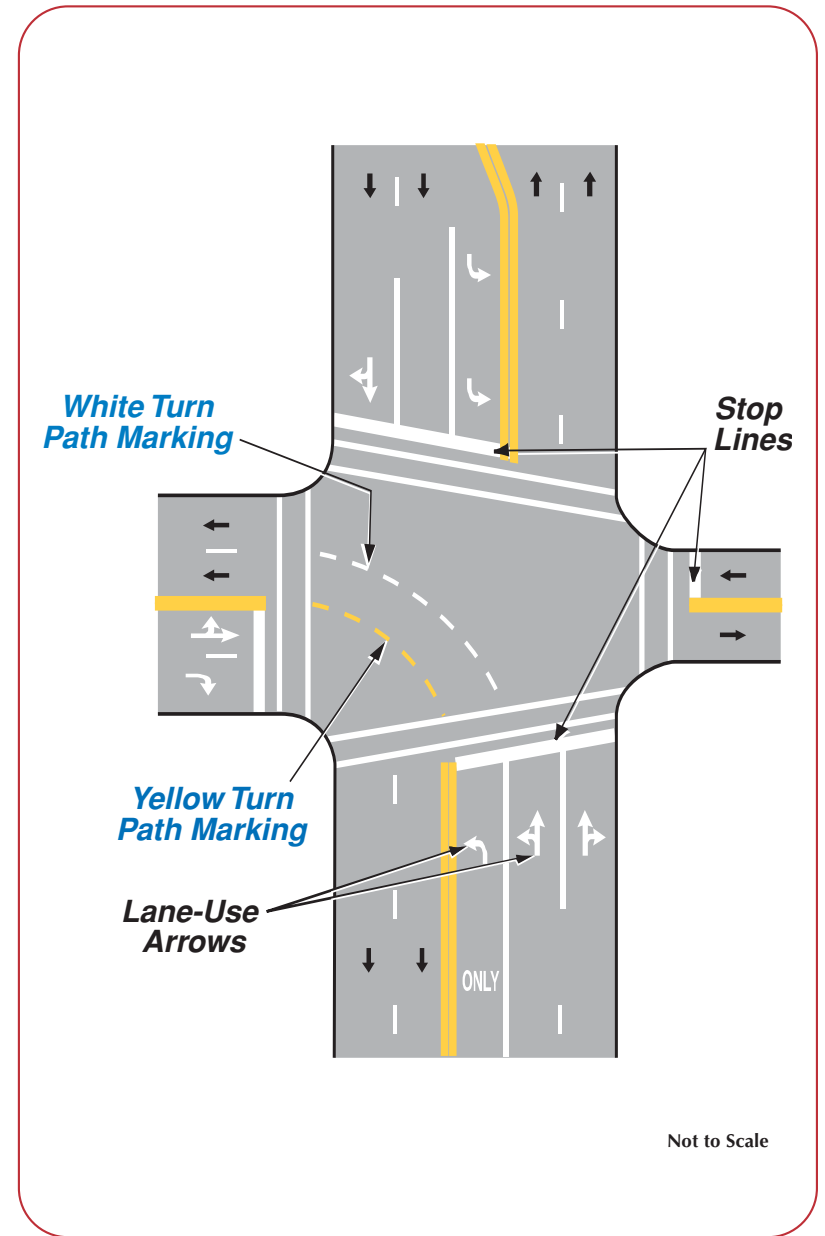
Many older drivers experience significant problems negotiating turning movements at intersections. Limited head mobility and confusion about the intended travel path leave them vulnerable to angle collisions and wrong-way movements.

▲ **Application:**

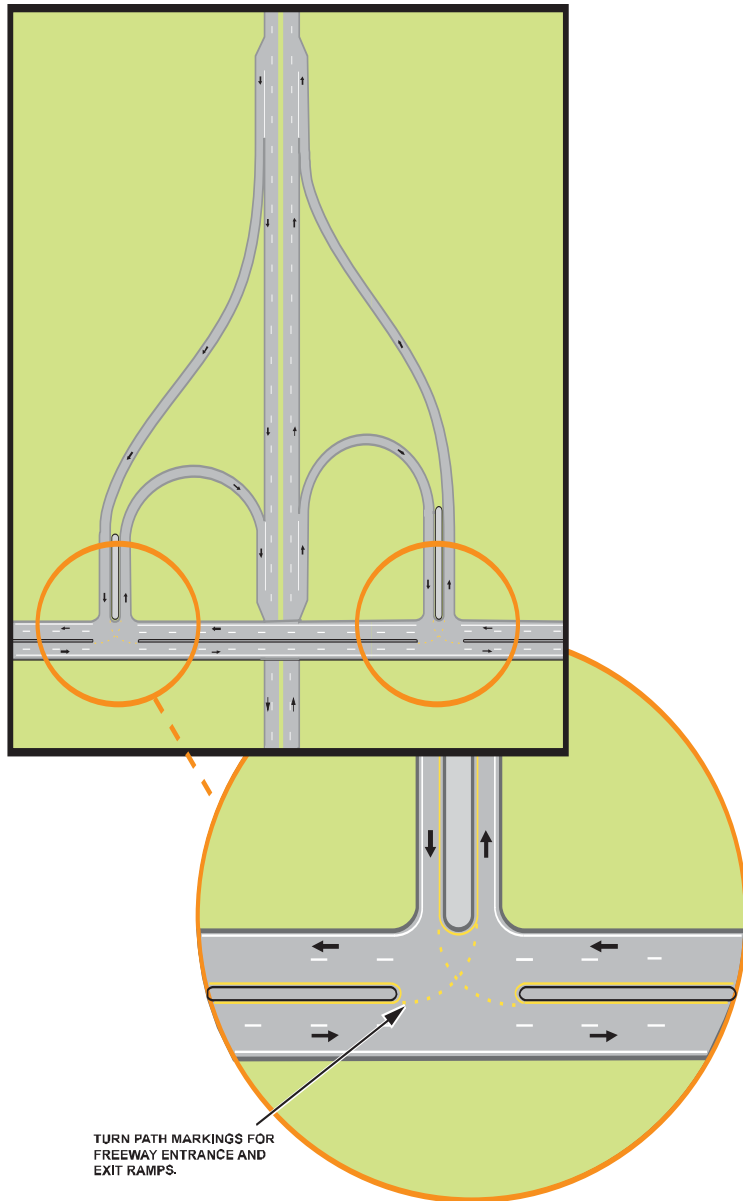
To enhance safety at intersections for older drivers, turn path markings should be installed. Critical situations for installation include: single and dual left-turn lanes at intersections; intersections with acute angle turns, particularly left turns; side by side entrance and exit ramps at partial cloverleaf interchanges; acute angle entrance ramps at diamond interchanges; and other locations where crash experience or operational observations suggest that older drivers may experience difficulties negotiating turning movements.

*See next pages for illustrations*

**Turn Path Markings at Intersection with Dual Left-Turn Lanes**







References: MUTCD 2000 and 2003 Editions Section 3B.08; Handbook Recommendation I-E-4d

**Section C. Signals**

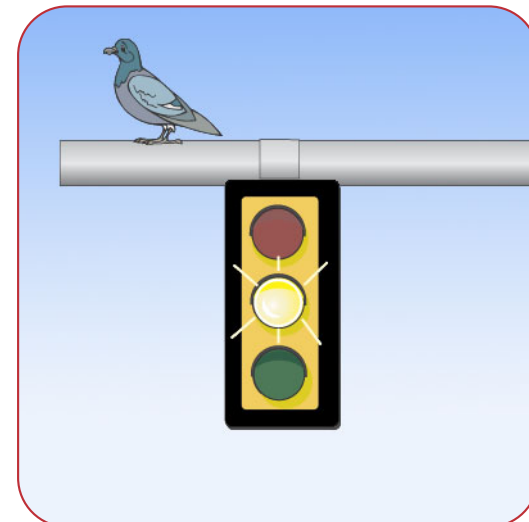
**Design Element 18.  
Backplate for Signals**

◆ **Problem:**

Because of diminished vision, older drivers may have trouble seeing which bulb is lit on a traffic signal, especially when sun glare is a problem.

▲ **Application:**

To enhance the target value of signal indications and reduce the potential for sun glare problems, a backplate should be used on signal faces viewed against a bright sky or a bright or confusing background. On roads with operating speeds of 65 km/h (40 mi/h) or higher, the use of a backplate can be particularly helpful in making the signals more visible to older drivers.



References: MUTCD 2000 and 2003 Editions Section 4D.17; Handbook Recommendation I-N-3

## Design Element 19. Leading Pedestrian Interval

### ◆ Problem:

Older pedestrians may need additional time to cross a street because of shorter stride, slower gait, and slower reaction time.

### Application:

- ▲ At intersections with high pedestrian volume and high turning vehicle volume, a leading pedestrian interval of three seconds or more can be helpful because it allows slower walkers to cross at least one roadway lane before conflicting turning vehicles are released. Blank-out or changeable message “no right turn” (symbolic) or NO TURN ON RED (text) signs can be used in conjunction with the leading pedestrian interval to restrict turns across the crosswalk during certain portions of the signal cycle.



Blank-out (symbolic)  
no turn on red  
sign

Leading pedestrian  
interval—walk signal  
allows pedestrians to  
start crossing while  
vehicle signal is  
still red

References: *MUTCD 2000 Edition Section 4E.9; MUTCD 2003 Edition Section 4E.10; Handbook Recommendation I-P-6*

## CHAPTER TWO CURVES

Roadway curves represent a considerable safety concern. Research shows that crash rates are between one and a half and four times higher on curves than on straightaways. Curves present a particular problem for older drivers, especially when drivers are not aware of the upcoming curvature or approach it at an unsafe speed.

Older drivers may have more trouble negotiating curves than their younger counterparts because:

- Declining vision changes their ability to see the roadway and judge speed-distance relationships.
- Declining strength makes it more difficult for them to abruptly change directions and shift gears.
- Increased reaction time makes it more difficult for them to safely adjust their driving when approaching unexpected changes in roadway curvature.
- Decreased ability to process large amounts of information makes it more likely that an older driver will miss important warnings about curves ahead.

The following design elements contain information about the application of traffic control devices to make curves safer for all roadway users, with special attention to the needs of older drivers and pedestrians.

### Design Element 1.

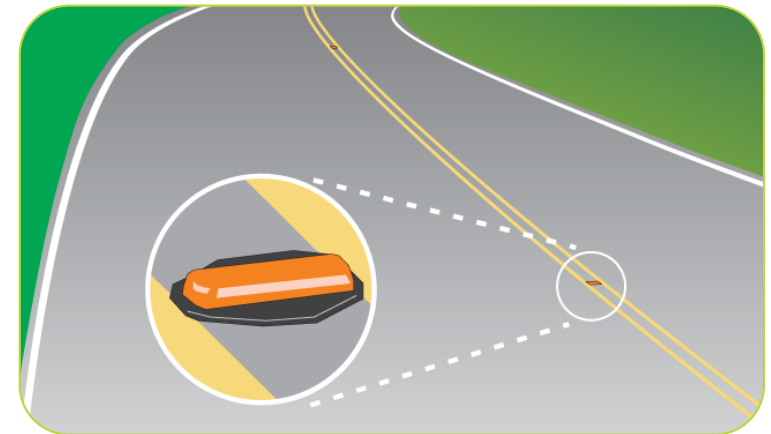
#### Raised Pavement Markings for Centerlines of Tight Curves

##### ◆ Problem:

Older drivers with slow reaction times and diminished cognitive abilities might approach curves at excessive speeds. These drivers need more conspicuous and redundant warnings of upcoming curves.

##### ▲ Application:

For curves with a radius of less than 1000 m (3280 ft), standard centerline markings may be supplemented with retroreflective raised pavement markers at a spacing of 12 m (40 ft) apart, starting at a point that is 5 seconds travel time (at the 85th percentile speed) in advance of the curve and continuing through the curve.



References: *MUTCD 2000 and 2003 Editions Section 3B.13; Handbook Recommendation III-A-2*

### Design Element 2.

#### HILL BLOCKS VIEW Warning Sign on Vertical Curves

◆ **Problem:**

Older drivers may need more time to react to traffic changes and can benefit from extra warnings about unexpected conditions ahead.

▲ **Application:**

Where the need exists to warn motorists that sight distance is restricted by a crest vertical curve, the HILL BLOCKS VIEW (W7-6) warning sign may be used. If used, it should be supplemented with an advisory speed sign (W13-1).



Reference: *MUTCD 2000 Edition Section 2C.42; MUTCD 2003 Edition Sections 2C.14, 2C.46; Handbook Recommendation III-C-2*

### Design Element 3.

#### Advance Warning for Signal Obscured by Curve

◆ **Problem:**

Slow reaction time and diminished vision can make it difficult for older drivers to see and react safely to an unexpected signal, such as one obscured by a curve.

▲ **Application:**

If a signalized intersection is obscured by vertical or horizontal curvature, the BE PREPARED TO STOP (W3-4) or SIGNAL AHEAD (W3-3a) warning signs may be used. A flashing yellow beacon interconnected with a traffic signal controller assembly may be used with this traffic signal warning sign, supplemented with a WHEN FLASHING plaque.



References: *MUTCD 2000 Edition Sections 2C.26, 4K.01, 4K.03; MUTCD 2003 Edition Sections 2C.29, 4K.01, 4K.03; Handbook Recommendation III-C-3*

# CHAPTER THREE TEMPORARY TRAFFIC CONTROL ZONES

Temporary traffic control zones pose a particular safety problem because they are frequently unexpected and may involve complicated driving maneuvers. To navigate safely through a temporary traffic control area, drivers must be aware of the conditions ahead and they must understand the necessary changes in driving behavior. This is particularly important for older drivers, who may have functional deficits that make it difficult for them to read and interpret traffic control devices and to react quickly and safely to changing roadway conditions. These deficits might include:

- Decreased ability to focus attention on important messages in the face of a variety of stimuli.
- Increased time necessary to process information from traffic control devices.
- Impaired vision, which makes it difficult to see and read traffic control devices.
- Increased reaction time, which makes it difficult to react safely when coming upon unexpected traffic conditions.

These deficits necessitate that traffic control devices in temporary traffic control areas be conspicuous—easily seen by people with diminished vision—and unambiguous—clear about the recommended driving action or changes in traffic conditions. The following design elements contain information about the application of traffic control devices to make temporary traffic control zones safer for all roadway users, with special attention to the needs of older drivers and pedestrians. This chapter is divided into four sections:

- Section A. Lane Closure/Lane Transition Practices
- Section B. Portable Changeable Message Signs
- Section C. Channelization and Path Guidance Practices
- Section D. Temporary Pavement Markings

## Section A. Lane Closure/Lane Transition Practices

### Design Element 1. Use of Flashing Arrow Panel

#### ◆ Problem:

Older drivers may need extra time to react safely to an unexpected lane closure.

#### ▲ Application:

In temporary traffic control zones on high-speed and divided highways, the consistent use of a flashing arrow panel located at the taper for each lane closure is recommended.



References: *MUTCD 2000 Edition Section 6F.53; MUTCD 2003 Edition Section 6F.56; Handbook Recommendation IV-A-1*

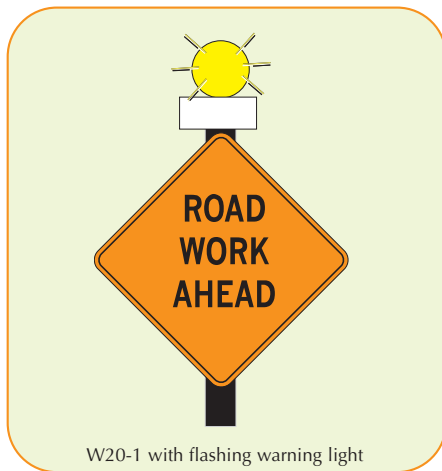
## Design Element 2. Sign Conspicuity

### ◆ Problem:

Diminished cognitive skills may cause older drivers to have trouble focusing on important information when driving. In addition, vision problems may affect their ability to see and read roadway signs.

### ▲ Application:

In order to increase the conspicuity of the first and second upstream static warning signs encountered by drivers (e.g., W20-1, W20-5), these signs may be equipped with flashing warning lights that operate through the entire time period of the lane closure. They may also have fluorescent orange reflective sheeting that provides high retroreflectivity at the widest available observation angle, and have a minimum letter height of 200 mm (8 in).



References: *MUTCD 2000 Edition Sections 6F.15, 6F.69, 6F.71; MUTCD 2003 Edition Sections 6F.15, 6F.75, 6F.77; Handbook Recommendation IV-A-2*

## Section B. Portable Changeable Message Signs

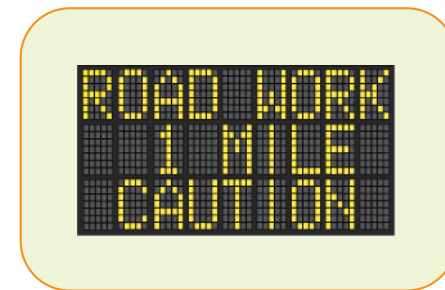
### Design Element 3. Content of Portable Changeable Message Signs

### ◆ Problem:

Some older drivers can become easily confused by unexpected and complex driving conditions. Signs that contain complicated or unfamiliar messages may be difficult for them to read and understand.

### ▲ Application:

It is recommended that no more than one unit of information be displayed on a single line and no more than three lines be displayed for any single phase of a portable changeable message sign (PCMS). The top line should present the problem, the center line should present the location or distance ahead, and the bottom line should present the recommended driver action. A phase should consist of no more than three lines of a maximum of eight characters per line. The pixel matrix of each character module shall be at least 125 mm (5 in) wide and 175 mm (7 in) high.



References: *MUTCD 2000 Edition Section 6F.52; MUTCD 2003 Edition Section 6F.55; Handbook Recommendations IV-B-3, IV-B-6a*

**Design Element 4.**  
**Phases of Portable Changeable Message Signs**

- ◆ **Problem:**  
 Older drivers may not be able to process large amounts of information as efficiently as younger drivers. Signs that contain too much information may confuse them.
- ▲ **Application:**  
 It is recommended that no more than two phases be used on a PCMS. If a message cannot be conveyed in two phases, additional PCMSs should be used.



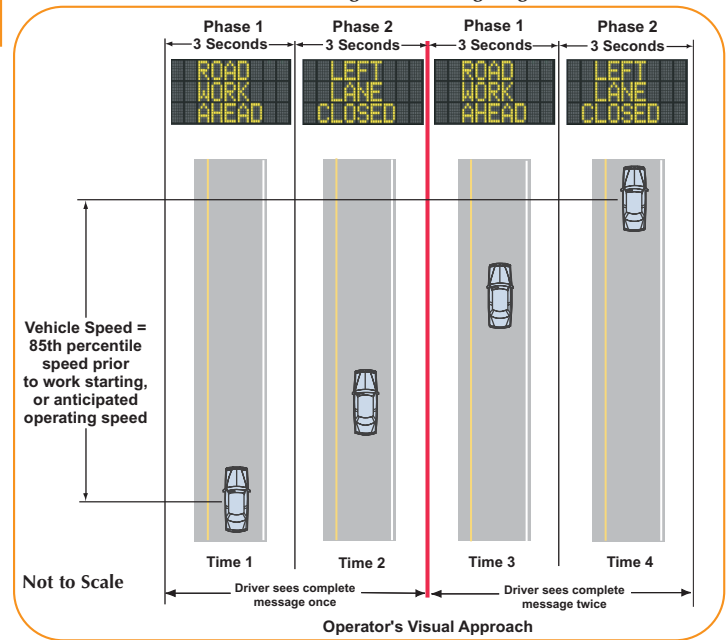
References: MUTCD 2000 Edition Section 6F.52; MUTCD 2003 Edition Section 6F.55; Handbook Recommendations IV-B-1; IV-B-4; IV-B-5

Note: The minimum 3-second phase display time is an addition to the MUTCD introduced in Section 6F.55 of the 2003 Edition of the Manual.

**Design Element 5.**  
**Timing of Phases of Portable Changeable Message Signs**

- ◆ **Problem:**  
 Older drivers may process information more slowly and require extra time to read and understand information on PCMS.
- ▲ **Application:**  
 It is recommended that each phase of a PCMS be displayed for a minimum of 3 seconds. This recommendation is made so that the entire message can be read at least twice at the posted speed, the off-peak 85th percentile speed prior to work starting, or the anticipated operating speed.

**Minimum Display Time for Phases of Portable Changeable Message Signs**



References: MUTCD 2000 Edition Section 6F.52; MUTCD 2003 Edition Section 6F.55; Handbook Recommendation IV-B-2

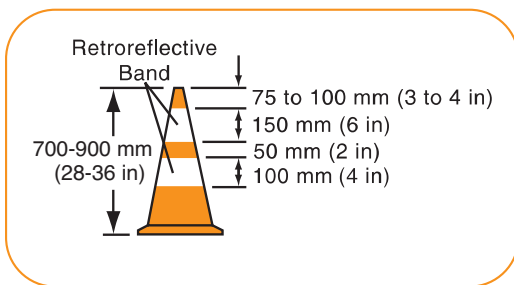
Temporary Traffic Control Zones

**Section C. Channelization and Path Guidance Practices**

**Design Element 6.  
Retroreflection for Cones**

◆ **Problem:**  
Because of decreased vision and difficulty processing large amounts of information, especially in potentially complicated and unfamiliar situations such as temporary traffic control zones, older drivers may benefit from traffic control devices with extra conspicuity.

▲ **Application:**  
Retroreflection of cones that are 700 to 900 mm (28 to 36 in) in height shall be provided by a 150 mm (6 in) wide white band located 75 to 100 mm (3 to 4 in) from the top of the cone and an additional 100 mm (4 in) wide white band located approximately 50 mm (2 in) below the 150 mm (6 in) band. These are the minimum dimensions required in the MUTCD. This does not preclude the use of wider bands.

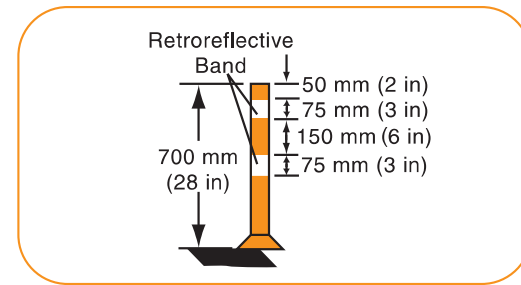


References: *MUTCD 2000 Edition Section 6F.56; MUTCD 2003 Edition Section 6F.59; Handbook Recommendation IV-C-1a*

**Design Element 7.  
Retroreflection for Tubular Markers**

◆ **Problem:**  
Older drivers with decreased vision may need extra conspicuity on traffic control devices, especially in unexpected or complicated situations such as temporary traffic control zones.

▲ **Application:**  
Retroreflection of 700 mm (28 in) or larger tubular markers shall be provided by two 75 mm (3 in) wide white bands placed a maximum of 50 mm (2 in) from the top with a maximum of 150 mm (6 in) between the bands. These are minimum dimensions as required by the MUTCD. This does not preclude the use of wider bands.



References: *MUTCD 2000 Edition Section 6F.57; MUTCD 2003 Edition Section 6F.60; Handbook Recommendation IV-C-1b*



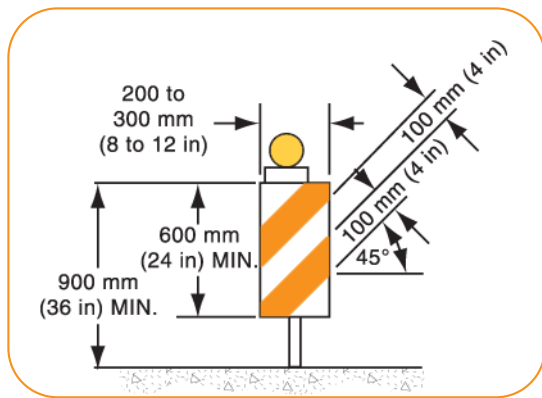
### Design Element 8. Retroreflection for Vertical Panels

#### ◆ Problem:

Older drivers with decreased vision may need large and conspicuous traffic control devices to guide them through temporary traffic control zones.

#### ▲ Application:

Vertical panels shall be 200 to 300 mm (8 to 12 in) in width and be mounted with the top a minimum of 900 mm (36 in) above the roadway. The height of the panel itself shall be at least 600 mm (24 in). Markings for vertical panels shall be alternating orange and white retroreflective stripes, sloping downward at an angle of 45 degrees in the direction vehicular traffic is to pass. Where the height of the panel itself is less than 900 mm (36 in), a panel stripe width of 100 mm (4 in) may be used. Vertical panels used on freeways, expressways, and other high-speed roadways shall have a minimum of 174,000 mm<sup>2</sup> (270 in<sup>2</sup>) retroreflective area facing vehicular traffic.



References: MUTCD 2000 Edition Section 6F.58; MUTCD 2003 Edition Section 6F.61; Handbook Recommendation IV-C-1c

### Design Element 9. Traffic Control Devices for Temporary Traffic Barriers

#### ◆ Problem:

Older drivers with decreased capacity to process large amounts of information and decreased physical capacity to perform abrupt driving maneuvers need conspicuous and unambiguous traffic control devices when traveling through temporary traffic control zones.

#### ▲ Application:

When temporary traffic barriers are placed immediately adjacent to the traveled way, they shall be equipped with appropriate channelizing traffic control devices, delineation, and/or other temporary traffic control devices to provide guidance and warning both day and night. Screens may be mounted on top of temporary traffic barriers that separate two-way traffic.



Photo courtesy of AAA Foundation for Traffic Safety

References: MUTCD 2000 Edition Sections 6F.62, 6F.75, 6G.11; MUTCD 2003 Edition Sections 6F.65, 6F.81, 6G.12

**Design Element 10.**  
**Separating Opposing Traffic**

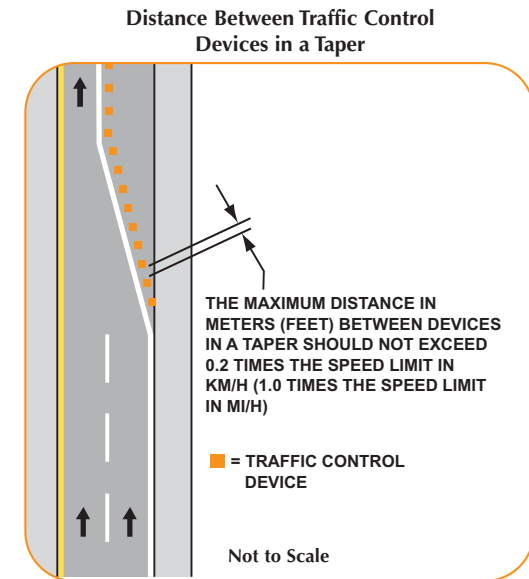
- ◆ **Problem:**  
Older drivers may need conspicuous and unambiguous traffic control devices to compensate for declining vision and cognitive skills.
- ▲ **Application:**  
Channelizing devices or temporary barriers shall be used to separate opposing traffic.



References: MUTCD 2000 Edition Sections 6F.55-6F.58, 6F.64, 6F.75, 6G.11, and Figure 6H.39; MUTCD 2003 Edition Sections 6F.58-6F.61, 6F.70, 6F.81, Figure 6H.39; Handbook Recommendation IV-D-1

**Design Element 11.**  
**Spacing for Channelizing Devices**

- ◆ **Problem:**  
Older drivers may have vision and cognitive deficiencies that make it difficult for them to safely navigate through temporary traffic control zones.
- ▲ **Application:**  
For channelizing devices (other than concrete barriers) the maximum distance in meters (feet) between devices in a taper should not exceed 0.2 times the speed limit in km/h (1.0 times the speed limit in mi/h).

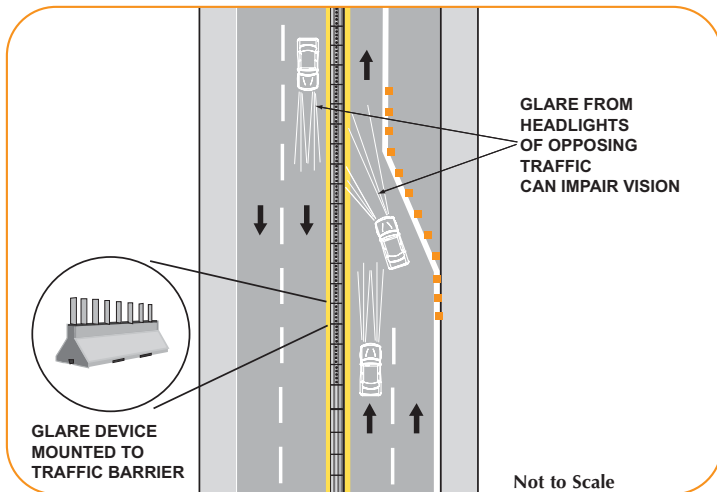


References: MUTCD 2000 and 2003 Editions Section 6C.08; Handbook Recommendation IV-C-2

**Design Element 12.**  
**Glare Control Devices for Transition and Crossover Areas**

- ◆ **Problem:**  
 Glare from the headlights of opposing traffic in temporary traffic control zones can impair vision. This glare is particularly troublesome for older people with decreased vision.
- ▲ **Application:**  
 In transition and crossover areas, glare control devices may be mounted on top of temporary traffic barriers that separate two-way traffic.

**Application of Glare Control Device in Temporary Traffic Control Zone**



References: *MUTCD 2000 Edition Section 6F.79; MUTCD 2003 Edition Section 6F.85; Handbook Recommendation IV-D-4*

**Section D. Temporary Pavement Markings**

**Design Element 13.**  
**Retroreflective Markers for Pavement Markings**

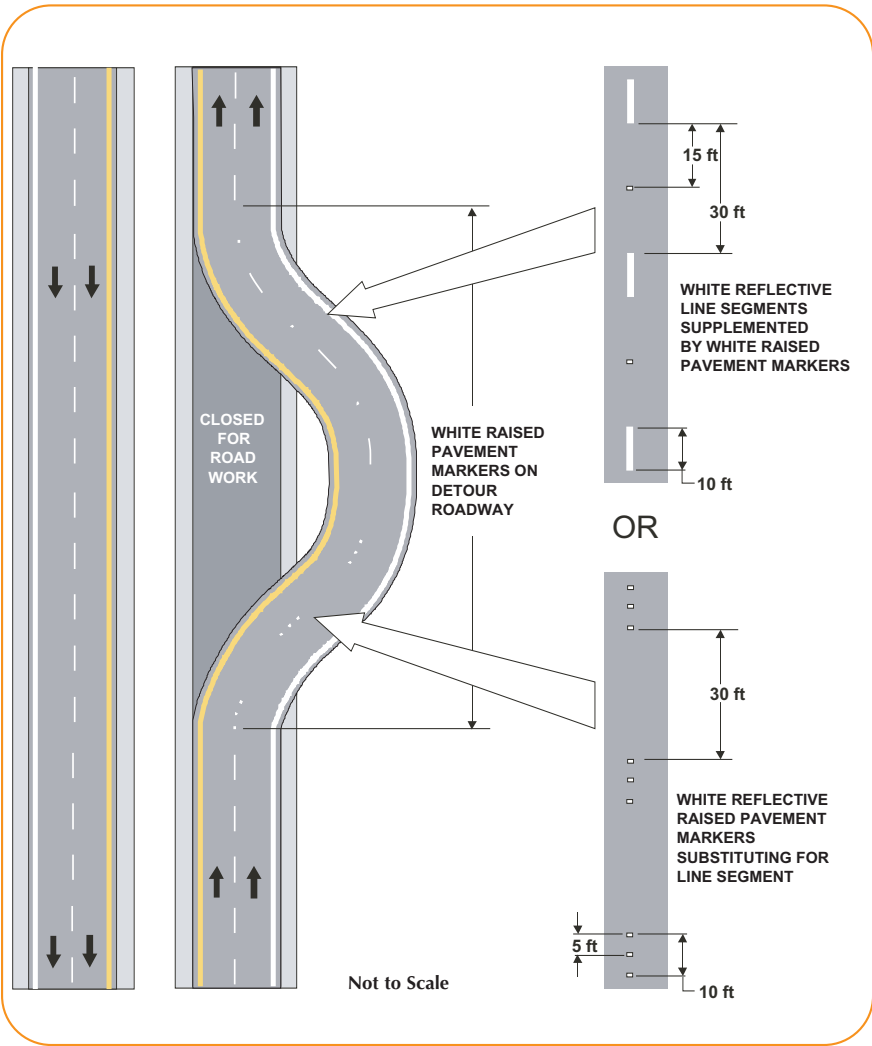
- ◆ **Problem:**  
 Older drivers with declining vision may have difficulty seeing pavement markings.
- ▲ **Application:**  
 Raised retroreflective pavement markers (RPMs) should be considered for use along detours, temporary roadways, and other changed or new travel-lane alignments. The raised pavement markers can supplement other temporary line markings or they can substitute for other temporary line markings to enhance visibility of the lines at night, especially in the rain. Where the temporary line is a broken line with segments longer than 1.5 m (5 ft):

- For RPMs supplementing other markings, one retroreflective RPM every N is recommended for curved temporary alignments, or every 2N for tangent temporary alignments;
- For RPMs substituting for other markings, a group of at least three retroreflective RPMs shall be equally spaced at no greater than N/8.

[Note: The value of N for a broken or dotted line shall equal the length of one line segment plus one gap.]

*See next page for illustration*

Use of Raised Pavement Markings to Supplement and Substitute for Temporary Pavement Markings



References: MUTCD 2000 Edition Sections 3B.13, 6F.67; MUTCD 2003 Edition Sections 3B.13, 6F.73; Handbook Recommendation IV-E-1