Manual on Uniform Traffic Control Devices (MUTCD)

Introduction and Parts 1, 2, 3, & 6

PRESENTED BY:
DELAWARE T²/LTAP CENTER
Delaware T² Center

- T² Centers or LTAPs located in all 50 states
- Funded by FHWA and state DOTs
- Mission – promote training, tech transfer, research implementation at local level
- Delaware T² hosted by University of Delaware, part of Delaware Center for Transportation
- Delaware T² funded by FHWA and DelDOT
Today’s Instructors:
- Dr. Earl “Rusty” Lee – T² Center Coordinator
- Matheu J. Carter, P.E. – Municipal Engineering Circuit Rider

Restrooms, etc.

Standard Reminders:
- Cell phones, pagers, beepers, walkie-talkies
- Sidebar conversations
The T² Center MUTCD Program

What we cover directly:
- Introduction and Part 1 (General)
- Part 2 (Signs)
- Part 3 (Markings)
- Part 6 (Temporary Traffic Control/Work Zones)

What we incorporate:
- Part 7 (School Areas)
- Part 9 (Bicycle Facilities)
The T² Center MUTCD Program

What we don’t cover:

- Part 4 (Traffic Signals)
- Part 5 (Low-Volume Roads)
- Part 8 (Railroad and Light Rail)

Why?:

- These modules are directed towards municipal gov’ts
- Part 4 – you probably don’t own signals
- Part 5 – their definition of low-volume roads excludes municipal streets
- Part 8 – you probably aren’t responsible for RRs or light rail

However

Go to the DE MUTCD website for training slides on the changes to Parts 2, 3, 4, 6, 7, 8, & 9
Acknowledgements

Primary references:
- Delaware MUTCD
- Federal MUTCD

Who we’ve shamelessly stolen from (with our thanks):
- DelDOT
- DelDOT’s consultants
- FHWA MUTCD website
- Numerous others

Good writers borrow from other writers; Great writers steal from them outright – Aaron Sorkin
Delaware MUTCD

• Federal MUTCD published in Dec. 2009

Next Update Programmed for 2017...we’ll see...no sign yet

• DE MUTCD committee began meeting in Jan. 2010 to establish DE-specific guidance

• DE MUTCD submitted to Delaware Register for public comment in Spring 2011

• Except as noted, all presentation materials are the Delaware MUTCD June 2011
Where Do I Find the Delaware MUTCD?

DelDOT Website
http://www.deldot.gov/

Look for “Publications”

http://deldot.gov/index.shtml
Where Do I Find the Delaware MUTCD?
Where Do I Find the Delaware MUTCD?

Notice there are other documents here too – complimentary guidance, memoranda, recipes, secret codes, treasure maps, etc.

www.mutcd.delDOT.gov
Manual on Uniform Traffic Control Devices (MUTCD)

Introduction and Part 1

Presented by:
DELAWARE T²/LTAP CENTER
Introduction

In this module:

- A little bit of “MUTCD 101”
- A general overview of the “Parts”
- Details of the MUTCD Introduction and Part 1
- Some thoughts on regulatory liability and tort implications
- The meaning of “DelDOT maintained street”
- Retroreflectivity of signs and markings
- A focus on the Delaware MUTCD
2009 MUTCD and DE MUTCD Format Revisions

- Paragraphs are numbered
- No more metric
- Definitions relocated to Part 1
- Delaware Revisions in blue with line in margin and “(DE Revision)” at beginning of paragraph
- DE Standard: Reverted to 2003 MUTCD language allowing engineering judgment
  - More on this later

Standards are bolded
Guidance is italicized
Options remain unformatted
How to Read the MUTCD

Throughout the MUTCD, each section will contain one or more of the following in some combination:

- **Standard** — “a statement of required, mandatory, or specifically prohibitive practice regarding a TCD” – these are “SHALLs”

- **Guidance** — “a statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate” – these are “SHOULDs”

- **Option** — “a statement of practice that is a permissive condition and carries no requirement or recommendation” – these are “MAYs”

- **Support** — “an informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition”
So what?

- You won’t like some of the things the MUTCD tells you to do or how to do it or where to do it or that you can’t do it
- You will get frustrated
- You may want to throw it across the room – don’t, it’s too expensive and not bound very well
- Instead, know the differences between shall, should, and may
Fun Fact Time

- How long has the MUTCD been around?

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1927</td>
<td>Manual and Specifications for the Manufacture, Display, and Erection of U.S. Standard Road Markers and Signs (for rural roads)</td>
</tr>
<tr>
<td>1930</td>
<td>Manual on Street Traffic Signs, Signals, and Markings (for urban streets)</td>
</tr>
<tr>
<td>1935</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)</td>
</tr>
<tr>
<td>1948</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways</td>
</tr>
<tr>
<td>1961</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways</td>
</tr>
<tr>
<td>1971</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways</td>
</tr>
<tr>
<td>1978</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways</td>
</tr>
<tr>
<td>1988</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways</td>
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<tr>
<td>2003</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways</td>
</tr>
<tr>
<td>2009</td>
<td>Manual on Uniform Traffic Control Devices for Streets and Highways</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Month / Year Revised</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/29, 12/31</td>
</tr>
<tr>
<td>No revisions</td>
</tr>
<tr>
<td>2/39</td>
</tr>
<tr>
<td>No revisions</td>
</tr>
<tr>
<td>9/54</td>
</tr>
<tr>
<td>No revisions</td>
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<tr>
<td>11/71, 4/72, 3/73, 10/73, 6/74, 6/75, 9/76, 12/77</td>
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<tr>
<td>12/79, 12/83, 9/84, 3/86</td>
</tr>
<tr>
<td>1/90, 3/92, 9/93, 11/94, 12/96, 6/98, 1/00</td>
</tr>
<tr>
<td>7/02</td>
</tr>
<tr>
<td>11/04, 12/07</td>
</tr>
</tbody>
</table>
Does the MUTCD Apply to My Road?

- In all likelihood, yes
- If you can put a car, truck, bus, bike, segway, skateboard, or pedestrian on it and it’s open to the public, yes (¶01)

“Private” property too

Now, notice ¶03 C.
Where Doesn’t the MUTCD Apply?

- Generally, look to definition of Private Road Open to Public in 1A.13
- Unless you have a gated property where you restrict access at all times, you need to read the MUTCD
- The private sector commercial, industrial, retail, etc. folks need to understand this from a liability standpoint

Part 1; Section 1A.13; ¶03
Does the MUTCD Apply to My Road?

- **Yes**
  - Circulation roads

- **No**
  - Parking Isles

- **Still...MUTCD is best practice**
Do I Have to Upgrade Immediately?

- Generally, no
- See Introduction
- Typically called “programmatic replacement”

<table>
<thead>
<tr>
<th>Standard:</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 In accordance with 23 CFR 655.603(b)(3), States or other Federal agencies that have their own MUTCDs or Supplements shall revise these MUTCDs or Supplements to be in substantial conformance with changes to the National MUTCD within 2 years of the effective date of the Final Rule for the changes. Substantial conformance of such State or other Federal agency MUTCDs or Supplements shall be as defined in 23 CFR 655.603(b)(1).</td>
</tr>
<tr>
<td>20 After the effective date of a new edition of the MUTCD or a revision thereto, or after the adoption thereof by the State, whichever occurs later, new or reconstructed devices installed shall be in compliance with the new edition or revision.</td>
</tr>
<tr>
<td>21 In cases involving Federal-aid projects for new highway or bikeway construction or reconstruction, the traffic control devices installed (temporary or permanent) shall be in conformance with the most recent edition of the National MUTCD before that highway is opened or re-opened to the public for unrestricted travel [23 CFR 655.603(d)(2) and (d)(3)].</td>
</tr>
<tr>
<td>22 Unless a particular device is no longer serviceable, non-compliant devices on existing highways and bikeways shall be brought into compliance with the current edition of the National MUTCD as part of the systematic upgrading of unsubstantive traffic control devices (and installation of new required traffic control devices) required pursuant to the Highway Safety Program, 23 U.S.C. §402(a). The FHWA has the authority to establish other target compliance dates for implementation of particular changes to the MUTCD [23 CFR 655.603(d)(1)]. These target compliance dates established by the FHWA shall be as shown in Table I-2.</td>
</tr>
<tr>
<td>23 Except as provided in Paragraph 24, when a non-compliant traffic control device is being replaced or refurbished because it is damaged, missing, or no longer serviceable for any reason, it shall be replaced with a compliant device.</td>
</tr>
</tbody>
</table>

- But there are exceptions – see Table I-2 for compliance dates – we’ll talk about some of these in later modules
Do I Have to Upgrade Immediately?

- Compliance table
- Programmatic change
- Tort liability
- Stay on schedule

Table I-2. Target Compliance Dates Established by the FHWA

<table>
<thead>
<tr>
<th>2009 MUTCD Section Number(s)</th>
<th>2009 MUTCD Section Title</th>
<th>Specific Provision</th>
<th>Compliance Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A.08</td>
<td>Maintaining Minimum Retroreflectivity</td>
<td>Implementation and continued use of an assessment or management method that is designed to maintain regulatory and warning sign retroreflectivity at or above the established minimum levels (see Paragraph 2)</td>
<td>2 years from the effective date of this revision of the 2009 MUTCD*</td>
</tr>
<tr>
<td>2A.19</td>
<td>Lateral Offset</td>
<td>Crashworthiness of sign supports on roads with posted speed limit of 50 mph or higher (see Paragraph 2)</td>
<td>January 17, 2013 (date established in the 2000 MUTCD)</td>
</tr>
<tr>
<td>2B.40</td>
<td>ONE WAY Signs (R5-1, R6-2)</td>
<td>New requirement in the 2009 MUTCD for the number and locations of ONE WAY signs (see Paragraphs 4, 9, and 10)</td>
<td>December 31, 2019</td>
</tr>
<tr>
<td>2C.06 through 2C.14</td>
<td>Horizontal Alignment Warning Signs</td>
<td>Revised requirements in the 2009 MUTCD regarding the use of various horizontal alignment signs (see Table 2C-5)</td>
<td>December 31, 2019</td>
</tr>
<tr>
<td>2E.31, 2E.33, and 2E.36</td>
<td>Plaques for Left-Hand Extts</td>
<td>New requirement in the 2009 MUTCD to use E1-5aP and E1-5bP plaques for left-hand exits</td>
<td>December 31, 2014</td>
</tr>
</tbody>
</table>

* 2 years from the effective date of this revision of the 2009 MUTCD.
When is a TCD Needed?

Section 1A.02 guides us:

“To be effective, a traffic control device should meet five basic requirements:
A. Fulfill a need;
B. Command attention;
C. Convey a clear, simple meaning;
D. Command respect from road users; and
E. Give adequate time for proper response.”
Uniformity

- Drivers have seconds or less to see a TCD
- Peds and bikers too
- Urban environment – density of TCDs much higher
- Uniformity (size, color, shape, condition, even font) is key to fast recognition of the message
Uniformity, Placement, Maintenance

- Uniformity of the TCDs alone does not constitute conformity – how and where they are placed (and not placed) just as important
- Placement standards will be particularly examined in the Part 2 (signs) and Part 3 (markings) modules
- Maintenance
  - Retroreflectivity is key with signs and markings – more on that later
  - Even small amounts of graffiti, dirt, bullet holes or vegetative growth can greatly diminish the effectiveness of TCDs
Responsibility for TCDs

- The agency, corporation, or individual that “has jurisdiction”
  - State route – state DOT? Don’t assume; stay tuned
  - Municipal side street – municipal responsibility presumably
  - Bike path through a park – parks department presumably
  - Shopping center circulation road – mall owner presumably
  - If my agency “maintains the road” does that mean we’re responsible for the TCDs outside the curbs? More on that later under the topic “DelDOT maintained streets”

- “23 CFR 655.603 adopts the MUTCD as the national standard for all traffic control devices installed on any street, highway, bikeway, or private road open to public travel (see definition in Section 1A.13)”
Responsibility for TCDs

Guidance:
States should adopt Section 15-116 of the “Uniform Vehicle Code,” which states that, “No person shall install or maintain in any area of private property used by the public any sign, signal, marking, or other device intended to regulate, warn, or guide traffic unless it conforms with the State manual and specifications adopted under Section 15-104.”

Support:
(De Revision) Delaware Code Title 17, Chapter 1, §147, requires the state of Delaware to “adopt a uniform standard for each type of traffic-control device to be used on all highways open to the public in this State.” Delaware has adopted the Delaware MUTCD and the Delaware Sign Book to fulfill this requirement. The Delaware MUTCD addresses adaptations of the Federal Highway Administration (FHWA) MUTCD to Delaware’s experience.

10 (De Revision) Delaware Code Title 17, Chapter 1, §147, prohibits anyone from selling or offering for sale any traffic control device that does not conform with the “state manual and specifications”.

11 (De Revision) Delaware Code Title 17, Chapter 1, §147, states that “any traffic control device erected in violation of [the Delaware MUTCD], except experimental devices erected by the Department, shall be unofficial, unauthorized and unenforceable.”
Authority to Place TCDs

- If you/your agency/your company has jurisdiction over the road, you have the authority (and the responsibility) to determine what signs and markings do and don’t get installed or removed
- State road within a town – typically a shared jurisdiction with the state and town
- Advertisements and announcements within the right of way – only if you say so
- Let the Delaware MUTCD be your guide – follow it and you should be okay
When a TCD Isn’t

- Some signs and devices in the ROW are not TCDs

- They can be there if you say so and if they fulfill a legitimate purpose

- But they cannot be allowed to interfere with TCDs

Within the highway right-of-way by or with the permission of the public agency or the official having jurisdiction over the street or highway. Most of these signs and other devices are not intended for use by road users in general, and their message is only important to individuals who have been instructed in their meanings. These signs and other devices are not considered to be traffic control devices and provisions regarding their design and use are not included in this Manual. Among these signs and other devices are the following:

A. Devices whose purpose is to assist highway maintenance personnel. Examples include markers to guide snowplow operators, devices that identify culvert and drop inlet locations, and devices that precisely identify highway locations for maintenance or mowing purposes.

B. Devices whose purpose is to assist fire or law enforcement personnel. Examples include markers that identify fire hydrant locations, signs that identify fire or water district boundaries, speed measurement pavement markings, small indicator lights to assist in enforcement of red light violations, and photo enforcement systems.

C. Devices whose purpose is to assist utility company personnel and highway contractors, such as markers that identify underground utility locations.

D. Signs posting local non-traffic ordinances.

E. Signs giving civic organization meeting information.

Standard:

07 Signs and other devices that do not have any traffic control purpose that are placed within the highway right-of-way shall not be located where they will interfere with, or detract from, traffic control devices.

Guidance:

06 Any unauthorized traffic control device or other sign or message placed on the highway right-of-way by a private organization or individual constitutes a public nuisance and should be removed. All unofficial or non-essential traffic control devices, signs, or messages should be removed.
Support:
01 Definitions of an engineering study and engineering judgment are contained in Section 1A.13.

Standard:
02 This Manual describes the application of traffic control devices, but shall not be a legal requirement for their installation.

Guidance:
02A (DE Revision) The decision to use a particular device at a particular location should be made on the basis of either an engineering study or the application of engineering judgment. Thus, while this Manual provides Standards, Guidance, and Options for design and application of traffic control devices, this Manual should not be considered a substitute for engineering judgment.

02B (DE Revision) Engineering judgment should be exercised in the selection and application of traffic control devices.

03 Early in the processes of location and design of roads and streets, engineers should coordinate such location and design with the design and placement of the traffic control devices to be used with such roads and streets.

04 Jurisdictions, or owners of private roads open to public travel, with responsibility for traffic control that do not have engineers on their staffs who are trained and/or experienced in traffic control devices should seek engineering assistance from others, such as the State transportation agency, their county, a nearby large city, or a traffic engineering consultant.

Support:
05 As part of the Federal-aid Program, each State is required to have a Local Technical Assistance Program (LTAP) and to provide technical assistance to local highway agencies. Requisite technical training in the application of the principles of the MUTCD is available from the State’s Local Technical Assistance Program for needed engineering guidance and assistance.
MUTCD defines the difference
Notice that a study requires documentation, but judgment alone does not
To practice engineering in Delaware, you have to be an Engineer.
Interpretations, Experimentation, Changes

- Design, application, and placement of TCDs other than those adopted in the MUTCD prohibited
  - Prohibited – plaintiff lawyers love that word
  - Don’t get creative
- You can ask for permission from FHWA to try something different, but DelDOT can tell you that’s a significant undertaking
There are many others list in Section 1A.11
Colors

- Each one has identified purposes
- Improper use can undermine enforcement attempts

Support:
01 The following color code establishes general meanings for 11 colors of a total of 13 colors that have been identified as being appropriate for use in conveying traffic control information. Tolerance limits for each color are contained in 23 CFR Part 655, Appendix to Subpart F and are available at the Federal Highway Administration’s MUTCD website at http://mutcd.fhwa.dot.gov or by writing to the FHWA, Office of Safety Research and Development (HRD-T-301), 6300 Georgetown Pike, McLean, VA 22101.
02 The two colors for which general meanings have not yet been assigned are being reserved for future applications that will be determined only by FHWA after consultation with the States, the engineering community, and the general public. The meanings described in this Section are of a general nature. More specific assignments of colors are given in the individual Parts of this Manual relating to each class of devices.
Standard:
03 The general meaning of the 13 colors shall be as follows:
   A. Black—regulation
   B. Blue—road user services guidance, tourist information, and evacuation route
   C. Brown—recreational and cultural interest area guidance
   D. Coral—unassigned
   E. Fluorescent Pink—incident management
   F. Fluorescent Yellow-Green—pedestrian warning, bicycle warning, playground warning, school bus and school warning
   G. Green—indicated movements permitted, direction guidance
   H. Light Blue—unassigned
   I. Orange—temporary traffic control
   J. Purple—lanes restricted to use only by vehicles with registered electronic toll collection (ETC) accounts
   K. Red—stop or prohibition
   L. White—regulation
   M. Yellow—warning

Part 1; Section 1A.12; ¶01 et seq.
Definitions and Acronyms

- These used to be scattered throughout the MUTCD
- They are now centralized in Part 1
- 259 Definitions
- 43 Acronyms
Section 1A.15 lists abbreviations

- Acceptable
- Unacceptable
- Specific to Portable Changeable Message Signs
- How and when to abbreviate

### Table 1A-3. Unacceptable Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Intended Word</th>
<th>Common Misinterpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC</td>
<td>Accident</td>
<td>Access (Road)</td>
</tr>
<tr>
<td>CLRS</td>
<td>Clears</td>
<td>Colors</td>
</tr>
<tr>
<td>DLY</td>
<td>Delay</td>
<td>Daily</td>
</tr>
<tr>
<td>FDR</td>
<td>Feeder</td>
<td>Federal</td>
</tr>
<tr>
<td>L</td>
<td>Left</td>
<td>Lane (Merge)</td>
</tr>
<tr>
<td>LT</td>
<td>Light (Traffic)</td>
<td>Left</td>
</tr>
<tr>
<td>PARK</td>
<td>Parking</td>
<td>Park</td>
</tr>
<tr>
<td>POLL</td>
<td>Pollution (Index)</td>
<td>Poll</td>
</tr>
<tr>
<td>RED</td>
<td>Reduce</td>
<td>Red</td>
</tr>
<tr>
<td>STAD</td>
<td>Stadium</td>
<td>Standard</td>
</tr>
<tr>
<td>WRNG</td>
<td>Warning</td>
<td>Wrong</td>
</tr>
</tbody>
</table>
Delaware Rules of the Road

- Worth a browse once a year
  - Pedestrian rules
  - Bicycle rules
  - Skateboard rules
  - Scooter rules
  - Vehicle rules
  - Setting speed limits

http://delcode.delaware.gov/title21/co41/index.shtml
Setting speed restrictions

§ 4168. General speed restrictions.
(a) No person shall drive a vehicle on a highway at a speed greater than is reasonable and prudent under the conditions and without having regard to the actual and potential hazards then existing. In every event, avoid colliding with any person, vehicle or other conveyance on or entering the highway, in compliance with legal requirements and the duty of all persons to give way to each other with due care.
(b) The driver of every vehicle shall, consistent with the requirements of subsection (a) of this section, drive at an appropriate speed when approaching and crossing an intersection or railway grade crossing, approaching a hill crest, when traveling upon any narrow or winding roadway or when a special hazard exists with respect to pedestrians or other traffic or by reason of weather or highway conditions.

§ 4169. Specific speed limits; penalty.
(a) Where no special hazard exists, the following speeds shall be lawful, but any speed in excess of such limits shall be absolute evidence that the speed is not reasonable or prudent and that it is unlawful:
   All types of vehicles:
   (1) 25 miles per hour in any business district;
   (2) 25 miles per hour in any residential district;
   (3) 30 miles per hour at all school zones where 20 mph regulatory signs are posted and state the time periods or conditions during which the speed limit is in effect; such conditions may include when children are attending school, or otherwise;
   (4) 50 miles per hour on 2-lane roadways;
   (5) 55 miles per hour on 4-lane roadways and on divided roadways.
(b) Whenever the Department of Transportation shall determine, on the basis of engineering studies and traffic investigations or upon the basis of a federal law or directive by the Congress or the President, that a maximum speed limit set pursuant to subsection (a) of this section in any particular place on the state maintained highway system is greater or less than is reasonable or safe, the Department shall declare a reasonable and safe maximum limit thereof, which limit shall be effective when posted. Such maximum limit may be deemed to be effective either part or all of the time and differing limits may be established for different times of the day, for different types of vehicles, for different weather conditions and when other significant factors differ. Such maximum limits may be posted on fixed or variable signs. Any speed in excess of such displayed limits shall be absolute evidence that the speed is not reasonable or prudent and that it is unlawful.

Penalties for violation of this section are as follows:
(1) Whoever violates this section for the first offense shall be fined $20. For each subsequent offense, the person shall be fined $25 or be imprisoned not less than 10 nor more than 30 days, or both. A subsequent violation, before being punishable as such, shall have been committed within 24 months after the commission of the prior offense.
(2) Any person violating the section who exceeds the maximum speed limit by more than 5 miles per hour but less than 16 miles per hour shall pay an additional fine of $1 per mile, if such violation is a first offense, or $2 per mile, if such violation is a subsequent offense, for each mile in excess of the maximum speed limit.
(3) Any person violating the section who exceeds the maximum speed limit by more than 16 miles per hour but less than 20 miles per hour shall pay an additional fine of $2 per mile, if such violation is a first offense, or $3 per mile, if such violation is a subsequent offense, for each mile in excess of the maximum speed limit.

(4) Any person violating this section who exceeds the maximum speed limit by more than 19 miles per hour shall pay an additional fine of $3 per mile, if such violation is a first offense, or $4 per mile, if such violation is a second offense, for each mile in excess of the maximum speed limit.
(5) The Department of Transportation shall designate a maximum speed limit of 65 miles per hour for all portions of Delaware State Route 1 located between the Red Lion Creek and the Appoquinimink River. Such maximum limits may be posted on fixed or variable signs. Any speed in excess of such displayed limits shall be absolute evidence that the speed is not reasonable or prudent and that it is unlawful.

§ 4170. Speed limits set by local authorities.
(a) Whenever local authorities within their respective jurisdictions determine upon the basis of an engineering and traffic investigation that the absolute speed permitted under this chapter is greater than is reasonable or safe under the conditions found to exist, such local authority, subject to subsection (c) of this section, shall determine and declare a reasonable and safe absolute speed limit, which shall be effective when appropriate signs giving notice thereof are erected.
(b) Local authorities in their respective jurisdictions may at their discretion, but subject to subsection (c) of this section, authorize by ordinance higher absolute speeds than those stated in this chapter upon through highways or upon highways or portions thereof where there are no intersections or between widely spaced intersections provided signs are erected giving notice of the authorized speed, but local authorities shall not modify or alter the basic rule set forth in subsection (a) of § 4168 of this title.
(c) Alteration of absolute limits on state-maintained highways in any municipality by local authorities shall not be effective until such alteration has been approved by the Department of Safety and Homeland Security.
“DelDOT Maintained Streets”

- Within municipal limits, this often means curb to curb only
  - Town Agreements
  - Project Agreements
- So, the sidewalks, the signage, etc. are typically your concern, despite what DelDOT may from time to time do
- How does this square with MUTCD 1A.07 – the agency, corporation, or individual that “has jurisdiction” is responsible for signage?
  - By virtue of whatever agreements may be in place and the practices that are generally accepted by DelDOT and the municipalities
Liabilities and Risk

- You can’t eliminate risk – but you can manage it

- Liabilities
  - Regulatory – while there are no “MUTCD Police,” you may find that you can’t get certain funding if your signs and markings are non-compliant
  - Constituents – your residents expect safe roads and they exact their frustrations through many avenues
  - Tort liability – signs and pavement markings are a cottage industry for plaintiffs’ attorneys

- Yes, you have many unmet transportation challenges, but you can’t afford to ignore this one
Manual on Uniform Traffic Control Devices (MUTCD)

Part 2 - Signs

Presented by:
Delaware T²/LTAP Center
Introduction

In this module:

- General (colors, dimensions, mountings, locations, retroreflectivity)
- Regulatory signs, barricades, and gates
- Warning signs and object markers
- Guide signs for conventional roads (as opposed to freeways)
- General information signs
- Tourist-oriented directional signs
- Changeable message signs
- Emergency management signs
- A focus on Delaware MUTCD
What’s in Part 2 – Signs?

- **2A – General**
- **2B – Regulatory signs, barricades, gates**
- **2C – Warning signs, object markers**
- **2D – Guide signs (conventional roads)**
- **2E – Guide signs (freeways/expressways)**
- **2F – Toll road signs**
- **2G – Preferential and managed lane signs**
- **2H – General information signs**
- **2I – General service signs**
- **2J – Specific service (logo) signs**
- **2K – Tourist-oriented signs**
- **2L – Changeable message signs**
- **2M – Recreational and cultural interest signs**
- **2N – Emergency management signs**
Standardization and Sign Clutter

- Consistency very important, but at the same time...
- Urban and rural installations – look for differences in sizes, mounting heights, offsets, etc.
- Excessive use of signs
  - Can lose effectiveness
  - Every sign is a liability (crashes, maintenance, etc.)
  - Does it meet the Section 1A.02 guidance?
    - Fulfill a need;
    - Command attention;
    - Convey a clear, simple meaning;
    - Command respect from road users; and
    - Give adequate time for proper response.

Part 2; Section 2A.03 & 2A.04
Standardization and Sign Clutter

- Is there really a need for a sign?
- Does the sign become a feckless substitute for what really needs to be done?
  - Speed enforcement?
  - Other traffic enforcement?
  - Poor geometrics or maintenance?
- Again, does it meet the Section 1A.02 guidance?
  - Fulfill a need;
  - Command attention;
  - Convey a clear, simple meaning;
  - Command respect from road users; and
  - Give adequate time for proper response.

Part 2; Section 2A.03 & 2A.04
Standardization and Sign Clutter

"Lesson Learned: The establishment of ordinances and/or policies that restrict the use of TCDs are a proven method for managing risk associated with actions that are consistent with the adopted ordinances."

Part 2; Section 2A.03 & 2A.04
12 In situations where word messages are required other than those provided in this Manual, the signs shall be of the same shape and color as standard signs of the same functional type.

Option:

13 (DE Revision) DelDOT and local highway agencies may develop special word message signs in situations where roadway conditions make it necessary to provide road users with additional regulatory, warning, or guidance information, such as when road users need to be notified of special regulations or warned about a situation that might not be readily apparent. Unlike colors that have not been assigned or symbols that have not been approved for signs, new word message signs may be used without the need for experimentation.

Standard:

13A (DE Revision) Special word message signs installed on state-maintained roadways shall be approved by DelDOT Traffic.

- Custom word messages used for special situations that are not readily apparent to motorists
- **Non-standard word messages shall match standard shape and color**

James St bridge, Newport
Emergency one-lane bridge conversion

Custom regulatory plaque to reinforce alternating right-of-way at one-lane bridge
Standard Signs Book

- FHWA’s “Standard Highway Signs and Markings”
- [https://mutcd.fhwa.dot.gov/shs_millennium.htm](https://mutcd.fhwa.dot.gov/shs_millennium.htm)
Retroreflectivity promises to be a real attractor for tort liability lawsuits.

- **Deadline – was 2013**
  - i.e., deadline passed
  - Assessment or management method must be in place
  - If you don’t have one...get one
Retroreflectivity

- All Signs and pavement markings should be retroreflective
- Many sign colors now have minimum quantitative retroreflectivity levels (Table 2A-3) that must be maintained
  - Additional sign standards are coming
  - Similar standards coming for pavement markings
Retroreflectivity and Illumination

Standard:

Regulatory, warning, and guide signs shall be retroreflective or illuminated to show the same shape and similar color by both day and night, unless specifically stated otherwise in the text discussion in this Manual of a particular sign or group of signs.
Retroreflectivity
Retroreflectivity

Video
Retroreflectivity

### Table 2A-3. Minimum Maintained Retroreflectivity Levels

<table>
<thead>
<tr>
<th>Sign Color</th>
<th>Beaded Sheeting</th>
<th>Prismatic Sheeting</th>
<th>Additional Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III, IV, VI, VII, VIII, IX, X</td>
</tr>
<tr>
<td>White on Green</td>
<td>W*; G ≥ 7</td>
<td>W*; G ≥ 15</td>
<td>W ≥ 250; G ≥ 25</td>
</tr>
<tr>
<td></td>
<td>W*; G ≥ 7</td>
<td></td>
<td>W ≥ 120; G ≥ 15</td>
</tr>
<tr>
<td>Black on Yellow or Black on Orange</td>
<td>Y*; O*</td>
<td>Y ≥ 50; O ≥ 50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Y*; O*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White on Red</td>
<td>W ≥ 35; R ≥ 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black on White</td>
<td>W ≥ 50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. The minimum maintained retroreflectivity levels shown in this table are in units of cd/lx/m² measured at an observation angle of 0.2° and an entrance angle of 4.0°.
2. For text and fine symbol signs measuring at least 48 inches and for all sizes of bold symbol signs.
3. For text and fine symbol signs measuring less than 48 inches.
* This sheeting type shall not be used for this color for this application.
Standard:

Public agencies or officials having jurisdiction shall use an assessment or management method that is designed to maintain sign retroreflectivity at or above the minimum levels in Table 2A-3.
And those methods are:

- **Visual nighttime inspections**
  - Consistent parameters method (60+ year old driver)
  - Calibration signs ("calibrate" eyes with near minimum signs)
  - Comparison panels (using near minimum coupons)

- **Measured sign retroreflectivity**

- **Expected sign life**

- **Blanket replacement**

- **Control signs**

- **Combinations of these**

- **Other methods**
Retroreflectivity

Deadlines: July 2013

- January 22, 2012 – implementation and continued use of an assessment or management method designed to maintain retro above minimum levels
- January 22, 2015 – replacement of regulatory, warning, and post-mounted guide signs (except street name) that fail minimum levels
- January 22, 2018 – replacement of street name and overhead guide signs that fail minimum levels
For now, you can exclude these from retroreflectivity maintenance:

- Parking, standing, stopping (R7 and R8 series)
- Walking, hitchhiking, crossing (R9 series, R10-1 to R10-4b)
- Acknowledgement
- Blue and brown backgrounds
  - But stay sharp – retro levels coming for these, too
- Bikeway signs exclusively for use by cyclists and peds
Support:

Compliance with the Standard in Paragraph 2 is achieved by having a method in place and using the method to maintain the minimum levels established in Table 2A-3. Provided that an assessment or management method is being used, an agency or official having jurisdiction would be in compliance with the Standard in Paragraph 2 even if there are some individual signs that do not meet the minimum retroreflectivity levels at a particular point in time.
Shapes

Shapes are designated for exclusive purposes

Drivers (as well as peds and bikers) have limited time to gather info – shapes are quickly recognized

Table 2A-4. Use of Sign Shapes

<table>
<thead>
<tr>
<th>Shape</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Octagon</td>
<td>Stop*</td>
</tr>
<tr>
<td>Equilateral Triangle (1 point down)</td>
<td>Yield*</td>
</tr>
<tr>
<td>Circle</td>
<td>Grade Crossing Advance Warning*</td>
</tr>
<tr>
<td>Pennant Shape/Isosceles Triangle</td>
<td>No Passing*</td>
</tr>
<tr>
<td>(longer axis horizontal)</td>
<td></td>
</tr>
<tr>
<td>Pentagon (pointed up)</td>
<td>School Advance Warning Sign</td>
</tr>
<tr>
<td></td>
<td>(squared bottom corners)*</td>
</tr>
<tr>
<td></td>
<td>County Route Sign (tapered bottom</td>
</tr>
<tr>
<td></td>
<td>corners)*</td>
</tr>
<tr>
<td>Crossbuck (two rectangles in an “X”</td>
<td>Grade Crossing*</td>
</tr>
<tr>
<td>configuration)</td>
<td></td>
</tr>
<tr>
<td>Diamond</td>
<td>Warning Series</td>
</tr>
<tr>
<td>Rectangle (including square)</td>
<td>Regulatory Series</td>
</tr>
<tr>
<td></td>
<td>Guide Series**</td>
</tr>
<tr>
<td></td>
<td>Warning Series</td>
</tr>
<tr>
<td>Trapezoid</td>
<td>Recreational and Cultural Interest</td>
</tr>
<tr>
<td></td>
<td>Area Series</td>
</tr>
<tr>
<td></td>
<td>National Forest Route Sign</td>
</tr>
</tbody>
</table>

* This sign shall be exclusively the shape shown.

** Guide series includes general service, specific service, tourist-oriented directional, general information, recreational and cultural interest area, and emergency management signs.
Colors to be used on standard signs shall be as provided in the applicable sections of the MUTCD.

That is, you don’t get creative.

Why? Again – we have limited time to get a message across and standard colors make part of the message arrive intuitively.

There are approved fluorescent versions of the standard red, yellow, green and orange that can be used as an alternative (¶06).
• DE Guidance: *Fluorescent yellow (FY) sheeting should be used for overhead warning signs*

• *Fluorescent yellow-green (FYG) background for all school signs*

Option:

06 The approved fluorescent version of the standard red, yellow, green, or orange color may be used as an alternative to the corresponding standard color.

Guidance:

06A (DE Revision) A fluorescent yellow background should be used for overhead warning signs.

NCC Industrial Track Greenway, Boulden Blvd crossing

FY sheeting used on overhead Pedestrian warning sign

Plaque shall be FYG
• Width and height of signs must comply with applicable sections of the MUTCD.
• Some are going to strike you as BIG – that’s because they are.
• Particularly in urban environments, their size will make horizontal placement...tricky. More later.

W11-2: 30”x30” single lane
36”x36” multi-lane

R1-5 – 36”x36”
Part 2; Section 2A.09 & 2A.10
Section 2A.13 Word Messages

OLD

NEW

Upper-case / lower-case legend now required

Change is Programmatic Update when the sign must otherwise be replaced
DE Guidance: 6-ft to 12-ft lateral offset from pavement edge regardless of shoulder width

- May be reduced to 2 ft if constrained (e.g., right-of-way, utilities, sight distance)
**Section 2A.16 Standardization of Location & Section 2A.19 Lateral Offset**

**Figure 2A-2. Examples of Heights and Lateral Locations of Sign Installations (Delaware Revision)**

- **A - Roadside Sign in Rural Area**
  - 6 ft - 12 ft
  - 5 ft MIN.

- **B - Roadside Sign in Rural Area**
  - 6 ft - 12 ft
  - 5 ft MNL.

- **C - Roadside Sign in Business, Commercial, or Residential Area**
  - 5 ft
  - 2 ft MIN.
  - 7 ft MIN.

- **D - Warning Sign with Advisory Speed Plaque in Rural Area**
  - 6 ft - 12 ft
  - 4 ft MIN.

- **E - Roadside Assembly in Rural Area**
  - 6 ft - 12 ft
  - 5 ft MIN.

- **F - Sign on Noise of Median**
  - Lateral offset may be reduced to 2 ft minimum in areas where space is limited due to site specific conditions (e.g., limited right-of-way, sight distance, etc.)

- **G - Freeway or Expressway Sign with Secondary Sign**
  - Shoulder wider than 6 ft

**Note:**
See Section 2A.19 for reduced lateral offset distances that may be used in areas where lateral offsets are limited, and in business, commercial, or residential areas where sidewalk width is limited or where existing poles are close to the curb.

**Figure 2A-3. Examples of Locations for Some Typical Signs at Intersections**

- **A - Acute Angle Intersection**
  - 6 ft to 12 ft MIN.

- **B - Channelized Intersection**
  - 2 ft MIN.

- **C - Minor Crossroad**
  - 6 ft to 12 ft MIN.

- **D - Urban Intersection**
  - 4 ft MIN.

- **E - Divisional Island**
  - 6 ft to 12 ft MIN.

- **F - Wide Throat Intersection**
  - 50 ft MAX.

**Note:**
Lateral offset is a minimum of 6 feet measured from the edge of the shoulder, or 12 feet measured from the edge of the traveled way. See Section 2A.19 for lower minimums that may be used in urban areas, or where lateral offset space is limited.
The typical municipal situation

This probably works – probably >1’ – using the “lean technique” to comply is maybe a tad too creative
Lateral Offsets

- Some aren’t close. Some just squeeze in.

Is this one >1’ from the face of the curb?

Part 2; Section 2A.16 & 2A.19
Within the Clear Zone, support anchors shall be crashworthy:

- Breakaway
- Yielding
- Shielded with longitudinal barrier

A breakaway design

NOT breakaway, NOT yielding, not acceptable
Breakaway or Yielding Anchors

- DelDOT’s breakaway assembly detail (excerpt)
  - Sleeve in sleeve approach
  - Notice 4” maximum limitation
Breakaway or Yielding Anchors

- Maryland’s wooden breakaway assembly detail (excerpt)
  - Pre-dug hole
  - Tamped backfill (no concrete)
  - 1½” holes drilled at 4” & 18”
  - Perpendicular to roadway

A breakaway design
Breakaway or Yielding Anchors

- Beyond a 4”x4” post, wooden support modifications necessary to ensure a surface break

A breakaway design
There are many ways to enhance sign conspicuity (see Section 2A-15).

One is a strip of retroreflective material on the post.

Must be $\geq 2''$ wide and run full length of post from bottom of sign to $< 2'$ above roadway.

Color shall match background of the sign.
Maintenance

- Retroreflectivity
- Graffiti
- Vegetation

Part 2; Section 2A.22
2011 DE MUTCD

Section 2B.03 Size of Regulatory Signs

Guidance:

01A (DE Revision) At intersections of multi-lane roads with single lane roads, the regulatory sign sizes on all approaches to the intersection should be as required for multi-lane roads.

Standard:

03 Except as provided in Paragraphs 4 and 5, the minimum sizes for regulatory signs facing traffic on multi-lane conventional roads shall be as shown in the Multi-lane column of Table 2B-1.

Option:

04 Where the posted speed limit is 35 mph or less on a multi-lane highway or street, other than for a STOP sign, the minimum size shown in the Single Lane column in Table 2B-1 may be used.

05 Where a regulatory sign, other than a STOP sign, is placed on the left-hand side of a multi-lane roadway in addition to the installation of the same regulatory sign on the right-hand side or the roadway, the size shown in the Single Lane column in Table 2B-1 may be used for both the sign on the right-hand side and the sign on the left-hand side of the roadway.

Table 2B-1. Regulatory Sign and Plaque Sizes (Sheet 1 of 5)

<table>
<thead>
<tr>
<th>Sign or Plaque</th>
<th>Sign Designation</th>
<th>Section</th>
<th>Conventional Road</th>
<th>Expressway</th>
<th>Freeway</th>
<th>Minimum</th>
<th>Oversized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>R1-1</td>
<td>29.05</td>
<td>36 x 36**</td>
<td>36 x 36</td>
<td>36 x 36</td>
<td>36 x 36</td>
<td>30 x 36*</td>
</tr>
<tr>
<td>Yield</td>
<td>R1-2</td>
<td>29.05</td>
<td>36 x 36 x 36*</td>
<td>48 x 48 x 48</td>
<td>48 x 48 x 48</td>
<td>48 x 48 x 48</td>
<td>36 x 30 x 30*</td>
</tr>
<tr>
<td>To Oncoming Traffic</td>
<td>R1-2aP</td>
<td>28.10</td>
<td>24 x 18</td>
<td>24 x 18</td>
<td>36 x 30</td>
<td>48 x 36</td>
<td>24 x 18</td>
</tr>
<tr>
<td>To U-Turning Traffic</td>
<td>R1-2aP-DE</td>
<td>28.10</td>
<td>24 x 18</td>
<td>24 x 18</td>
<td>36 x 30</td>
<td>48 x 36</td>
<td>24 x 18</td>
</tr>
</tbody>
</table>

Note – multi-lane is any road with more than one lane in a single direction

Some Larger sizes for multi-lane roads with a posted speed limit ≥ 40 MPH

Single Lane size can be used on multi-lane road if same sign is posted on left-hand and right-hand side

DE Guidance: At intersections of multi-lane and single lane roads, larger sizes should be used on all approaches (e.g., YIELD signs)
Use of “Minimum” Column

- Engineering judgment
- Careful with use
  - Single lane should be the default; not Minimum
  - Subdivision street intersects state maintained – Single Lane
- Appropriate considerations
  - Urban scenarios where space is prohibitive
  - Narrow alley
  - Low ADT residential

---

**Table 2B.1. Regulatory Sign and Plaque Sizes (Sheet 1 of 5)**

<table>
<thead>
<tr>
<th>Sign or Plaque</th>
<th>Sign Designation</th>
<th>Section</th>
<th>Conventional Road</th>
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<th>Oversized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>R1-1</td>
<td>28.05</td>
<td>36 x 36**</td>
<td>36 x 36</td>
<td>36 x 36</td>
<td>—</td>
<td>30 x 30*</td>
</tr>
<tr>
<td>Yield</td>
<td>R1-2</td>
<td>28.08</td>
<td>36 x 36 x 36</td>
<td>48 x 48</td>
<td>48 x 48</td>
<td>—</td>
<td>30 x 30*</td>
</tr>
<tr>
<td>To Oncoming Traffic</td>
<td>R1-2aP</td>
<td>2B.10</td>
<td>24 x 18</td>
<td>24 x 18</td>
<td>36 x 30</td>
<td>48 x 36</td>
<td>24 x 18</td>
</tr>
<tr>
<td>(plaque)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To U-Turning Traffic</td>
<td>R1-2aP-DE</td>
<td>2B.10</td>
<td>24 x 18</td>
<td>24 x 18</td>
<td>36 x 30</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>(plaque)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Part 2; Section 2B.03
Section 2B.03 Size of Regulatory Signs

Standard:
06 A minimum size of 36 x 36 inches shall be used for STOP signs that face multi-lane approaches.
07 Where side roads intersect a multi-lane street or highway that has a speed limit of 45 mph or higher, the minimum size of the STOP signs facing the side road approaches, even if the side road only has one approach lane, shall be 36 x 36 inches.
08 Where side roads intersect a multi-lane street or highway that has a speed limit of 40 MPH or lower, the minimum size of the STOP signs facing the side road approaches shall be as shown in the Single Lane or Multi-lane columns of Table 2B-1 based on the number of approach lanes on the side street approach.

Guidance:
08A (DE Revision) Except as provided in Paragraph 8B, a minimum size of 36 x 36 inches should be used for STOP signs at intersections that include one or more state-maintained roadway(s).
08B (DE Revision) A minimum size of 30 x 30 inches should be used for STOP signs at the intersection of two subdivision streets.

• DE Guidance: 36” x 36” (min.) STOP signs at intersections with one or more state-maintained roadway(s)
• DE Guidance: 30” x 30” STOP signs at intersection of two subdivision streets
Section 2B.05 STOP (R1-1) and ALL WAY Plaque (R1-3P)

Standard:
01 When it is determined that a full stop is always required on an approach to an intersection, a STOP (R1-1) sign (see Figure 2B-1) shall be used.
02 The STOP sign shall be an octagon with a white legend and border on a red background.
03 Secondary legends shall not be used on STOP sign faces.
04 At intersections where all approaches are controlled by STOP signs (see Section 2B.07), an ALL WAY supplemental plaque (R1-3P) shall be mounted below each STOP sign. The ALL WAY plaque (see Figure 2B-1) shall have a white legend and border on a red background.
05 The ALL WAY plaque shall only be used if all intersection approaches are controlled by STOP signs.
06 Supplemental plaques with legends such as 2-WAY, 3-WAY, 4-WAY, or other numbers of ways shall not be used with STOP signs.

- ALL WAY plaque required, where applicable
- 2-WAY, 3-WAY, and 4-WAY plaques no longer permitted
Option:
01  The CROSS TRAFFIC DOES NOT STOP (W4-4P) plaque (see Figure 2C-9) may be used in combination with a STOP sign when engineering judgment indicates that conditions are present that are causing or could cause drivers to misinterpret the intersection as an all-way stop.
02  Alternative messages (see Figure 2C-9) such as TRAFFIC FROM LEFT (RIGHT) DOES NOT STOP (W4-4aP) or ONCOMING TRAFFIC DOES NOT STOP (W4-4bP) may be used when such messages more accurately describe the traffic controls established at the intersection.

Guidance:
03  Plaques with the appropriate alternative messages of TRAFFIC FROM LEFT (RIGHT) DOES NOT STOP or ONCOMING TRAFFIC DOES NOT STOP should be used at intersections where STOP signs control all but one approach to the intersection, unless the only non-stopped approach is from a one-way street.

Standard:
04  If a W4-4P plaque or a plaque with an alternative message is used, it shall be mounted below the STOP sign.

• Use W4-4P at locations where motorists may think that an intersection is an all-way stop
• W4-4aP and/or W4-4bP plaques should be used when all approaches except one are stop-controlled
Crash history indicated side-street motorists assumed all-way stop

- W4-4P (Cross Traffic Does not Stop) should be installed below STOP
- 2-WAY plaque no longer permitted
So When/Where Do We Use Stop Signs?

- Bottom line – don’t assume that every intersection requires a Stop sign
  - Consider Yield
  - Consider...nothing

Guidance:

01 At intersections where a full stop is not necessary at all times, consideration should first be given to using less restrictive measures such as YIELD signs (see Sections 2B.08 and 2B.09).

02 The use of STOP signs on the minor-street approaches should be considered if engineering judgment indicates that a stop is always required because of one or more of the following conditions:

  A. The vehicular traffic volumes on the through street or highway exceed 6,000 vehicles per day;
  B. A restricted view exists that requires road users to stop in order to adequately observe conflicting traffic on the through street or highway; and/or
  C. Crash records indicate that three or more crashes that are susceptible to correction by the installation of a STOP sign have been reported within a 12-month period, or that five or more such crashes have been reported within a 2-year period. Such crashes include right-angle collisions involving road users on the minor-street approach failing to yield the right-of-way to traffic on the through street or highway.

Support:

03 The use of STOP signs at grade crossings is described in Sections 8B.04 and 8B.05.

Part 2; Section 2B.06
**Yield Sign Application**

- Yield signs **may** be used in lieu of Stop signs

---

**Option:**

01  **YIELD** signs may be installed:

A. On the approaches to a through street or highway where conditions are such that a full stop is not always required.

B. At the second crossroad of a divided highway, where the median width at the intersection is 30 feet or greater. In this case, a **STOP** or **YIELD** sign may be installed at the entrance to the first roadway of a divided highway, and a **YIELD** sign may be installed at the entrance to the second roadway.

C. For a channelized turn lane that is separated from the adjacent travel lanes by an island, even if the adjacent lanes at the intersection are controlled by a highway traffic control signal or by a **STOP** sign.

D. At an intersection where a special problem exists and where engineering judgment indicates the problem to be susceptible to correction by the use of the **YIELD** sign.

E. Facing the entering roadway for a merge-type movement if engineering judgment indicates that control is needed because acceleration geometry and/or sight distance is not adequate for merging traffic operation.

---

**Standard:**

02  A **YIELD** (R1-2) sign shall be used to assign right-of-way at the entrance to a roundabout. **YIELD** signs at roundabouts shall be used to control the approach roadways and shall not be used to control the circulatory roadway.

03  **(DE Revision)** Other than for all of the approaches to a roundabout, **YIELD** signs shall not be placed on all of the approaches to an intersection as the sole means of traffic control.
Standard:
01 The STOP or YIELD sign shall be installed on the near side of the intersection on the right-hand side of the approach to which it applies. When the STOP or YIELD sign is installed at this required location and the sign visibility is restricted, a Stop Ahead sign (see Section 2C.36) shall be installed in advance of the STOP sign or a Yield Ahead sign (see Section 2C.36) shall be installed in advance of the YIELD sign.
02 The STOP or YIELD sign shall be located as close as practical to the intersection it regulates, while optimizing its visibility to the road user it is intended to regulate.

Guidance:
07 STOP or YIELD signs should not be placed farther than 50 feet from the edge of the pavement of the intersected roadway (see Drawing F in Figure 2A-3).
08 A sign that is mounted back-to-back with a STOP or YIELD sign should stay within the edges of the STOP or YIELD sign. If necessary, the size of the STOP or YIELD sign should be increased so that any other sign installed back-to-back with a STOP or YIELD sign remains within the edges of the STOP or YIELD sign.

- Shall be installed on right-hand side
- As close as practical to intersection, while optimizing visibility
- No farther than 50 ft from edge of intersecting road (i.e., does not have to be adjacent to stop line)
- Back-to-back signs should stay within edges of STOP or YIELD (now includes DO NOT ENTER)
Section 2B.10 STOP Sign or YIELD Sign Placement

STOP shall be 36” x 36” on a multi-lane approach and it shall be installed on the right-hand side.

Sign on back (Keep Right) should stay within edges of STOP

Lantana Dr at SR 7
2011 DE MUTCD
(DRAFT)

Section 2B.11 Yield Here To Pedestrians Signs and Stop Here For Pedestrians Signs (R1-5 Series)

Guidance:
02 If yield (stop) lines and Yield Here To (Stop Here For) Pedestrians signs are used in advance of a crosswalk that crosses an uncontrolled multi-lane approach, they should be placed 20 to 50 feet in advance of the nearest crosswalk line (see Section 3B.16 and Figure 3B-17), and parking should be prohibited in the area between the yield (stop) line and the crosswalk.

Option:
04 Yield Here To (Stop Here For) Pedestrians signs may be used in advance of a crosswalk that crosses an uncontrolled multi-lane approach to indicate to road users where to yield (stop) even if yield (stop) lines are not used.

05 A Pedestrian Crossing (W11-2) warning sign may be placed overhead or may be post-mounted with a diagonal downward pointing arrow (W16-7P) plaque at the crosswalk location where Yield Here To (Stop Here For) Pedestrians signs have been installed in advance of the crosswalk.

Standard:
06 If a W11-2 sign has been post-mounted at the crosswalk location where a Yield Here To (Stop Here For) Pedestrians sign is used on the approach, the Yield Here To (Stop Here For) Pedestrians sign shall not be placed on the same post as or block the road user’s view of the W11-2 sign.

- **R1-5 size now 36” x 36”** (previously 18” x 18”)
- **Install 20 ft to 50 ft in advance of uncontrolled crosswalk**
- **Parking prohibition between yield line and crosswalk**
- **New Options**
  - R1-5 sign without yield line
  - R1-5 signs with **W11-2 assemblies** at crosswalk; however, R1-5 signs shall not block W11-2 assemblies
Section 2B.11 Yield Here To Pedestrians Signs and Stop Here For Pedestrians Signs (R1-5 Series)

Optional W11-2 assemblies; R1-5 signs shall not block W11-2 signs

Standard size now 36” x 36”

Parking prohibition

E. Main St, Newark
Yield Here to Pedestrians

- If “sharks teeth” or other yield lines are used, must also place an R1-5 sign

Standard:
01 (DE Revision) Yield Here To (Stop Here For) Pedestrians (R1-5 and R1-5b) signs (see Figure 2B-2) shall be used if yield (stop) lines are used in advance of a marked crosswalk that crosses an uncontrolled multi-lane approach. The Stop Here for Pedestrians signs shall only be used where the law specifically requires that a driver must stop for a pedestrian in a crosswalk. The legend STATE LAW may be displayed at the top of the R1-5 and R1-5b signs, if applicable.

Part 2; Section 2B.11
In-Street Pedestrian Signs

- DE Code says **Yield** to pedestrians (21 Del.C. § 4142)

**Support:**

01A (DE Revision) §4142 of Title 21 of the Delaware Code states that drivers shall yield the right-of-way, slowing down or stopping if need be to so yield, to a pedestrian crossing the roadway within a crosswalk when the pedestrian is upon the half of the roadway upon which the vehicle is traveling, or when the pedestrian is approaching so closely from the opposite half of the roadway as to be in danger.

**Guidance:**

01B (DE Revision) Based on current Delaware Code, the *Yield Here to Pedestrians* sign should be used along state-maintained roadways.

01C (DE Revision) Prior to sign installation, §4142 of Title 21 of the Delaware Code should be reviewed to determine whether the *Yield Here to Pedestrians* or *Stop Here For Pedestrians* signs should be used. Local ordinances should be reviewed for *Yield Here To (Stop Here For) Pedestrians* signs installed along municipal-maintained roadways.
In-Street Pedestrian Signs

These must be designed and placed carefully to ensure they don’t create more problems than they solve.

Option:
01 The In-Street Pedestrian Crossing (R1-6 or R1-6a) sign (see Figure 2B-2) or the Overhead Pedestrian Crossing (R1-9 or R1-9a) sign (see Figure 2B-2) may be used to remind road users of laws regarding right-of-way at an unsignalized pedestrian crosswalk. The legend STATE LAW may be displayed at the top of the R1-6, R1-6a, R1-9, and R1-9a signs, if applicable. On the R1-6 and R1-6a signs, the legends STOP or YIELD may be used instead of the appropriate STOP sign or YIELD sign symbol.
02 Highway agencies may develop and apply criteria for determining the applicability of In-Street Pedestrian Crossing signs.
Standard:
03 If used, the In-Street Pedestrian Crossing sign shall be placed in the roadway at the crosswalk location on the center line, on a lane line, or on a median island. The In-Street Pedestrian Crossing sign shall not be post-mounted on the left-hand or right-hand side of the roadway.
04 If used, the Overhead Pedestrian Crossing sign shall be placed over the roadway at the crosswalk location.
05 An In-Street or Overhead Pedestrian Crossing sign shall not be placed in advance of the crosswalk to educate road users about the State law prior to reaching the crosswalk, nor shall it be installed as an educational display that is not near any crosswalk.
05A (DE Revision) The installation of In-Street Pedestrian Crossing signs along state-maintained roadways shall be approved by DelDOT Traffic.
In-Street Pedestrian Signs

- DE Code says Yield – not Stop

05B (DE Revision) If In-Street Pedestrian Crossing signs are installed along state-maintained roadways by municipalities or sponsoring agencies, they shall be maintained by the municipality or sponsoring agency and shall not be maintained by DelDOT.

Standard:

08 The In-Street Pedestrian Crossing sign and the Overhead Pedestrian Crossing sign shall not be used at signalized locations.

09 The STOP FOR legend shall only be used in States where the State law specifically requires that a driver must stop for a pedestrian in a crosswalk.

Guidance:

09A (DE Revision) Based on current Delaware Code, the YIELD sign symbol should be used with In-Street Pedestrian Crossing signs and the YIELD TO legend should be used with Overhead Pedestrian Crossing signs along state-maintained roadways.

09B (DE Revision) Prior to sign installation, §4142 of Title 21 of the Delaware Code should be reviewed to determine whether the STOP or YIELD sign symbol should be used with In-Street Pedestrian Crossing signs or whether the legend STOP FOR or YIELD TO should be used with Overhead Pedestrian Crossing signs along state-maintained roadways. Local ordinances should be reviewed for In-Street Pedestrian Crossing and Overhead Pedestrian Crossing signs installed along municipal-maintained roadways.

Option:

09C (DE Revision) If local ordinances indicate that drivers must stop for pedestrians at unsignalized crosswalks, the STOP sign symbol may be used with In-Street Pedestrian Crossing signs and the legend STOP FOR may be used with Overhead Pedestrian Crossing signs along municipal-maintained roadways.

Standard:

09D (DE Revision) Along municipal-maintained roadways, the legend STATE LAW shall not be installed with In-Street Pedestrian Crossing signs with the STOP sign symbol or with Overhead Pedestrian Crossing signs with the STOP FOR legend.

Part 2; Section 2B.12
In-Street Pedestrian Signs

• Posting height exception

10 The In-Street Pedestrian Crossing sign shall have a black legend (except for the red STOP or YIELD sign symbols) and border on a white background, surrounded by an outer yellow or fluorescent yellow-green background area (see Figure 2B-2). The Overhead Pedestrian Crossing sign shall have a black legend and border on a yellow or fluorescent yellow-green background at the top of the sign and a black legend and border on a white background at the bottom of the sign (see Figure 2B-2).

11 Unless the In-Street Pedestrian Crossing sign is placed on a physical island, the sign support shall be designed to bend over and then bounce back to its normal vertical position when struck by a vehicle.

Guidance:

11A (DE Revision) Along state-maintained roadways, In-Street Pedestrian Crossing signs should have a fluorescent yellow-green background area and Overhead Pedestrian Crossing signs should have a fluorescent yellow-green background at the top of the sign (see Figure 2B-2).

Support:

12 The Provisions of Section 2A.18 concerning mounting height are not applicable for the In-Street Pedestrian Crossing sign.

Standard:

13 The top of an In-Street Pedestrian Crossing sign shall be a maximum of 4 feet above the pavement surface. The top of an In-Street Pedestrian Crossing sign placed in an island shall be a maximum of 4 feet above the island surface.

Option:

14 The In-Street Pedestrian Crossing sign may be used seasonally to prevent damage in winter because of plowing operations, and may be removed at night if the pedestrian activity at night is minimal.

15 In-Street Pedestrian Crossing signs, Overhead Pedestrian Crossing signs, and Yield Here To (Stop Here For) Pedestrians signs may be used together at the same crosswalk.
In-Street Pedestrian Signs

Photos courtesy DelDOT

Part 2; Section 2B.12
Clarification of speed studies

- **Study includes analysis of free-flow speed distribution**
- **List of significant changes to consider reevaluating speed zones**
- **Posted speed limit should be within 5 MPH of the free-flow 85\textsuperscript{th}-percentile speed**
- **Obtain speeds outside ½-mile influence area of traffic signal**
Establishing Speed Limits

By default (Delaware), maximum speed in residential areas is 25 mph, 50 mph on 2-lane roadways, ...

Local authorities may establish, through engineering study, higher or lower speeds for their roads.
Speed Studies

• Spot counts acceptable
• At least 30 vehicles or 30 minutes; more better
• Free flowing traffic away from stop conditions
• Can do by tube counter and other means, too
Section 2B.13 Speed Limit Sign (R2-1) & Section 2C.38 Reduced Speed Limit Ahead Sign (W3-5, W3-5-DE)

- **Used where speed reduction exceeds 10 MPH**
- **Installed in advance of downstream Speed Limit sign based on Table 2C-4**

### Table 2C-4. Guidelines for Advance Placement of Warning Signs

<table>
<thead>
<tr>
<th>Posted or 85th-Percentile Speed</th>
<th>Condition A: Speed reduction and lane changing in heavy traffic</th>
<th>Condition B: Deceleration to the listed advisory speed (mph) for the condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>20 mph</td>
<td>225 ft</td>
<td>100 ft</td>
</tr>
<tr>
<td>25 mph</td>
<td>325 ft</td>
<td>100 ft</td>
</tr>
<tr>
<td>30 mph</td>
<td>460 ft</td>
<td>100 ft</td>
</tr>
<tr>
<td>35 mph</td>
<td>565 ft</td>
<td>100 ft</td>
</tr>
<tr>
<td>40 mph</td>
<td>670 ft</td>
<td>125 ft</td>
</tr>
<tr>
<td>45 mph</td>
<td>775 ft</td>
<td>175 ft</td>
</tr>
<tr>
<td>250 ft</td>
<td>200 ft</td>
<td>175 ft</td>
</tr>
<tr>
<td>325 ft</td>
<td>275 ft</td>
<td>225 ft</td>
</tr>
<tr>
<td>350 ft</td>
<td>325 ft</td>
<td>275 ft</td>
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<tr>
<td>400 ft</td>
<td>450 ft</td>
<td>350 ft</td>
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<tr>
<td>475 ft</td>
<td>450 ft</td>
<td>350 ft</td>
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<tr>
<td>525 ft</td>
<td>525 ft</td>
<td>350 ft</td>
</tr>
<tr>
<td>550 ft</td>
<td>525 ft</td>
<td>350 ft</td>
</tr>
<tr>
<td>75 mph</td>
<td>1,350 ft</td>
<td>650 ft</td>
</tr>
</tbody>
</table>

**Guidance:**

(DE Revision) A Reduced Speed Limit Ahead (W3-5) sign (see Section 2C.38) should be used to inform road users of a reduced speed zone where the speed limit is being reduced by more than 10 mph, or where engineering judgment indicates the need for advance notice to comply with the posted speed limit ahead.

- **Condition A:**
  - Speed reduction and lane changing in heavy traffic

- **Condition B:**
  - Deceleration to the listed advisory speed (mph) for the condition

- **Condition B to 0 MPH:** Stop and yield conditions

- **Condition B to XX MPH:** Speed reduction in advance of hazard (e.g., curve)

Ex. – 50 mph posted with 30 mph advisory – 125’
Sign Spacing

Table 2C-4 notes

1. The distances are adjusted for a sign legibility distance of 180 feet for Condition A. The distances for Condition B have been adjusted for a sign legibility distance of 250 feet, which is appropriate for an alignment warning symbol sign. For Conditions A and B, warning signs with less than 6-inch legend or more than four words, a minimum of 100 feet should be added to the advance placement distance to provide adequate legibility of the warning sign.

2. Typical conditions are locations where the road user must use extra time to adjust speed and change lanes in heavy traffic because of a complex driving situation. Typical signs are Merge and Right Lane Ends. The distances are determined by providing the driver a PRT of 14.0 to 14.5 seconds for vehicle maneuvers (2004 AASHTO Policy, Exhibit 3-3, Decision Sight Distance, Avoidance Maneuver E) minus the legibility distance of 180 feet for the appropriate sign.

3. Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, Signal Ahead, and Intersection Warning signs. The distances are based on the 2004 AASHTO Policy, Exhibit 3-1, Stopping Sight Distance, providing a PRT of 2.5 seconds, a deceleration rate of 11.2 feet/second², minus the sign legibility distance of 180 feet.

4. Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn, Curve, Reverse Turn, or Reverse Curve. The distance is determined by providing a 2.5 second PRT, a vehicle deceleration rate of 10 feet/second², minus the sign legibility distance of 250 feet.

5. No suggested distances are provided for these speeds, as the placement location is dependent on site conditions and other signing. An alignment warning sign may be placed anywhere from the point of curvature up to 100 feet in advance of the curve. However, the alignment warning sign should be installed in advance of the curve and at least 100 feet from any other signs.

6. The minimum advance placement distance is listed as 100 feet to provide adequate spacing between signs.
Section 2B.18 Movement Prohibition Signs (R3-1 through R3-4, R3-18, and R3-27)

Standard:
01 Except as provided in Paragraphs 11 and 13, where specific movements are prohibited, Movement Prohibition signs shall be installed.

Guidance:
02 Movement Prohibition signs should be placed where they will be most easily seen by road users who might be intending to make the movement.
03 If No Right Turn (R3-1) signs (see Figure 2B-4) are used, at least one should be placed either over the roadway or at a right-hand corner of the intersection.
04 If No Left Turn (R3-2) signs (see Figure 2B-4) are used, at least one should be placed over the roadway, at the far left-hand corner of the intersection, on a median, or in conjunction with the STOP sign or YIELD sign located on the near right-hand corner.

- **Installed where movements are prohibited** (unless ONE WAY signs are installed)
- **Placed where easily seen by motorists who might attempt the illegal movement**

Overhead or near right corner

Overhead, far left corner, in median, or near right corner with STOP or YIELD
- 2B.19 Intersection lane control signs
- 2B.20 Mandatory movement lane control signs
- 2B.21 Optional movement lane control
- 2B.22 Advance intersection lane control signs
- 2B.23 Right (left) lane must exit signs
- 2B.24 Two-way left turn only signs
- ...
- 2B.35 Slow vehicle turn-out signs
Section 2B.37 DO NOT ENTER Sign (R5-1)

Standard:

01 The DO NOT ENTER (R5-1) sign (see Figure 2B-11) shall be used where traffic is prohibited from entering a restricted roadway.

Guidance:

02 (DE Revision) The DO NOT ENTER sign, if used, should be placed directly in view of a road user at the point where a road user could wrongly enter a divided highway, one-way roadway, or ramp (see Figures 2B-12 and 2B-12A). The sign should be mounted on the right-hand side of the roadway, facing traffic that might enter the roadway or ramp in the wrong direction.

03 If the DO NOT ENTER sign would be visible to traffic to which it does not apply, the sign should be turned away from, or shielded from, the view of that traffic.

03A (DE Revision) DO NOT ENTER (R5-1) signs (see Figure 2B-12) should be installed on both the right-hand and left-hand side of the roadway, facing traffic that might enter the roadway in the wrong direction at intersections of divided highways with state-maintained roadways (excluding subdivision streets) where the median width is greater than 30 feet (see Figure 2B-12).

03B (DE Revision) A DO NOT ENTER (R5-1) sign should be installed on the right-hand side of the roadway, facing traffic that might enter the roadway in the wrong direction at intersections of divided highways with subdivision streets, non-DelDOT owned roadways, private driveways, and median U-turn openings where the median width is greater than 30 feet (see Figure 2B-12A).

Option:

05 (DE Revision) A second DO NOT ENTER sign on the left-hand side of the roadway may be used, particularly where traffic approaches from an intersecting roadway (see Figure 2B-12A).

- **Used where traffic is prohibited from entering a restricted roadway**
- **DE Guidance:** Two R5-1 signs at intersections of divided highways with state-maintained roads and median widths ≥ 30 ft
- **DE Option:** R5-1 sign in median is optional at intersections of divided highways with subdivision streets, U-turn openings, and private driveways and median widths ≥ 30 ft
Section 2B.40 ONE WAY Signs (R6-1, R6-2)

Standard:
01 Except as provided in Paragraph 6, the ONE WAY (R6-1 or R6-2) sign (see Figure 2B-13) shall be used to indicate streets or roadways upon which vehicular traffic is allowed to travel in one direction only.
02 ONE WAY signs shall be placed parallel to the one-way street at all alleys and roadways that intersect one-way roadways as shown in Figure 2B-14.
03 At an intersection with a divided highway that has a median width at the intersection itself of 30 feet or more, ONE WAY signs shall be placed, visible to each crossroad approach, on the near right and far left corners of each intersection with the directional roadways (see Figure 2B-15).
04 At an intersection with a divided highway that has a median width at the intersection itself of less than 30 feet, Keep Right (R4-7) signs and/or ONE WAY signs shall be installed (see Figures 2B-16, 2B-16A, 2B-17, and 2B-17A). If Keep Right signs are installed, they shall be placed as close as practical to the approach ends of the medians and shall be visible to traffic on the divided highway and each crossroad approach. If ONE WAY signs are installed, they shall be placed on the near right and far left corners of the intersection and shall be visible to each crossroad approach.

Guidance:
04B (DE Revision) At an intersection with a divided highway that has a median width at the intersection itself of greater than or equal to 18 feet and less than 30 feet, ONE WAY signs should be installed (see Figures 2B-16A and 2B-17A) on the near right and far left corners of the intersection and should be visible to each crossroad approach.

• Used where travel is in one direction only
• Intersections along divided highways with median widths ≥ 30 ft
• DE Guidance: Intersections along divided highways with median widths ≥ 18 ft and < 30 ft
• Near right and far left corners of intersection
Section 2B.40 ONE WAY Signs (R6-1, R6-2)

Figure 2B-14. Locations of ONE WAY Signs

Legend
- Optional
- Direction of travel
Section 2B.45 Examples of Roundabout Signing

Figure 2B-22. Example of Regulatory, Warning, and Guide Signs for a One-Lane Roundabout

(Delaware Revision)

Notes:
1. Signs shown for only one leg
2. See Section 2D.38 for guide signs at roundabouts
3. See Chapter 3C for markings at roundabouts
4. The spacings shown on this figure are for rural intersections. See Sections 2D.39, 2D.30, 2D.32, 2D.34, 2D.40, and 2D.42 for low-speed and/or urban conditions
5. All guide signs are optional

* See Table 2C-4 for placement distance. Placement of guide signs should be adjusted, as necessary, to provide a minimum of 100 ft spacing between signs.
• Modifications to two common signs

OLD

TURNING TRAFFIC MUST YIELD TO PEDESTRIANS
R10-15

NEW

TURNING VEHICLES
R10-15

• Used where motorists need to be reminded to yield to pedestrians

OLD

TURN ON FLASHING RED WITH CAUTION AFTER STOP
R10-17-DE

NEW

LEFT TURN YIELD ON FLASHING RED ARROW AFTER STOP
R10-27

• Used with DE’s flashing red arrow signal phasing

• Should be installed overhead adjacent to left-turn signal heads

• New sign for right-turn overlap signal phasing

A U-TURN YIELD TO RIGHT TURN (R10-16) sign (see Figure 2B-27) may be installed near the left-turn signal face if U-turns are allowed on a protected left-turn movement on an approach from which a right-turn GREEN ARROW signal indication is simultaneously being displayed to drivers making a right turn from the conflicting approach to their left.
Section 2B.67 Barricades

Option:
01 Barricades may be used to mark any of the following conditions:
   A. A roadway ends,
   B. A ramp or lane closed for operational purposes, or
   C. The permanent or semi-permanent closure or termination of a roadway.

Standard:
02 When used to warn and alert road users of the terminus of a roadway in other than temporary traffic control zones, barricades shall meet the design criteria of Section 6F.68 for a Type 3 Barricade, except that the colors of the stripes shall be retroreflective white and retroreflective red.

Option:
03 An end-of-roadway marker or markers may be used as described in Section 2C.66.

Guidance:
04 Appropriate advance warning signs (see Chapter 2C) should be used.

- Permanent barricades shall meet criteria for Type 3 Barricades in Part 6
- Alternating retroreflective red and white stripes on all rails
- Standard construction detail T–16: Type 4 end-of-roadway object markers installed on middle rail

US 13 at Hickory Ridge Rd
Section 2B.67 Barricades

Wood Barricade Post Chart

<table>
<thead>
<tr>
<th>Roadway Width</th>
<th>Number of Barricades</th>
<th>Type of Post</th>
<th>Outside Overhang</th>
</tr>
</thead>
<tbody>
<tr>
<td>4” x 3” (100)</td>
<td>3</td>
<td>2-Post</td>
<td>6” (150)</td>
</tr>
<tr>
<td>4” x 4” (100)</td>
<td>3</td>
<td>3-Post</td>
<td>8” (200)</td>
</tr>
<tr>
<td>4” x 5” (150)</td>
<td>3</td>
<td>3-Post</td>
<td>10” (250)</td>
</tr>
<tr>
<td>4” x 6” (200)</td>
<td>3</td>
<td>3-Post</td>
<td>12” (300)</td>
</tr>
<tr>
<td>4” x 7” (250)</td>
<td>3</td>
<td>3-Post</td>
<td>14” (350)</td>
</tr>
<tr>
<td>4” x 8” (300)</td>
<td>3</td>
<td>3-Post</td>
<td>16” (400)</td>
</tr>
</tbody>
</table>

Notes:
1. Barricades shall be placed completely across the roadway from edge of road to edge of road. If necessary, the barricade overhang beyond the outside posts (typically 4”-0” (12cm) may be reduced to the “outside overhang” value indicated in the table above if obstacles are present beyond the roadway edge.
2. Markings for barricade rails shall be alternating fluorescent red and white stripes, sloping downward at an angle of 45 degrees, using prismatic retroreflective sheeting.
3. Attach barricade rail and object marker to the 4” x 4” (100) pressure treated wood post using lag bolts 12” (300) long, minimum with washers. Two bolts per rail per post shall be required.
4. All wood shall be pressure treated.
5. The end of road object marker (MUTCD Code O5-4) shall be 18” (450) x 18” (450) with red prismatic, retroreflective sheeting.
6. Treated wood post shall be placed in pre-dug hole, backfilled using suitable material, and tempered thoroughly to provide a rigid sub-surface condition around the post.
7. Barricade rails may be constructed using plastic or wood and should not be metal.
8. Longer width closers can be accommodated by various combinations of 2-post and 3-post barricades.
Warning Signs – Function & Application

- Call attention to unexpected conditions on or adjacent to a roadway
- Should be needed to alert the driver of the need for some different behavior (e.g., slowing down)
- Should be effective at doing so
- Their use, design, location, should be based on engineering study or on engineering judgment

Part 2; Section 2C.01 & 2C.02
Section 2C.03 Design of Warning Signs

Standard:

01 **(DE Revision)** Except as provided in Paragraph 2 or unless specifically designated otherwise, all warning signs shall be diamond-shaped (square with one diagonal vertical) with a black legend and border on a yellow background. Warning signs shall be designed in accordance with the sizes, shapes, colors, and legends contained in the “Standard Highway Signs and Markings” book (see Section 1A.11) and/or in the Delaware Standard Signs book.

Guidance:

01A **(DE Revision)** A fluorescent yellow background should be used for overhead warning signs.

Option:

02 A warning sign that is larger than the size shown in the Oversized column in Table 2C-2 for that particular sign may be diamond-shaped or may be rectangular or square in shape.

04 Word message warning signs other than those provided in this Manual may be developed and installed by State and local highway agencies.

- **Black-on-yellow diamond warning signs, unless otherwise specified (e.g., plaques)**
- Signs larger than Oversized size can be rectangular or square
- Custom word messages for special circumstances
- **DE Guidance:** *Fluorescent yellow sheeting should be used for overhead warning signs*

Custom warning message shall be black-on-yellow; rectangular because it exceeds Oversized size

I-495 southbound south of DE-PA state line

NOTICE header typically reserved for regulatory signs

CHANGEABLE SPEED LIMIT ZONE AHEAD

W3-5-DE
Section 2C.03 Design of Warning Signs

05 Warning signs regarding conditions associated with pedestrians, bicyclists, and playgrounds may have a black legend and border on a yellow or fluorescent yellow-green background.

Standard:

06 Warning signs regarding conditions associated with school buses and schools and their related supplemental plaques shall have a black legend and border on a fluorescent yellow-green background (see Section 7B.07).

- **Fluorescent yellow-green (FYG) background for all school signs**

- FYG can be used for ped and bike signs; however, in DE, generally reserved for in-street ped signs and ped signs in beach area

Church St (Rehoboth) approaching SR 1

All school signs now FYG; new symbolic S3-1 in Part 7; discontinue use of supplemental plaque
Section 2C.04 Size of Warning Signs

Standard:
01. Except as provided in Section 2A.11, the sizes for warning signs shall be as shown in Table 2C-2.
02. Except as provided in Paragraph 5, the minimum size for all diamond-shaped warning signs facing traffic on a multi-lane conventional road where the posted speed limit is higher than 35 mph shall be 36 x 36 inches.

Option:
05. If a diamond-shaped warning sign is placed on the left-hand side of a multi-lane roadway to supplement the installation of the same warning sign on the right-hand side of the roadway, the minimum size identified in the Single Lane column in Table 2C-2 may be used.

- Sizes shall follow Table 2C-2
- Some larger sizes for multi-lane roads with a posted speed limit > 35 MPH
- Single lane sizes can be used if same sign is posted on left-hand and right-hand side

Table 2C-2. Warning Sign and Plaque Sizes (Sheet 1 of 4)

<table>
<thead>
<tr>
<th>Sign or Plaque</th>
<th>Sign Designation</th>
<th>Section</th>
<th>Conventional Road</th>
<th>Expressway</th>
<th>Freeway</th>
<th>Minimum</th>
<th>Oversized</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Single Lane</td>
<td>Multi-Lane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horizontal Alignment</td>
<td>W1-1,2,3,4,5</td>
<td>2C.07</td>
<td>30 x 30</td>
<td>36 x 36</td>
<td>36 x 36</td>
<td>36 x 36</td>
<td>48 x 48</td>
</tr>
<tr>
<td>Combination Horizontal</td>
<td>W1-1a,2a</td>
<td>2C.10</td>
<td>36 x 36</td>
<td>48 x 48</td>
<td>48 x 48</td>
<td>48 x 48</td>
<td>48 x 48</td>
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<tr>
<td>Alignment/Advisory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-Direction Large Arrow</td>
<td>W1-6</td>
<td>2C.12</td>
<td>48 x 24</td>
<td>60 x 30</td>
<td>60 x 30</td>
<td>60 x 30</td>
<td>60 x 30</td>
</tr>
<tr>
<td>Two-Direction Large Arrow</td>
<td>W1-7</td>
<td>2C.47</td>
<td>48 x 24</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>60 x 30</td>
</tr>
<tr>
<td>Chevron Alignment</td>
<td>W1-8</td>
<td>2C.09</td>
<td>18 x 24</td>
<td>30 x 36</td>
<td>36 x 48</td>
<td>—</td>
<td>24 x 30</td>
</tr>
</tbody>
</table>
Section 2C.05 Placement of Warning Signs

Guidance:

03 Warning signs should be placed so that they provide an adequate PRT. The distances contained in Table 2C-4 are for guidance purposes and should be applied with engineering judgment. Warning signs should not be placed too far in advance of the condition, such that drivers might tend to forget the warning because of other driving distractions, especially in urban areas.

- Advance placement based on Table 2C-4, which has new values

<table>
<thead>
<tr>
<th>Posted or 85th-Percentile Speed</th>
<th>Condition A: Speed reduction and lane changing in heavy traffic</th>
<th>Condition B to XX MPH: Speed reduction in advance of hazard (e.g., curve)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex. – 50 mph posted with 35 mph advisory – 112.5’</td>
<td>Condition B to 0 MPH: Stop and yield conditions</td>
<td>Table 2C-4. Guidelines for Advance Placement of Warning Signs</td>
</tr>
</tbody>
</table>
Section 2C.05 Placement of Warning Signs

Guidance:

04. (DE Revision) Minimum spacing between warning signs with different messages should be based on the estimated PRT for driver comprehension of and reaction to the second sign. The minimum warning sign spacing contained in Table 2C-4A should be applied with engineering judgment.

05. The effectiveness of the placement of warning signs should be periodically evaluated under both day and night conditions.

Option:

06. Warning signs that advise road users about conditions that are not related to a specific location, such as Deer Crossing or SOFT SHOULDER, may be installed in an appropriate location, based on engineering judgment, since they are not covered in Table 2C-4.

DE Guidance: *Table 2C-4A for minimum spacing between warning signs*

- Appropriate to install some signs adjacent to hazard (e.g., Pedestrian warning sign adjacent to crossing)

<table>
<thead>
<tr>
<th>Posted or 85th Percentile Speed</th>
<th>Minimum Spacing</th>
<th>Posted or 85th Percentile Speed</th>
<th>Minimum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mph</td>
<td>100 ft</td>
<td>45 mph</td>
<td>300 ft</td>
</tr>
<tr>
<td>25 mph</td>
<td>100 ft</td>
<td>50 mph</td>
<td>400 ft</td>
</tr>
<tr>
<td>30 mph</td>
<td>100 ft</td>
<td>55 mph</td>
<td>500 ft</td>
</tr>
<tr>
<td>35 mph</td>
<td>150 ft</td>
<td>60 mph</td>
<td>600 ft</td>
</tr>
<tr>
<td>40 mph</td>
<td>200 ft</td>
<td>65 mph</td>
<td>700 ft</td>
</tr>
</tbody>
</table>
Warning signs should be far enough apart for motorists to comprehend and react to each condition.
Section 2C.06 Horizontal Alignment Warning Signs

Figure 2C-1. Horizontal Alignment Signs and Plaques

- W1-1
- W1-1a
- W1-2
- W1-2a
- W1-3
- W1-4
- W1-5
- W1-6
- W1-8
- W1-10
- W1-10a
- W1-10b
- W1-10c
- W1-10d
- W1-10e
- W1-11
- W1-13
- W1-15
- W13-1P
- W13-2
- W13-3
- W13-6
- W13-7
**DE Guidance:** *Table 2C-5 applies where advisory speed < posted or statutory speed limit*

**DE Support:** Data collection and formal engineering studies not required at all curves – not practical per FHWA Interpretation Letter (¶ 03)

---

**Table 2C-5. Horizontal Alignment Sign Selection (DE Revision)**

<table>
<thead>
<tr>
<th>Type of Horizontal Alignment Sign</th>
<th>Difference Between Approach Speed and Curve Advisory Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 mph</td>
</tr>
<tr>
<td>Turn (W1-1), Curve (W1-2), Reverse Turn (W1-3), Reverse Curve (W1-4), Winding Road (W1-5), and Combination Horizontal Alignment/Intersection (W1-10 series) (see Section 2C.07 to determine which sign to use)</td>
<td>Recommended</td>
</tr>
<tr>
<td>Advisory Speed Plaque (W13-1P)</td>
<td>Recommended</td>
</tr>
<tr>
<td>Chevrons (W1-8) and/or One Direction Large Arrow (W1-6)</td>
<td>Optional</td>
</tr>
<tr>
<td>Exit Speed (W13-2) and Ramp Speed (W13-3) on exit ramp</td>
<td>Optional</td>
</tr>
</tbody>
</table>

* Difference Between Approach Speed and Curve Advisory Speed is defined as the difference in speed between the posted or statutory speed limit or 85th-percentile speed on the tangent approach to the curve and the advisory speed for the curve.
Section 2C.07 Horizontal Alignment Signs
(W1-1 through W1-5, W1-11, W1-15)

Standard:
01 If Table 2C-5 indicates that a horizontal alignment sign (see Figure 2C-1) is required, recommended, or allowed, the sign installed in advance of the curve shall be a Curve (W1-2) sign unless a different sign is recommended or allowed by the provisions of this Section.

02 A Turn (W1-1) sign shall be used instead of a Curve sign in advance of curves that have advisory speeds of 30 mph or less (see Figure 2C-2).

Guidance:
03 Where there are two changes in roadway alignment in opposite directions that are separated by a tangent distance of less than 600 feet, the Reverse Turn (W1-3) sign should be used instead of multiple Turn (W1-1) signs and the Reverse Curve (W1-4) sign should be used instead of multiple Curve (W1-2) signs.

Option:
04 A Winding Road (W1-5) sign may be used instead of multiple Turn (W1-1) or Curve (W1-2) signs where there are three or more changes in roadway alignment each separated by a tangent distance of less than 600 feet.

• Installed based on criteria in Table 2C-5
• W1-1 sign used instead of W1-2 for advisory speeds ≤ 30 MPH
• W1-3 or W1-4 used when tangent ≤ 600 ft between reverse curves/turns
• Optional W1-5 if three or more curves each separated by tangents ≤ 600 ft
Section 2C.07 Horizontal Alignment Signs
(W1-1 through W1-5, W1-11, W1-15)

Figure 2C-2. Example of Warning Signs for a Turn

Notes:
1. See Table 2C-4 for advance placement distance guidelines
2. See Table 2C-5 for the selection of horizontal alignment signs
3. See Table 2C-6 for spacing of W1-8 signs
4. A 25-mph advisory speed is shown for illustrative purposes only
Section 2C.08 Advisory Speed Plaque (W13-1P)

Standard:
02 The use of the Advisory Speed plaque for horizontal curves shall be in accordance with the information shown in Table 2C-5. The Advisory Speed plaque shall also be used where an engineering study indicates a need to advise road users of the advisory speed for other roadway conditions.
04 Except in emergencies or when the condition is temporary, an Advisory Speed plaque shall not be installed until the advisory speed has been determined by an engineering study.
05 The Advisory Speed plaque shall only be used to supplement a warning sign and shall not be installed as a separate sign installation.
08 The 16, 14, and 12 degrees of ball-bank criteria are comparable to the current AASHTO horizontal curve design guidance. Research has shown that drivers often exceed existing posted advisory curve speeds by 7 to 10 mph.

Guidance:
09 The advisory speed should be determined based on free-flowing traffic conditions.

- Installed based on criteria in Table 2C-5
- Requires engineering study (e.g., ball-bank indicator for free-flow traffic)
  - Apparent conflict with 2C.06 ¶03 (Data collection and formal engineering studies not required at all curves – not practical per FHWA Interpretation Letter) – DelDOT struggling with this as much as anyone else
- Supplements other warning sign; not installed as separate sign
Section 2C.09 Chevron Alignment Sign (W1-8)

Installed based on criteria in Table 2C-5

Can be used in place of delineators

Placed on outside of turn or curve with bottom of sign 4 ft above pavement (min.)
Section 2C.09 Chevron Alignment Sign (W1-8)

Guidance:

05 The approximate spacing of Chevron Alignment signs on the turn or curve measured from the point of curvature (PC) should be as shown in Table 2C-6.

06 If used, Chevron Alignment signs should be visible for a sufficient distance to provide the road user with adequate time to react to the change in alignment.

Standard:

07 Chevron Alignment signs shall not be placed on the far side of a T-intersection facing traffic on the stem approach to warn drivers that a through movement is not physically possible, as this is the function of a Two-Direction (or One-Direction) Large Arrow sign.

08 Chevron Alignment signs shall not be used to mark obstructions within or adjacent to the roadway, including the beginning of guardrails or barriers, as this is the function of an object marker (see Section 2C.63).

- Spacing based on Table 2C-6
- Visible in advance of curve
- Shall not be used to delineate end of road or obstructions within or adjacent to road
Section 2C.11 Combination Horizontal Alignment/Intersection Signs (W1-10 Series)

Option:
01 The Turn (W1-1) sign or the Curve (W1-2) sign may be combined with the Cross Road (W2-1) sign or the Side Road (W2-2 or W2-3) sign to create a combination Horizontal Alignment/Intersection (W1-10 series) sign (see Figure 2C-1) that depicts the condition where an intersection occurs within or immediately adjacent to a turn or curve.

Guidance:
02 Elements of the combination Horizontal Alignment/Intersection sign related to horizontal alignment should comply with the provisions of Section 2C.07, and elements related to intersection configuration should comply with the provisions of Section 2C.46. The symbol design should approximate the configuration of the intersecting roadway(s). No more than one Cross Road or two Side Road symbols should be displayed on any one combination Horizontal Alignment/Intersection sign.

Standard:
03 The use of the combination Horizontal Alignment/Intersection sign shall be in accordance with the appropriate Turn or Curve sign information shown in Table 2C-5.

- Option to consolidate Alignment and Intersection warning signs
- Installed in accordance with criteria in Table 2C-5
Standard:
03 The One-Direction Large Arrow sign shall be a horizontal rectangle with an arrow pointing to the left or right.
04 The use of the One-Direction Large Arrow sign shall be in accordance with the information shown in Table 2C-5.
05 If used, the One-Direction Large Arrow sign shall be installed on the outside of a turn or curve in line with and at approximately a right angle to approaching traffic.
06 The One-Direction Large Arrow sign shall not be used where there is no alignment change in the direction of travel, such as at the beginnings and ends of medians or at center piers.
07 The One-Direction Large Arrow sign directing traffic to the right shall not be used in the central island of a roundabout.
Guidance:
08 If used, the One-Direction Large Arrow sign should be visible for a sufficient distance to provide the road user with adequate time to react to the change in alignment.

- Shall meet criteria in Table 2C-5
- Installed on outside of curve/turn at a right angle to traffic
- Shall not be used at roundabouts
Guidance:
01 Except as provided in Paragraph 2, a ROAD NARROWS (W5-1) sign (see Figure 2C-5) should be used in advance of a transition on two-lane roads where the pavement width is reduced abruptly to a width such that vehicles traveling in opposite directions cannot simultaneously travel through the narrow portion of the roadway without reducing speed.

Option:
02 The ROAD NARROWS (W5-1) sign may be omitted on low-volume local streets that have speed limits of 30 mph or less.

- Abrupt change in roadway cross-section requires braking
- Can omit sign on local roads with posted speed ≤ 30 MPH

Guidance:
01 A NARROW BRIDGE (W5-2) sign (see Figure 2C-5) should be used in advance of any bridge or culvert having a two-way roadway clearance width of 16 to 18 feet, or any bridge or culvert having a roadway clearance less than the width of the approach travel lanes.

- 16 ft to 18 ft clearance or lane widths less than approach

Guidance:
01 A ONE LANE BRIDGE (W5-3) sign (see Figure 2C-5) should be used on two-way roadways in advance of any bridge or culvert:
   A. Having a clear roadway width of less than 16 feet, or
   B. Having a clear roadway width of less than 18 feet when commercial vehicles constitute a high proportion of the traffic, or
   C. Having a clear roadway width of 18 feet or less where the sight distance is limited on the approach to the structure.

- Clearance < 16 ft or < 18 ft with high truck percentage or limited sight distance
Guidance:
01 A Divided Highway (W6-1) sign (see Figure 2C-5) should be used on the approaches to a section of highway (not an intersection or junction) where the opposing flows of traffic are separated by a median or other physical barrier.

Standard:
02 The Divided Highway (W6-1) sign shall not be used instead of a Keep Right (R4-7 series) sign on the approach end of a median island.

• **Installed on approach to median or barrier separated roadway**
• **Shall not be used instead of Keep Right on median nose**

Guidance:
01 A Divided Highway Ends (W6-2) sign (see Figure 2C-5) should be used in advance of the end of a section of physically divided highway (not an intersection or junction) as a warning of two-way traffic ahead.
02 The Two-Way Traffic (W6-3) sign (see Section 2C.44) should be used to give warning and notice of the transition to a two-lane, two-way section.

• **Installed in advance of end of divided highway**

Guidance:
01 A Two-Way Traffic (W6-3) sign (see Figure 2C-8) should be used to warn road users of a transition from a multi-lane divided section of roadway to a two-lane, two-way section of roadway.
02 A Two-Way Traffic (W6-3) sign with an AHEAD (W16-9P) plaque (see Figure 2C-12) should be used to warn road users of a transition from a one-way street to a two-lane, two-way section of roadway (see Figure 2B-14).

• **Installed adjacent to end of divided highway**
• **Used with AHEAD plaque where one-way street becomes two-way street**
Section 2C.44 Two-Way Traffic Sign (W6-3)

Should be used with AHEAD plaque in advance of transition from one-way to two-way traffic

SR 4 westbound (S. Monroe St)
Section 2C.22 Divided Highway Sign (W6-1)

Shall not be used on the approach end of a median island; Keep Right instead.

Traffic calming along Harmony Rd
Section 2C.26 DEAD END/NO OUTLET Signs (W14-1, W14-1a, W14-2, W14-2a)

Option:

01 The DEAD END (W14-1) sign (see Figure 2C-5) may be used at the entrance of a single road or street that terminates in a dead end or cul-de-sac. The NO OUTLET (W14-2) sign (see Figure 2C-5) may be used at the entrance to a road or road network from which there is no other exit.

02 DEAD END (W14-1a) or NO OUTLET (W14-2a) signs (see Figure 2C-5) may be used in combination with Street Name (D3-1) signs (see Section 2D.43) to warn turning traffic that the cross street ends in the direction indicated by the arrow.

Standard:

05 When the W14-1 or W14-2 sign is used, the sign shall be posted as near as practical to the entry point or at a sufficient advance distance to permit the road user to avoid the dead end or no outlet condition by turning at the nearest intersecting street.

06 The DEAD END (W14-1a) or NO OUTLET (W14-2a) signs shall not be used instead of the W14-1 or W14-2 signs where traffic can proceed straight through the intersection into the dead end street or no outlet area.

- DEAD END used at single road ending in dead end or cul-de-sac
- NO OUTLET used at entrance to road “network” (e.g., subdivision) with no other exit
- W14-1a and W14-2a signs installed to face cross street traffic
  - May be installed in conjunction with Street Name sign
  - Shall not replace W14-1 or W14-2 for straight through traffic
Section 2C.28 – Section 2C.35
Roadway and Weather Condition Signs

- BUMP (W8-1)
- DIP (W8-2)
- PAVEMENT ENDS (W8-3)
- SOFT SHOULDER (W8-4)
- WHEN WET (W8-5)
- ICE (W8-5P)
- STEEL DECK (W8-5aP)
- EXCESS OIL (W8-5bP)
- LOOSE GRAVEL (W8-5cP)
- ROUGH ROAD (W8-6)
- LOW SHOULDER (W8-9)
- UNEVEN LANES (W8-11)
- NO CENTER LINE (W8-12)
- BRIDGE ICES BEFORE ROAD (W8-13)
- FALLEN ROCKS (W8-14)
- GROOVED PAVEMENT (W8-15)
- METAL BRIDGE DECK (W8-16)
- SHOULDER DROP-OFF (W8-17P)
- ROAD MAY FLOOD (W8-18)
- GUSTY WINDS AREA (W8-19)
- FOG AREA (W8-22)
- NO SHOULDER (W8-23)
- SHOULDER ENDS (W8-25)
- SPEED HUMP (W17-1)
- WATER ON ROAD (W21-7-DE)
Section 2C.36 Advance Traffic Control Signs (W3-1, W3-2, W3-3, W3-3-DE, W3-3-DE1, W3-3P-DE, W3-4)

**Standard:**

The Advance Traffic Control symbol signs (see Figure 2C-6) include the Stop Ahead (W3-1), Yield Ahead (W3-2), and Signal Ahead (W3-3) signs. These signs shall be installed on an approach to a primary traffic control device that is not visible for a sufficient distance to permit the road user to respond to the device (see Table 2C-4). The visibility criteria for a traffic control signal shall be based on having a continuous view of at least two signal faces for the distance specified in Table 4D-2.

- **W3-1 and W3-2 installed if STOP or YIELD visibility distance is less than AASHTO stopping sight distance (Table 3-1)**
- **Located in advance of STOP or YIELD based on Condition B (to 0 MPH) in Table 2C-4**

### Table 2C-4. Guidelines for Advance Placement of Warning Signs

<table>
<thead>
<tr>
<th>Posted or 85th-Percentile Speed</th>
<th>Condition A: Speed reduction and lane changing in heavy traffic</th>
<th>Advance Placement Distance</th>
<th>Condition B: Deceleration to the listed advisory speed (mph) for the condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0²</td>
<td>10⁴</td>
<td>20⁴</td>
</tr>
<tr>
<td>20 mph</td>
<td>225 ft</td>
<td>100 ft²</td>
<td>N/A²</td>
</tr>
<tr>
<td>25 mph</td>
<td>325 ft</td>
<td>100 ft²</td>
<td>N/A²</td>
</tr>
<tr>
<td>30 mph</td>
<td>460 ft</td>
<td>100 ft²</td>
<td>N/A²</td>
</tr>
<tr>
<td>35 mph</td>
<td>565 ft</td>
<td>100 ft²</td>
<td>N/A²</td>
</tr>
<tr>
<td>40 mph</td>
<td>670 ft</td>
<td>125 ft²</td>
<td>100 ft²</td>
</tr>
<tr>
<td>45 mph</td>
<td>775 ft</td>
<td>175 ft²</td>
<td>125 ft²</td>
</tr>
<tr>
<td>50 mph</td>
<td>885 ft</td>
<td>250 ft²</td>
<td>200 ft²</td>
</tr>
<tr>
<td>55 mph</td>
<td>990 ft</td>
<td>325 ft²</td>
<td>275 ft²</td>
</tr>
<tr>
<td>60 mph</td>
<td>1,100 ft</td>
<td>400 ft²</td>
<td>350 ft²</td>
</tr>
<tr>
<td>65 mph</td>
<td>1,200 ft</td>
<td>475 ft²</td>
<td>450 ft²</td>
</tr>
<tr>
<td>70 mph</td>
<td>1,250 ft</td>
<td>550 ft²</td>
<td>625 ft²</td>
</tr>
<tr>
<td>75 mph</td>
<td>1,350 ft</td>
<td>650 ft²</td>
<td>625 ft²</td>
</tr>
</tbody>
</table>

### US Customary

<table>
<thead>
<tr>
<th>Design Speed (mph)</th>
<th>Brake Reaction Distance (ft)</th>
<th>Braking Distance on Level (ft)</th>
<th>Stopping Sight Distance (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>55.1</td>
<td>21.6</td>
<td>75.7</td>
</tr>
<tr>
<td>20</td>
<td>73.5</td>
<td>34.8</td>
<td>111.9</td>
</tr>
<tr>
<td>25</td>
<td>91.9</td>
<td>60.0</td>
<td>151.9</td>
</tr>
<tr>
<td>30</td>
<td>110.3</td>
<td>86.4</td>
<td>196.7</td>
</tr>
<tr>
<td>35</td>
<td>128.6</td>
<td>117.6</td>
<td>246.2</td>
</tr>
<tr>
<td>40</td>
<td>147.0</td>
<td>153.6</td>
<td>300.6</td>
</tr>
<tr>
<td>45</td>
<td>165.4</td>
<td>194.4</td>
<td>359.8</td>
</tr>
<tr>
<td>50</td>
<td>183.8</td>
<td>240.0</td>
<td>423.8</td>
</tr>
<tr>
<td>55</td>
<td>202.1</td>
<td>290.3</td>
<td>492.4</td>
</tr>
<tr>
<td>60</td>
<td>220.5</td>
<td>345.5</td>
<td>566.0</td>
</tr>
<tr>
<td>65</td>
<td>238.0</td>
<td>405.5</td>
<td>644.4</td>
</tr>
<tr>
<td>70</td>
<td>257.3</td>
<td>470.3</td>
<td>727.6</td>
</tr>
<tr>
<td>75</td>
<td>275.6</td>
<td>530.0</td>
<td>815.5</td>
</tr>
<tr>
<td>80</td>
<td>294.0</td>
<td>614.3</td>
<td>908.3</td>
</tr>
</tbody>
</table>

Note: Brake reaction distance calculated on a time of 2.5 s; deceleration rate of 3.4 m/s² [11.2 ft/s²] used to determine calculated sight distance.
Section 2C.46 Intersection Warning Signs
(W2-1 through W2-8, W21-9-DE, W21-9P-DE, W21-10-DE)

Option:
01 (DE Revision) A Cross Road (W2-1) symbol, Side Road (W2-2 or W2-3) symbol, T-Symbol (W2-4), Y-Symbol (W2-5), WATCH FOR TURNING TRAFFIC (W21-9-DE), or WATCH FOR ENTERING TRAFFIC (W21-10-DE) sign or WATCH FOR TURNING TRAFFIC (W21-9P-DE) plaque (see Figure 2C-9) may be used in advance of an intersection to indicate the presence of an intersection and the possibility of turning or entering traffic.

Guidance:
03 If an approach to a roundabout has a statutory or posted speed limit of 40 mph or higher, the Circular Intersection (W2-6) symbol sign should be installed in advance of the circular intersection.
03A (DE Revision) The Circular Intersection (W2-6) symbol sign should be installed on all approaches in advance of a circular intersection along a state-maintained roadway regardless of the statutory or posted speed limit (see Figures 2B-21 through 2B-23).

Option:
06 An advance street name plaque (see Section 2C.58) may be installed above or below an Intersection Warning sign.

- **DE Guidance:** W2-6 on the approaches to all roundabouts along state-maintained roads
- Typically include W16-8P (Advance Street Name) plaque with Intersection Warning assembly
Section 2C.47 Two-Direction Large Arrow Sign (W1-7)

Standard:
02 If used, it shall be installed on the far side of a T-intersection in line with, and at approximately a right angle to, traffic approaching from the stem of the T-intersection.
03 The Two-Direction Large Arrow sign shall not be used where there is no change in the direction of travel such as at the beginnings and ends of medians or at center piers.
04 The Two-Direction Large Arrow sign directing traffic to the left and right shall not be used in the central island of a roundabout.

Guidance:
05 The Two-Direction Large Arrow sign should be visible for a sufficient distance to provide the road user with adequate time to react to the intersection configuration.
05A (DE Revision) The Two-Direction Large Arrow sign should not be installed on the far side of a T-intersection along a divided highway for traffic approaching from the stem of the T-intersection.

- If used, shall be installed on far side of "T" intersection
- Typically supplemented with Type 4 object marker(s)
- DE Guidance – *Should not be installed at T-intersections along divided highways*
2011 DE MUTCD (DRAFT)


Guidance:
03 Vehicular Traffic Warning signs should be used only at locations where the road user's sight distance is restricted, or the condition, activity, or entering traffic would be unexpected.
05 The combined Bicycle/Pedestrian (W11-15) sign may be used where both bicyclists and pedestrians might be crossing the roadway, such as at an intersection with a shared-use path. A TRAIL X-ING (W11-15P) supplemental plaque (see Figure 2C-10) may be mounted below the W11-15 sign. The TRAIL CROSSING (W11-15a) sign may be used to warn of shared-use path crossings where pedestrians, bicyclists, and other user groups might be crossing the roadway.
08 If used in advance of a pedestrian and bicycle crossing, a W11-15 or W11-15a sign should be supplemented with an AHEAD or XX FEET plaque to inform road users that they are approaching a point where crossing activity might occur.

Standard:
09 If a post-mounted W11-1, W11-11, W11-15, or W11-15a sign is placed at the location of the crossing point where golf carts, pedestrians, bicyclists, or other shared-use path users might be crossing the roadway, a diagonal downward pointing arrow (W16-7P) plaque (see Figure 2C-12) shall be mounted below the sign. If the W11-1, W11-11, W11-15, or W11-15a sign is mounted overhead, the W16-7P supplemental plaque shall not be used.

• Installed at locations with limited sight distance or where entering traffic is unexpected
• New combined Bicycle/Pedestrian sign (W11-15)
• AHEAD or XX FT plaque if warning sign is installed in advance of specific ped or bike crossing
• W16-7P plaque required if warning sign is installed adjacent to ped, bike, or golf cart crossing
• Used at locations with unexpected entries into the roadway

• **AHEAD or XX FT plaque if warning sign is installed in advance of specific crossing**

![Figure 2C-11. Non-Vehicular Warning Signs (Delaware Revision)](image)
W11-2 assembly is generally reserved for unexpected crossing locations, not signalized intersections, where pedestrians are expected.
Standard:
04 If a post-mounted W11-2, W11-6, W11-7, or W11-9 sign is placed at the location of the crossing point where pedestrians, snowmobilers, or equestrians might be crossing the roadway, a diagonal downward pointing arrow (W16-7P) plaque (see Figure 2C-12) shall be mounted below the sign. If the W11-2, W11-6, W11-7, or W11-9 sign is mounted overhead, the W16-7P plaque shall not be used.

- **W16-7P plaque required if warning sign is installed adjacent to crossing**
Avoid mixing yellow and FYG backgrounds

These signs should be FYG per Section 2C.50; all school signs shall be FYG per Section 2A.10
Slow Children at Play

- Studied extensively
- NCHRP Synthesis – Pedestrians and Traffic Control Measures
- Consensus – ineffective at best; dangerous or counterproductive under some circumstances
- Can send the wrong message
- The road is not suitable as a playground
- MUTCD is silent – You didn’t see it in Table 2C-11

- If you must...consider instead
  - W15-1 Playground
  - W-21-11-DE Watch Children
  - W-21-11-DE Watch Children (plaque)
Option:
01 A supplemental warning plaque (see Figure 2C-12) may be displayed with a warning or regulatory sign when engineering judgment indicates that road users require additional warning information beyond that contained in the main message of the warning or regulatory sign.

Standard:
02 Supplemental warning plaques shall be used only in combination with warning or regulatory signs. They shall not be mounted alone or displayed alone. If used, a supplemental warning plaque shall be installed on the same post(s) as the warning or regulatory sign that it supplements.
03 Unless otherwise provided in this Manual for a particular plaque, supplemental warning plaques shall be mounted below the sign they supplement.

- Shall not be used alone
- Installed below the sign they supplement

Figure 2C-12. Supplemental Warning Plaques (Delaware Revision)

Note: The background color (yellow or fluorescent yellow-green) shall match the color of the warning sign that it supplements.
Section 2C.58 Advance Street Name Plaque (W16-8P, W16-8aP)

New requirements & guidelines:

- Left road name above right road name
- Upper-case / lower-case legend
- Border
Option:

01 In situations where there is a need to warn drivers to watch for other slower forms of transportation traveling along the highway, such as bicycles, golf carts, horse-drawn vehicles, or farm machinery, a SHARE THE ROAD (W16-1P) plaque (see Figure 2C-12) may be used.

01A (DE Revision) In situations where there is a need to warn motorists to watch for bicyclists traveling along the highway, including junctions with designated bicycle routes, and on roadways with no shoulder or a shoulder with a width of less than 4 feet, a SHARE THE ROAD (W16-1P) plaque (see Figure 2C-12) may be used in conjunction with the Bicycle (W11-1) sign.

Standard:

02 A W16-1P plaque shall not be used alone. If a W16-1P plaque is used, it shall be mounted below either a Vehicular Traffic Warning sign (see Section 2C.49) or a Non-Vehicular Warning sign (see Section 2C.50). The background color of the W16-1P plaque shall match the background color of the warning sign with which it is displayed.

- Shall not be used alone and shall be mounted below Non-Vehicular Warning sign
- DE Option: Used to supplement Bicycle warning sign where shoulder width < 4 ft
SHARE THE ROAD typically not used when shoulder width exceeds 4 ft; use standard W11-1 with W16-1P
Shared Lane Markings ("Sharrows")

- Roadways with on-street parking only
  - Reduces "dooring"
  - Assists cyclists with lateral positioning
  - Alerts drivers of likely bike positioning
  - Reduces wrong-way cycling

- Not for:
  - Rural areas
  - Areas without on-street parking
  - Roadways with speeds >35 mph
  - Shoulders or designated bike lanes

Part 9; Section 9C.07

R4-11 can be used in addition or instead
Part 9 has a variety of signage appropriate when establishing bicycle facilities.

- General guide – bike lane spacing $L=2WS$

- E.g., $L = 2 \times 12' \times 40$ mph = 960’
Other Bicycle Facility Signage

- When there is a need to warn motorists to watch for cyclists, W16-1P plaque may be used in conjunction with W11-1 sign
  - Examples:
    - Junctions w/bike routes
    - Roadways w/no shoulders
    - Shoulders <4’
Section 2C.62 NEW and NEW TRAFFIC PATTERN Plaques (W16-15P and W23-2P-DE)

Option:

01. A NEW (W16-15P) plaque (see Figure 2C-12) may be mounted above a regulatory sign when a new regulation takes effect in order to alert road users to the new traffic regulation. A NEW plaque may also be mounted above an advance warning sign (such as a Signal Ahead sign for a newly-installed traffic control signal) for a new traffic regulation.

Standard:

02. The NEW plaque shall not be used alone.

03. The NEW plaque shall be removed no later than 6 months after the regulation has been in effect.

- Mounted above regulatory or warning sign for new traffic regulation
- Shall be black-on-yellow
- Removed no later than 6 months after new regulation is implemented
• Obstructions within the roadway require Type 1 or Type 3 object markers and corresponding pavement markings

• Obstructions adjacent to the roadway may be delineated with Type 2 or Type 3 object markers

• The end of a roadway may be delineated with a Type 4 object marker
Guide Sign Color

- White message on green background
- Also allowed:
  - White on blue
  - Black on white

Section 2D.03 Color, Retroreflection, and Illumination

Support:
01 Requirements for illumination, retroreflection, and color are stated under the specific headings for individual guide signs or groups of signs. General provisions are given in Sections 2A.07, 2A.08, and 2A.10.
Standard:
02 Except where otherwise provided in this Manual for individual signs or groups of signs, guide signs on streets and highways shall have a white message and border on a green background. All messages, borders, and legends shall be retroreflective and all backgrounds shall be retroreflective or illuminated.
Support:
03 Color coding is sometimes used to help road users distinguish between multiple potentially confusing destinations. Examples of valuable uses of color coding include guide signs for roadways approaching or inside an airport property with multiple terminals serving multiple airlines, and community wayfinding guide signs for various traffic generator destinations within a community or area.
The lettering for names of places, streets, and highways on conventional road guide signs shall be a combination of lower-case letters with initial upper-case letters (see Section 2A.13). The nominal loop height of the lower-case letters shall be 3/4 the height of the initial upper-case letter. When a mixed-case legend letter height is specified referring only to the initial upper-case letter, the height of the lower-case letters that follow shall be determined by this proportion. When the height of a lower-case letter is referenced, the reference is made to the nominal loop height and the height of the initial upper-case letter shall also be determined by this proportion.

All other word legends on conventional road guide signs shall be in upper-case letters.

- Destination legends shall be combination of upper-case and lower-case letters
- All other legends shall be upper-case

The principal legend on guide signs shall be in letters and numerals at least 6 inches in height for all upper-case letters, or a combination of 6 inches in height for upper-case letters and 4.5 inches in height for lower-case letters. On low-volume roads (as defined in Section 5A.01) with speeds of 25 mph or less, and on urban streets with speeds of 25 mph or less, the principal legend shall be in letters at least 4 inches in height for all upper-case letters, or a combination of 4 inches in height for upper-case letters and 3 inches in height for lower-case letters.

- 6” upper or 6”/4.5” upper/lower (min.) on roads with posted speed > 25 MPH
- 4” upper or 4”/3” upper/lower (min.) on roads with posted speed ≤ 25 MPH
Subdivision name shall be combination of upper-case and lower-case letters.
Skip Ahead, Skip Ahead

- 2D.08 Arrows
- 2D.09 Numbered highway systems
- 2D.10 Route signs and auxiliary signs
- 2D.11 Design of route signs
- 2D.12 Design of a space shuttle
- 2D.13 Junction auxiliary sign
- ...
Section 2D.43 Street Name Signs (D3-1, D3-1-DE, D3-1a)

**Guidance:**

01 Street Name (D3-1 and D3-1a) signs (see Figure 2D-10) should be installed in urban areas at all street intersections regardless of other route signs that might be present and should be installed in rural areas to identify important roads that are not otherwise signed.

Option:

01A (DE Revision) Private Street Name (D3-1-DE1) signs (see Figure 2D-10) may be installed at the intersection of a state-maintained roadway with a private roadway or at the intersection of two private roadways.

**Standard:**

03 The lettering for names of streets and highways on Street Name signs shall be composed of a combination of lower-case letters with initial upper-case letters (see Section 2A.13).

Option:

15 The border may be omitted from a Street Name sign.

- **Installed at all urban intersections**
- **Upper-case/lower-case letters**
- **Omit sign border (DE preference)**
- **DE Option: White background for private roads**
Section 2D.43 Street Name Signs (D3-1, D3-1-DE, D3-1a)

Guidance:

04 (DE Revision) Except as provided in Paragraphs 5, 6, and 7 lettering on post-mounted Street Name signs should be composed of initial upper-case letters at least 6 inches in height and lower-case letters at least 4.5 inches in height.

05 On multi-lane streets with speed limits greater than 40 mph, the lettering on post-mounted Street Name signs should be composed of initial upper-case letters at least 8 inches in height and lower-case letters at least 6 inches in height.

Option:

06 (DE Revision) At the intersection of two subdivision streets, the lettering on post-mounted Street Name signs may be composed of initial upper-case letters at least 4 inches in height and lower-case letters at least 3 inches in height.

Guidance:

07 If overhead Street Name signs are used, the lettering should be composed of initial upper-case letters at least 12 inches in height and lower-case letters at least 9 inches in height.

- **Minimum letter heights based on Table 2D-2**
- **DE Guidance: 4” letter heights for intersection of two subdivision streets**

<table>
<thead>
<tr>
<th>Type of Mounting</th>
<th>Type of Street or Highway</th>
<th>Speed Limit</th>
<th>Recommended Minimum Letter Height*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Initial Upper-Case</td>
<td>Lower-Case</td>
</tr>
<tr>
<td>Overhead</td>
<td>All types</td>
<td>All speed limits</td>
<td>12 inches</td>
</tr>
<tr>
<td>Post-mounted</td>
<td>Multi-lane</td>
<td>More than 40 mph</td>
<td>8 inches</td>
</tr>
<tr>
<td>Post-mounted</td>
<td>Multi-lane</td>
<td>40 mph or less</td>
<td>6 inches</td>
</tr>
<tr>
<td>Post-mounted</td>
<td>2-lane</td>
<td>All speed limits</td>
<td>6 inches</td>
</tr>
<tr>
<td>Post-mounted</td>
<td>Intersection of two subdivision streets</td>
<td>25 mph or less</td>
<td>4 inches</td>
</tr>
</tbody>
</table>

* Reduced letter height and reduced edge spacing may be used on Street Name signs if the sign size must be reduced due to factors including lane width or vertical or lateral clearance (see Paragraph 5 of Section 2D.04)
Street Name Signs

- ¶14 – street name signs must be retroreflective or illuminated
- ¶16, 18 – alternative background colors (other than green) may be used – blue, brown, white
- ¶18A – private roads white background with black legend
- ¶19 – consistency key – use same background throughout jurisdiction
- ¶21 – street name signs can be mounted overhead to optimize visibility and may be mounted above a regulatory or Stop or Yield sign with no vertical separation
Section 2D.50 Community Wayfinding Signs

Support:
01 Community wayfinding guide signs are part of a coordinated and continuous system of signs that direct tourists and other road users to key civic, cultural, visitor, and recreational attractions and other destinations within a city or a local urbanized or downtown area.
02 Community wayfinding guide signs are a type of destination guide sign for conventional roads with a common color and/or identification enhancement marker for destinations within an overall wayfinding guide sign plan for an area.
03 Figures 2D-18 through 2D-20 illustrate various examples of the design and application of community wayfinding guide signs.

Standard:
04 The use of community wayfinding guide signs shall be limited to conventional roads. Community wayfinding guide signs shall not be installed on freeway or expressway mainlines or ramps. Direction to community wayfinding destinations from a freeway or expressway shall be limited to the use of a Supplemental Guide sign (see Section 2E.35) on the mainline and a Destination sign (see Section 2D.37) on the ramp to direct road users to the area or areas within which community wayfinding guide signs are used. The individual wayfinding destinations shall not be displayed on the Supplemental Guide and Destination signs except where the destinations are in accordance with the State or agency policy on Supplemental Guide signs.
05 Community wayfinding guide signs shall not be used to provide direction to primary destinations or highway routes or streets. Destination or other guide signs shall be used for this purpose as described elsewhere in this Chapter and shall have priority over any community wayfinding sign in placement, prominence, and conspicuity.
06 Because regulatory, warning, and other guide signs have a higher priority, community wayfinding guide signs shall not be installed where adequate spacing cannot be provided between the community wayfinding guide sign and other higher priority signs. Community wayfinding guide signs shall not be installed in a position where they would obscure the road users’ view of other traffic control devices.
07 Community wayfinding guide signs shall not be mounted overhead.

Guidance:
08 If used, a community wayfinding guide sign system should be established on a local municipal or equivalent jurisdictional level or for an urbanized area of adjoining municipalities or equivalent that form an identifiable geographic entity that is conducive to a cohesive and continuous system of signs. Community wayfinding guide signs should not be used on a regional or statewide basis where infrequent or sparse placement does not contribute to a continuous or coordinated system of signing that is readily identifiable as such to the road user. In such cases, Destination or other guide signs detailed in this Chapter should be used to direct road users to an identifiable area in which the type of eligible destination described in Paragraph 1 is located.
Community Wayfinding Systems

Part 2; Section 2D.50

Guidance:

8. Because pedestrian wayfinding signs typically use smaller legends that are inadequately sized for viewing by vehicular traffic and because they can provide direction to pedestrians that might conflict with that appropriate for vehicular traffic, wayfinding signs designed for and intended to provide direction to pedestrians or other users of a sidewalk or other roadside area should be located to minimize their conspicuity to vehicular traffic. Such signs should be located as far as practical from the street, such as at the far edge of the sidewalk. Where locating such signs farther from the roadway is not practical, the pedestrian wayfinding signs should have their conspicuity to vehicular traffic minimized by employing one or a combination of the following methods:

A. Locating signs away from intersections where high-priority traffic control devices are present.
B. Facing the pedestrian message toward the sidewalk and away from the street.
C. Cantilevering the sign over the sidewalk if the pedestrian wayfinding sign is mounted at a height consistent with vehicular traffic signs, removing the pedestrian wayfinding signs from the line of sight in a sequence of vehicular signs.

11. To further minimize their conspicuity to vehicular traffic during nighttime conditions, pedestrian wayfinding signs should not be retroreflective.

Support:

12. Color coding is sometimes used on community wayfinding guide signs to help road users distinguish between multiple potentially confusing traffic generator destinations located in different neighborhoods or subareas within a community or area.

Option:

13. At the boundaries of the geographical area within which community wayfinding guide signing is used, an informational guide sign (see Figures 2D-18 and 2D-20) may be posted to inform road users about the presence of wayfinding signing and to identify the meanings of the various color codes or pictographs that are being used.

Standard:

14. These informational guide signs shall have a white legend and border on a green background and shall have a design similar to that illustrated in Figures 2D-1 and 2D-18 and shall be consistent with the basic design principles for guide signs. These informational guide signs shall not be installed on freeway or expressway mainlines or ramps.
Except for the informational guide sign posted at the boundary of the wayfinding guide system, the wayfinding guide signs may use background colors other than green in order to provide a color distinction between wayfinding destinations by geographical area within the overall wayfinding guide system. Community wayfinding guide signs may be used with or without the boundary informational corresponding color-coding panels described in Paragraphs 13 through 16. Except as provided in Paragraphs 18 and 19, in addition to the colors that are approved in this Manual for use on official traffic signs (see Section 2A.10), other background colors may also be used for the color coding of community wayfinding guide signs.

Standard:

- The standard colors of red, orange, yellow, purple, or the fluorescent versions thereof, fluorescent yellow-green, and fluorescent pink shall not be used as background colors for community wayfinding guide signs, in order to minimize possible confusion with critical, higher-priority regulatory and warning sign color meanings readily understood by road users.
- The minimum luminance ratio of legend to background for community wayfinding guide signs shall be 3:1.

All messages, borders, legends, and backgrounds of community wayfinding guide signs and any identification enhancement markers shall be retroeffective (see Sections 2A.07 and 2A.08).
CHAPTER 2H.
GENERAL INFORMATION SIGNS

Relocated from 2D & 2E

Signals
- I-1
- I-2
- I-2-DE1
- I-2-DE2
- I-3
- I-5
- I-6

Texas State Line
Entering the Corporate Limits of Newark
Now Leaving Corporate Limits of Newark
Brazos River
Airport
Bus Station

I-7
I-8
I-9
I-11
I-12
Sl-2-DE

Train Station
Library
Vehicle Ferry Terminal
Recycling Center
Light Rail Transit Station

Recycling Collection Center

Advance Turn and Directional Arrow Auxiliary Signs for use with General Information Signs

Example of directional assembly

Library Ave
Evacuation Route

Newark Library

Dragon Run

Mile 84
Standard:
Except for political boundary signs, General Information signs shall have white legends and borders on green rectangular-shaped backgrounds.

Part 2; Section 2H.01 & 2H.02
Manual on Uniform Traffic Control Devices (MUTCD)

Part 3 - Markings

PRESENTED BY:
DELAWARE T²/LTAP CENTER
Introduction

In this module:
- General (colors, dimensions, materials, retroreflectivity)
- Pavement and curb markings
- Delineators
- Colored pavements
- Channelizing devices
- Islands
- Rumble strip markings
What’s in Part 3 – Markings?

- 3A – General
- 3B – Pavement and curb markings
- 3C – Roundabout markings
- 3D – Markings for preferential lanes
- 3E – Markings for toll plazas
- 3F – Delineators
- 3G – Colored pavements
- 3H – Channelizing devices for emphasis of pavement marking patterns
- 3I – Islands
- 3J – Rumble strip markings
Functions

- Provide guidance and information to road users
- Convey regulations, guidance, or warnings
- Sometimes supplement other TCDs (signs, signals)

- Other times – act alone
Limitations

- Visibility can be limited
  - By snow
  - By debris
  - By water

- Durability affected by
  - Material characteristics
  - Traffic volumes
  - Weather
  - Location
Markings should be installed prior to opening a road

Shall be retroreflective

Conflicting markings shall be removed or obliterated

“Blackout” tape used to cover conflicting markings only if tape is approximately same color as pavement
Maintaining Minimum Retroreflectivity

- Reserved – i.e. no standard yet
  - Proposed rulemaking – comment period closes 5/4/2017
  - Summary of the Major Provisions of the Regulatory Action in Question
    - ...would establish minimum retroreflectivity levels for pavement markings on all roads open to public travel with average annual daily traffic (AADT) volumes over 6,000 and speed limits of 35 mph or higher. Agencies or officials having jurisdiction would be required to develop and implement a method for maintaining pavement marking retroreflectivity at minimum levels. It would not require agencies or officials having jurisdiction to upgrade markings by a specific date, nor would it require them to ensure every marking is above the minimum retroreflectivity level at all times.
    - ...Retroreflectivity levels and locations were simplified from what was presented in the NPA to the following criteria making it easier to understand and implement:
      - Requires a minimum retroreflectivity level of 50 mcd/m²/lx where statutory or posted speed limits are greater than or equal to 35 mph
      - Recommends a minimum retroreflectivity level of 100 mcd/m²/lx where statutory or posted speed limits are greater than or equal to 70 mph
      - Applies only to longitudinal lines (e.g., center lines, edge lines, and lane lines).
Bottom line

- Many (most? all?) locally maintained streets will not rise to the level of traffic (6,000 AADT) and so won’t be strictly subject to these.
- But they remain good guidance for maintaining your pavement markings.
- However, many DelDOT-maintained roads in your area will be affected by this and it may prove useful to understand what will be required for the maintenance of these roads.
Maintaining Minimum Retroreflectivity

Coefficient of Retroreflected Luminance

$R_L$ in (mcd/m²/lux)

Graphic courtesy 3M™
Maintaining Minimum Retroreflectivity

Part 3; Section 3A.03

1. Waterborne paint w/std 1.5 index glass beads
2. Edge is all weather paint w/dual beads while CL is waterborne paint w/std 1.5 index glass beads
3. Back to waterborne paint w/std 1.5 index glass beads

Video courtesy 3M™
Maintaining Minimum Retroreflectivity

- Snow plow impact

Charts courtesy 3M™
Conclusions:

- We’ll worry about it when the standards come out?
  - No. While quantitative standards aren’t official as yet, we know the targets and Section 3A.02 says:

  Standard:
  03 Markings that must be visible at night shall be retroreflective unless ambient illumination assures that the markings are adequately visible. All markings on Interstate highways shall be retroreflective.

- If paint wears out in six months, what’s the use?
  - Good news is that in the urban municipal environment, there are many areas that have ambient illumination sufficient to satisfy retroreflectivity requirements
  - Raised pavement markers can offset the requirement also
  - But don’t assume that’s the case, do an audit of your streets
  - Don’t wait for the “standards” – 3A.02 already gave you one
Marking Materials

- Includes raised pavement markers (RPMs)
- Delineators should not present horizontal or vertical obstacle to peds
Section 3A.05 Colors

### Standard:

01. Markings shall be yellow, white, red, blue, or purple. The colors for markings shall conform to the standard highway colors. Black in conjunction with one of the colors mentioned in the first sentence of this paragraph shall be a usable color.

02. When used, white markings for longitudinal lines shall delineate:
   A. The separation of traffic flows in the same direction, or
   B. The right-hand edge of the roadway.

03. When used, yellow markings for longitudinal lines shall delineate:
   A. The separation of traffic traveling in opposite directions,
   B. The left-hand edge of the roadways of divided highways and one-way streets or ramps, or
   C. The separation of two-way left-turn lanes and reversible lanes from other lanes.

08. Black may be used in combination with the colors mentioned in the first sentence of Paragraph 1 where a light-colored pavement does not provide sufficient contrast with the markings.

- **Yellow, white, red, blue, and purple markings only**
- **White separates traffic in same direction and delineates right edge of road**
- **Yellow separates traffic in opposite directions and delineates left edge of divided and one-way roads**
- **DE Guidance: Black contrast markings enhance white lane lines and edge lines along all concrete roads**
Section 3A.05 Colors

Yellow marking should be white because adjacent lanes are in same direction.

White markings shall be used to separate traffic in the same direction, not yellow markings.

US 13 Bus. (Walnut St) at A St, Wilmington
Concrete Roads

- For conventional roads, Figure 3A-1B

Part 3; Section 3A.05
Section 3A.05 Colors

Lane lines on all concrete roads should include black contrast markings.

White-on-black edge lines are no longer the preferred application due to maintenance concerns; follow side-by-side application in Figures 3A-1A and 3A-1B.

Don’t have concrete roads? Applies to bridge decks, also.

Incorrect – see next slide for correct application.

SR 1 southbound approaching Exit 119 (N. Smyrna)
Leading black contrast broken lane lines installed along Elkton Rd to enhance the conspicuity of the markings.
Standard:

The general functions of longitudinal lines shall be:

A. A double line indicates maximum or special restrictions,
B. A solid line discourages or prohibits crossing (depending on the specific application),
C. A broken line indicates a permissive condition, and
D. A dotted line provides guidance or warning of a downstream change in lane function.

- Double lines indicate crossing and passing prohibitions
- Solid lines discourage or prohibit crossing
- Broken lines delineate lane assignments and passing zones
- Dotted lines ("skips") inform motorists of changes in lane conditions
Section 3A.06 Functions, Widths, and Patterns of Longitudinal Pavement Markings

**Wide line** – at least twice normal width

**Broken lines consist of 10’ lines with 30’ gaps**

**DE Guidance:**

- 4” (normal) and 8” (wide) lines on conventional roads (5” and 10” on state maintained roads)
- **Double lines have 6” separation**
- **2’ lines with 6’ gaps for dotted lines on conventional roads**
Section 3B.01 Yellow Center Line Pavement Markings and Warrants

- Two-lane, two-way roads follow Figure 3B-1

- Single solid yellow center lines prohibited on two-way roads

- Multi-lane roads follow Figure 3B-2
Section 3B.01 Yellow Center Line
Pavement Markings and Warrants

Figure 3B-1. Examples of Two-Lane, Two-Way Marking Applications
(Delaware Revision)

- Typical two-lane, two-way marking with passing permitted in both directions
- Typical two-lane, two-way marking with no-passing zones
- Typical two-lane, two-way marking approaching an intersection

Legend
→ Direction of travel

No-passing zone

Figure 3B-2. Examples of Four-or-More Lane, Two-Way Marking Applications
(Delaware Revision)

- Typical multi-lane, two-way marking
- Typical multi-lane, two-way marking with single lane left turn channelization
- Typical multi-lane, two-way marking with raised median or flush median of contrasting color

Legend
→ Direction of travel

No-passing zone 200 ft minimum on departure from intersection

Minimum no-passing zone distance on approach to intersection (see Table 3B-1)
Section 3B.01 Yellow Center Line
Pavement Markings and Warrants

Milltown Rd at Grendon Dr

Two sets of solid double yellow center lines shall form flush medians of the same color regardless of the use of optional chevrons

CORRECT

SR 72 south of Old Baltimore Pk

INCORRECT
Otts Chapel Rd southbound approaching Old Baltimore Pk

Solid single yellow edge lines surround flush medians of contrasting color

Shall have two sets of solid double yellow center lines preceding leading end of flush median
Section 3B.01 Yellow Center Line
Pavement Markings and Warrants

Old Baltimore Pk at SR 896, west leg of intersection

Edge lines should be “wrapped” around leading end of median; Keep Right sign shall be installed

Solid single yellow edge lines surround raised medians
• **DE Standard:** Paved roads with traveled way ≥ 19’ and ADT ≥ 500 require center line markings

• **DE Guidance:** Engineering judgment where traveled way < 19’

• **Generally – no centerline within subdivisions**
• DE Option: Paved roads with traveled way ≥ 19’ and ADT < 500 may be striped with center line, based on study
Section 3B.02 No-Passing Zone
Pavement Markings and Warrants

• Used where passing sight distance < Table 3B-1
• Assumed eye and object heights 3.5’ above road
• Continuous no-passing zone if distance between two successive zones < 400’
• Required on approaches to rail crossings (see Part 8B.27)
No Passing Zone Warrants

- Vertical curve sight distances must also be checked

Figure 3B-4. Method of Locating and Determining the Limits of No-Passing Zones at Curves
**DE Guidance: No-passing zone ≥ Table 3B-1 on approach to intersection and ≥ 200’ on departure**

200’ (min.) and 1,000’ (min.) no-passing zones should be installed on the departures and approaches, respectively.

**Table 3B-1. Minimum Passing Sight Distances for No-Passing Zone Markings**

<table>
<thead>
<tr>
<th>85th-Percentile or Posted or Statutory Speed Limit</th>
<th>Minimum Passing Sight Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 mph</td>
<td>450 feet</td>
</tr>
<tr>
<td>30 mph</td>
<td>500 feet</td>
</tr>
<tr>
<td>35 mph</td>
<td>550 feet</td>
</tr>
<tr>
<td>40 mph</td>
<td>600 feet</td>
</tr>
<tr>
<td>45 mph</td>
<td>650 feet</td>
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<td>1,050 feet</td>
</tr>
<tr>
<td>90 mph</td>
<td>1,100 feet</td>
</tr>
<tr>
<td>95 mph</td>
<td>1,150 feet</td>
</tr>
<tr>
<td>100 mph</td>
<td>1,200 feet</td>
</tr>
</tbody>
</table>

**C - Typical two-lane, two-way marking approaching an intersection**

**Legend**

- Direction of travel

**SR 10 Alt. at Berrytown Rd**

**Posted: 50 MPH**

**85th-percentile: 60 MPH**
• **Broken (10’ lines; 30’ gaps) and solid yellow lines for two-way left-turn lanes**

• **Two-way left-turn arrows and Two-Way Left Turn Only signs (R3-9 Series) supplement longitudinal markings**

• **DE Guidance: 800’ arrow spacing between cross streets**
In other words, the number of left turn arrows here is excessive.

**Two-way left-turn arrows should be spaced at 800’ intervals between cross streets.**

**R3-9b sign should be adjacent to two-way left-turn lane pavement markings.**

**Middleford Rd west of US 13**

**17 two-way left-turn arrows within 1,600’ segment**

**SR 300 west of US 13**
Section 3B.04 White Lane Line Pavement Markings and Warrants

Lane line markings shall be used on all freeways and Interstate highways.

Guidance:

Lane line markings should be used on all roadways that are intended to operate with two or more adjacent traffic lanes in the same direction of travel, except as otherwise required for reversible lanes. Lane line markings should also be used at congested locations where the roadway will accommodate more traffic lanes with lane line markings than without the markings.

(De Revision) Along interstates, freeways, and expressways, the dotted white lane lines that are used for lane drop markings and that are used as a lane line separating through lanes from auxiliary lanes should consist of line segments that are 3 feet in length separated by 9-foot gaps. Along all other roadways, the dotted white lane lines that are used for lane drop markings and that are used as a lane line separating through lanes from auxiliary lanes should consist of line segments that are 2 feet in length separated by 6-foot gaps.

- Should be used on all roads to separate traffic in same direction
- DE Guidance:
  - 3’ lines with 9’ gaps for dotted lane lines on interstates, freeways, and expressways
  - 2’ lines with 6’ gaps for dotted lane lines on conventional roads

Solid and broken (10’ lines; 30’ gaps) lane lines separating double left-turn lanes

Solid and dotted (2’ lines; 6’ gaps) lane lines separating left-turn and through/right-turn traffic

Old Baltimore Pk eastbound at SR 896
- **Wide (10’’)** dotted (2’ lines; 6’ gaps) lane lines used at lane drops at intersections on conventional roads

- **DE Guidance:** Begin at first regulatory lane drop sign (R3-7)
Wide (10”) dotted (2’ lines; 6’ gaps) lane lines shall delineate combination acceleration/deceleration lanes between intersections.

SR 92 westbound between I-95 southbound off-ramp and Peachtree Rd / Society Dr (east)
**DE Guidance:**

- **Taper length**: \( L = WS \) for \( S \geq 45 \) MPH; \( L = \frac{WS^2}{60} \) for \( S < 45 \) MPH

- **Downstream solid lane line**, equal to 0.5L, separates turn and through lanes

- **Upstream dotted lane line**, equal to 0.5L, separates turn and through lanes

- **Upstream dotted lane line** extends through the taper
• **DE Guidance:**
  
  - **Unsignalized approach** – broken lane line(s) continues through intersection
  
  - **Signalized approach** – solid white lane line(s) separates adjacent through lanes; length equal to:
    
    - $0.5L_L$ if $L_R < L_L < 300'$
    
    - $0.5L_R$ if $L_L < L_R < 300'$
    
    - 150’ (max.)
Section 3B.04 White Lane Line
Pavement Markings and Warrants

SR 92 westbound at Society Dr (west)

- **Dotted (2’ lines; 6’ gaps)** lane line separates through and right-turn lanes for 0.5L and extends through taper
- **Solid lane line separates through and right-turn lanes for 0.5L**
- **Broken (10’ lines; 30’ gaps)** lane line continues through unsignalized intersection
- **Thru lanes with right turn lane**
- **Lane arrow placement should follow Section 3B.20**
Section 3B.04 White Lane Line Pavement Markings and Warrants

Solid lane line should be installed to separate adjacent through lanes at signal

US 13 southbound at Paddock Rd / Joe Goldsborough Rd

Intersection - Incorrect
Solid lane line, equal to 0.5L, separates through lanes at signalized intersection.

Intersection - correct

Lane arrow placement should follow Section 3B.20

SR 92 westbound at Carpenter Station Rd
• **DE Guidance – Bypass lanes:**
  
  - Dotted (2’ lines; 6’ gaps) and solid lane lines separate traffic in same direction
  
  - Design lengths based on Figure 5-19 in DelDOT Standards and Regulations for Subdivision Streets and State Highway Access
No-passing zones should be installed on approaches to and departures from intersections.

Dotted lane lines delineate approach and departure tapers.

Solid lane line separates through and bypass lanes.

Edge lines shall be installed to delineate right edge of bypass lane.

Extend the edge lines.

SR 30 at SR 26.
Section 3B.06 Edge Line Pavement Markings

Standard:
01 If used, edge line pavement markings shall delineate the right or left edges of a roadway.
02 Except for dotted edge line extensions (see Section 3B.08), edge line markings shall not be continued through intersections or major driveways.
03 If used on the roadways of divided highways or one-way streets, or on any ramp in the direction of travel, left edge line pavement markings shall consist of a normal solid yellow line to delineate the left-hand edge of a roadway or to indicate driving or passing restrictions left of these markings.
04 If used, right edge line pavement markings shall consist of a normal solid white line to delineate the right-hand edge of the roadway.

Guidance:
05 Edge line markings should not be broken for minor driveways.

• Should continue through minor driveways
• Shall not continue through intersections or major driveways
• Yellow edge lines used on left side of divided highways and one-way roads
• White edge lines delineate right edge of road

Detectable Warnings
Detectable warnings shall be installed at sidewalk curb ramps and at uncurbed sidewalks at the following locations:
• Crosswalks (marked & unmarked) and designated places where pedestrians cross public roadways (including medians and refuge islands);
• Signalized entrances;
• High volume entrances with ADT greater than about 400;
• Entrances with an operating speed of 25 m.p.h. or greater through the pedestrian area;
• Railroad crossings.

SR 1 southbound at Tybouts Corner

DelDOT DGM 1-16 Curb Ramps

DelDOT DGM 1-16 Curb Ramps, Page 2 of 5

ADT > 400 considered “high volume” per DelDOT DGM 1-16 Curb Ramps
• DE Standard:
  – All paved roads and surface treated streets \( \geq 20' \) wide with ADT \( \geq 3,000 \)

• Other paved roads based on engineering study or judgment
Section 3B.07 Warrants for Use of Edge Lines

Option:

04  Edge line markings may be placed on streets and highways with or without center line markings.

- Edge lines may be installed based on engineering study or judgment even if center lines are not installed
Section 3B.09 Lane-Reduction Transition Markings

Standard:

02 Except as provided in Paragraph 3, where pavement markings are used, lane-reduction transition markings shall be used to guide traffic through transition areas where the number of through lanes is reduced, as shown in Figure 3B-14. On two-way roadways, no-passing zone markings shall be used to prohibit passing in the direction of the convergence, and shall continue through the transition area.

Guidance:

04 For roadways having a posted or statutory speed limit of 45 mph or greater, the transition taper length for a lane-reduction transition should be computed by the formula \( L = WS \). For roadways where the posted or statutory speed limit is less than 45 mph, the formula \( L = WS^2/60 \) should be used to compute the taper length.

04A (DE Revision) Lane-reduction transition markings along interstates, freeways, and expressways should be installed as shown in Figure 3B-14A. Lane-reduction transition markings beyond intersections should be installed as shown in Figures 3B-14B and 3B-14C.

Option:

04B (DE Revision) Lane-reduction markings shown in Figures 3B-14A, 3B-14B, and 3B-14C may be adjusted based on engineering judgment at existing locations where space is limited due to site-specific conditions.

Support:

05 Under both formulas, \( L \) equals the taper length in feet, \( W \) equals the width of the offset distance in feet, and \( S \) equals the 85th-percentile speed or the posted or statutory speed limit, whichever is higher.

Guidance:

06 (DE Revision) Lane line markings should be discontinued where the transition taper begins.

06 Except as provided in Paragraph 3 for low-speed urban roadways, the edge line markings shown in Figure 3B-14 should be installed from the location of the Lane Ends warning sign to beyond the beginning of the narrower roadway.

Guidance:  (from Section 3B.20)

34 (DE Revision) Where a lane-reduction transition occurs on a roadway, the lane-reduction arrow markings shown in Drawing F in Figure 3B-24 should be used as shown in Figures 3B-14, 3B-14A, 3B-14B, and 3B-14C).

- **No-passing zone in transition area**
- **Taper length**: \( L = WS \) for \( S \geq 45 \) MPH; \( L = WS^2/60 \) for \( S < 45 \) MPH
- **DE Guidance**:
  - Figures 3B-14B and 3B-14C for lane reductions beyond intersections
  - Dotted lane line begins at first Lane Ends sign and terminates at beginning of taper
  - Lane reduction arrows used for all speed limits
Section 3B.09 Lane-Reduction Transition Markings
Section 3B.10 Approach Markings for Obstructions

Standard:

Obstructions within paved roads shall be marked.

Taper length:

- \( L = WS \) for \( S \geq 45 \text{ MPH} \)
- \( L = WS^2/60 \) for \( S < 45 \text{ MPH} \)
- \( L \) (min.) urban = 100’
- \( L \) (min.) rural = 200’
Section 3B.10 Approach Markings for Obstructions

Standard:
07 If traffic is required to pass only to the right of the obstruction, the markings shall consist of a two-direction no-passing zone marking at least twice the length of the diagonal portion as determined by the appropriate taper formula (see Drawing A of Figure 3B-15).

Standard:
09 If traffic can pass either to the right or left of the obstruction, the markings shall consist of two channelizing lines diverging from the lane line, one to each side of the obstruction. In advance of the point of divergence, a wide solid white line or normal solid double white line shall be extended in place of the broken lane line for a distance equal to the length of the diverging lines (see Drawing C of Figure 3B-15).

- **Figure 3B-15, Drawings A and B** for two-way traffic only passing on right
- **Figure 3B-15, Drawing C** for traffic in same direction passing on both sides
Section 3B.11 Raised Pavement Markers – General

Standard:
The color of raised pavement markers under both daylight and nighttime conditions shall conform to the color of the marking for which they serve as a positioning guide, or for which they supplement or substitute.

• **RPM matches color of line it supplements**
• **DE Standard:** Shall not be used as substitute for pavement markings unless otherwise approved by DelDOT Traffic
• **DE Guidance:**
  – *Used on all interstates, freeways, expressways, and principal arterials*
  – *Considered on two-lane, two-way arterials with posted speed ≥ 45 MPH*
  – *Installed along other roads based on engineering study*
  – *Should not be installed on surface treated roads*

White RPMs supplement solid, broken, and dotted lane lines at off-ramps

I-95 southbound approaching Exits 5A and 5B
Raised Pavement Markers

01B (DE Revision) Raised pavement markers should be considered for use along conventional roads under the following conditions:

A. Roadways with posted speed limits of 45 miles per hour or greater, with horizontal and/or vertical curves, and areas of low lighting
B. Locations with a history of roadway departure crashes
C. Locations with advisory speed postings
D. Locations where a barrier or parapet is less than 6 feet from the edge of the travel lane

01C (DE Revision) Raised pavement markers should also be installed on other roadways where engineering judgment indicates such a need.

01D (DE Revision) Raised pavement markers should not be installed along surface-treated roadways.
DE Guidance:

- Adjacent to single solid lines
- In line with broken and dotted lane lines
- Between double yellow center lines
- Longitudinally spaced at 80’ intervals along double yellow center lines and broken (10’ lines; 30’ gaps) lane lines
- Longitudinal spacing reduced to 40’ on curves and within “buffer” in advance of curves
Transverse Markings

Stop bars, yield lines, arrows, words, etc. shall be white

Section 3B.15 Transverse Markings

Standard:

01 Transverse markings, which include shoulder markings, word and symbol markings, arrows, stop lines, yield lines, crosswalk lines, speed measurement markings, speed reduction markings, speed hump markings, parking space markings, and others, shall be white unless otherwise provided in this Manual.

Guidance:

02 Because of the low approach angle at which pavement markings are viewed, transverse lines should be proportioned to provide visibility at least equal to that of longitudinal lines.
Section 3B.16 Stop and Yield Lines

Guidance:

01. Stop lines should be used to indicate the point behind which vehicles are required to stop in compliance with a traffic control signal.

Option:

02. Stop lines may be used to indicate the point behind which vehicles are required to stop in compliance with a STOP (R1-1) sign, a Stop Here For Pedestrians (R1-5b or R1-5c) sign, or some other traffic control device that requires vehicles to stop, except YIELD signs that are not associated with passive grade crossings.

03. Yield lines may be used to indicate the point behind which vehicles are required to yield in compliance with a YIELD (R1-2) sign or a Yield Here To Pedestrians (R1-5 or R1-5a) sign.

Standard:

04. Except as provided in Section 8B.28, stop lines shall not be used at locations where drivers are required to yield in compliance with a YIELD (R1-2) sign or a Yield Here To Pedestrians (R1-5 or R1-5a) sign or at locations on uncontrolled approaches where drivers are required by State law to yield to pedestrians.

05. Yield lines shall not be used at locations where drivers are required to stop in compliance with a STOP (R1-1) sign, a Stop Here For Pedestrians (R1-5b or R1-5c) sign, a traffic control signal, or some other traffic control device.

- Stop lines should be installed at all signal approaches
  - Primary signal heads ≥ 40’ from stop line
- DE Guidance:
  - Intersection of two state-maintained roads – stop lines on all stop-controlled approaches
  - Entrance along state-maintained road – stop lines on all stop-controlled approaches
  - Internal intersections within developments – stop lines typically not installed
- Stop lines prohibited on yield-controlled approaches (except rail crossings)
- Yield lines prohibited on stop-controlled and signal-controlled approaches
Stop lines shall not be installed for yield-controlled movements, including those defined by Rules of the Road in DE Code.
Stop and Yield Lines

- These sharks teeth have seen much change over the years
- This is how we do it now

Option:
02 Stop lines may be used to indicate the point behind which vehicles are required to stop in compliance with a STOP (R1-1) sign, a Stop Here For Pedestrians (R1-5b or R1-5c) sign, or some other traffic control device that requires vehicles to stop, except YIELD signs that are not associated with passive grade crossings.
03 Yield lines may be used to indicate the point behind which vehicles are required to yield in compliance with a YIELD (R1-2) sign or a Yield Here To Pedestrians (R1-5 or R1-5a) sign.
Standard:
04 Except as provided in Section 8B.28, stop lines shall not be used at locations where drivers are required to yield in compliance with a YIELD (R1-2) sign or a Yield Here To Pedestrians (R1-5 or R1-5a) sign or at locations on uncontrolled approaches where drivers are required by State law to yield to pedestrians.
05 Yield lines shall not be used at locations where drivers are required to stop in compliance with a STOP (R1-1) sign, a Stop Here For Pedestrians (R1-5b or R1-5c) sign, a traffic control signal, or some other traffic control device.
06 Stop lines shall consist of solid white lines extending across approach lanes to indicate the point at which the stop is intended or required to be made.
07 Yield lines (see Figure 3B-16) shall consist of a row of solid white isosceles triangles pointing toward approaching vehicles extending across approach lanes to indicate the point at which the yield is intended or required to be made.
Section 3B.16 Stop and Yield Lines

- Stop lines installed a minimum of 4’ in advance of crosswalks
- At locations without crosswalks, stop and yield lines should be ≥ 4’ and < 30’ from edge of intersecting road
Section 3B.16 Stop and Yield Lines

- **Yield line installed 20’ to 50’ in advance of midblock crosswalk**
- **Parking prohibition between yield line and crosswalk**
- **R1-5 signs required**
- **DE Guidance: W11-2 assemblies at crosswalk; however, R1-5 signs shall not block W11-2 assemblies**
Section 3B.16 Stop and Yield Lines

- **W11-2 assemblies; R1-5 signs shall not block W11-2 signs**
- **Yield line installed about 35’ in advance of uncontrolled midblock crosswalk**
- **Parking prohibition between yield line and crosswalk**
- **Standard R1-5 sign size now 36” x 36”**
- **SR 273 (Main St), Newark**

**Notes:**
- SR 273 (Main St), Newark
- W11-2 assemblies; R1-5 signs shall not block W11-2 signs
- Yield line installed about 35’ in advance of uncontrolled midblock crosswalk
- Parking prohibition between yield line and crosswalk
- Standard R1-5 sign size now 36” x 36”
Crosswalk Markings

- At intersections, crosswalks exist within the roadway as the extension of sidewalks
- Only at non-intersection locations must you legally establish a crosswalk

Part 3; Section 3B.18

Support:
01 Crosswalk markings provide guidance for pedestrians who are crossing roadways by defining and delineating paths on approaches to and within signalized intersections, and on approaches to other intersections where traffic stops.
02 In conjunction with signs and other measures, crosswalk markings help to alert road users of a designated pedestrian crossing point across roadways at locations that are not controlled by traffic control signals or STOP or YIELD signs.
03 At non-intersection locations, crosswalk markings legally establish the crosswalk.
Section 3B.18 Crosswalk Markings

**Standard:**
04 When crosswalk lines are used, they shall consist of solid white lines that mark the crosswalk. They shall not be less than 6 inches or greater than 24 inches in width.

**Guidance:**
05 (DE Revision) If 12-inch wide transverse lines are used to mark a temporary crosswalk or patterned pavement crosswalk or along non-state maintained roadways, the crosswalk width should be measured between the two lines (see Figure 3B-19).
05A (DE Revision) Crosswalk markings on roadways with a posted speed limit (or 85th-percentile speed) of 40 mph or greater and at locations with high pedestrian activity should be 10 feet wide. Crosswalk markings on other roadways should be 6 feet wide.
05B (DE Revision) Crosswalk markings on all approaches to an intersection with one or more roadways with a posted speed limit (or 85th-percentile speed) of 40 mph or greater or with high pedestrian activity should be 10 feet wide.

- **DE Standard:** 24” wide longitudinal (“piano key”) markings spaced 24” apart

- **DE Guidance:** 12” wide transverse lines used to delineate patterned or brick crosswalks (¶15B)

- **DE Option:** 12” wide transverse lines used for temporary crosswalks (¶15C)

**Figure 3B-19. Examples of Crosswalk Markings**  
(Delaware Revision)

Notes:
Transverse crosswalks should be used to delineate patterned and brick crosswalks.
Transverse crosswalks may also be used for temporary crosswalks.
Section 3B.18 Crosswalk Markings

Crosswalks shall consist of solid white lines

San Francisco, CA
Patterned and brick crosswalks should be delineated with 12” wide transverse crosswalk markings, not solely concrete borders.

SR 1A at Church St

SR 1A at 2nd St
Section 3B.18 Crosswalk Markings

Crosswalk lines should not be used indiscriminately. An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

New marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and either:

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.

- **Uncontrolled crosswalks installed based on engineering studies**
- **Guidelines based on number of lanes, speed limit, ADT, median, etc.**
- More criteria in NCHRP Report 562 and FHWA Publication HRT-04-100
Crosswalk Markings

Why not a fourth cross walk here?
- An oversight?
- Intentional?

- Here – very deliberate
- Probably high volume east bound turn movement on game day
- Law enforcement present on game day

Part 3; Section 3B.18
Crosswalks

- Shark’s teeth
- High pedestrian volume
- Diagonal crossing
- Cleveland Avenue/Paper Mill Road
- Cleveland Avenue/North College Avenue

Part 3; Section 3B.18
DE Guidance:

- 6’ crosswalks across roads < 40 MPH (posted or 85th-percentile speed)
- 10’ crosswalks across roads ≥ 40 MPH
- 10’ crosswalks in areas with high pedestrian volumes
- Intersection of high-speed and low-speed roads should have 10’ crosswalks, not varying sizes
Crosswalks

SR 41 at Yorklyn Road

Part 3; Section 3B.18
Crosswalks

But...diagonal alignment still not preferred
Crosswalks and ADA

- Crosswalks must be oriented consistent with curb ramps
- Truncated domes (detectable warning surfaces) are required at interface with traffic

Part 3; Section 3B.18
Parking Spaces

§4179 (e) of Title 21 of the Delaware State Code
http://delcode.delaware.gov/title21/c041/index.shtml
Section 3B.20 Pavement Word, Symbol, and Arrow Markings

Option:

Word, symbol, and arrow markings, including those contained in the “Standard Highway Signs and Markings” book (see Section 1A.11), may be used as determined by engineering judgment to supplement signs and/or to provide additional emphasis for regulatory, warning, or guidance messages. Among the word, symbol, and arrow markings that may be used are the following:

A. Regulatory:
   1. STOP
   2. YIELD
   3. RIGHT (LEFT) TURN ONLY
   4. 25 MPH
   5. Lane-use and wrong-way arrows
   6. Diamond symbol for HOV lanes
   7. Other preferential lane word markings

B. Warning:
   1. STOP AHEAD
   2. YIELD AHEAD
   3. YIELD AHEAD triangle symbol
   4. SCHOOL XING
   5. SIGNAL AHEAD
   6. PED XING
   7. SCHOOL
   8. R X R
   9. BUMP
   10. HUMP
   11. Lane-reduction arrows

C. Guide:
   1. Route numbers (route shield pavement marking symbols and/or words such as I-81, US 40, STATE 135, or ROUTE 10)
   2. Cardinal directions (NORTH, SOUTH, EAST, or WEST)
   3. TO
   4. Destination names or abbreviations thereof

Standard:

Word, symbol, and arrow markings shall be white, except as otherwise provided in this Section.

Guidance:

- Words, symbols, and arrows may be used based on engineering judgment
- Shall be white
- Letters and numerals ≥ 6’ in height
- No more than 3 lines of information
STOP word marking installed to reinforce unanticipated stop condition along SR 5

SR 5 at Hollyville Rd / Hollymount Rd

Why are there both stop signs AND signals?

New signal
STOP AHEAD markings are typically installed immediately adjacent to Stop Ahead signs.

STOP installed prior to AHEAD in the direction of travel.

Berrytown Rd approaching SR 10 Alt.

Multi-line word messages installed in the direction of travel.
Chapter 7C – Markings

From Part 7
TCDs in School Areas
Section 7C.03 – Pavement Word, Symbol, and Arrow Markings

Guidance:

01A  (DE Revision) Pavement word and symbol markings should not extend beyond the centerline, if present, into the opposing direction of travel.

01B  (DE Revision) When installed in a single lane with a width of 10.5 feet or greater, the SCHOOL word marking should consist of 16 inch wide by 96 inch high letters, separated by 4 inch spaces (see Figure 7C-1).

01C  (DE Revision) When installed in a single lane with a width less than 10.5 feet, the SCHOOL word marking should consist of 12 inch wide by 72 inch high letters, separated by 3 inch spaces (see Figure 7C-1).

DE Revision:

• Markings should not extend beyond centerline into opposing direction
Section 7C.03 – Pavement Word, Symbol and Arrow Markings

INCORRECT

SCHOOL word marking extends into the departure lane

CORRECT

SCHOOL word marking is scaled to fit one lane (although not quite in scale with new guidance in Fig 7C-1)

South Dover Elementary

North Dover Elementary
Curb Markings

- DelDOT would prefer you not paint curbs on state-maintained roads
- If you do, maintenance is yours

Support:
01 Curb markings are most often used to indicate parking regulations or to delineate the curb.

Standard:
02 Where curbs are marked to convey parking regulations in areas where curb markings are frequently obscured by snow and ice accumulation, signs shall be used with the curb markings except as provided in Paragraph 4.

Guidance:
03 Except as provided in Paragraph 4, when curb markings are used without signs to convey parking regulations, a legible word marking regarding the regulation (such as “No Parking” or “No Standing”) should be placed on the curb.
03A (DE Revision) Curb markings should not be used along state-maintained roadways to indicate parking regulations.

Standard:
03B Where curb markings are installed along state-maintained roadways by a local municipality, they shall be maintained by the local municipality.

Part 3; Section 3B.23
Section 3B.24 Chevron and Diagonal Crosshatch Markings

- Discourage motorists from driving across certain areas

- **DE Guidance: Used in diverge neutral areas**

- White “V” shaped markings when separating traffic in same direction

- Yellow markings when separating traffic in opposing directions

- Yellow markings on left shoulders

- White markings on right shoulders

White chevrons installed to discourage motorists from driving in the shoulder

SR 4 westbound at SR 7
DE Guidance:

- 12” wide markings

- Commonly angled at 45 degrees with respect to adjacent travel lane(s)

- Typically spaced at 25’ along conventional roads

- Typically spaced at 50’ along interstates, freeways, and expressways

SR 1A west of Church St

Striped flush medians require two sets of double yellow lines

Flush median delineated with 12” chevrons spaced 25’ at 45 degree angle
Section 3B.25 Speed Hump Markings

Standard:

1. If speed hump markings are used, they shall be a series of white markings placed on a speed hump to identify its location. If markings are used for a speed hump that does not also function as a crosswalk or speed table, the markings shall comply with Option A, B, or C shown in Figure 3B-29. If markings are used for a speed hump that also functions as a crosswalk or speed table, the markings shall comply with Option A or B shown in Figure 3B-30.

- Shall be white and shall comply with Figure 3B-29
- DE Guidance: Option A in Figure 3B-29 is preferred on state-maintained roads

Myrtle Ave west of Claymont Train Station
Speed Hump Markings

Advance warning markings (optional), as is wording HUMP

Part 3; Section 3B.25 & 3B.26
CHAPTER 3D.
MARKINGS FOR PREFERENTIAL LANES

N. College Ave at Cleveland Ave

Relocated from 3B

SR 1 north of Dartmouth Dr

Improper use of HOV only lane symbol
CHAPTER 3F. DELINEATORS

Delineators on left side of two-way roads shall be white, not red

Guardrail reflectors

I-95 southbound off-ramp to SR 273
Non-retroreflective colored pavement used for aesthetic purposes that does not regulate, warn, or guide traffic is not a traffic control device.

Standard:
03 If colored pavement is used within the traveled way, on flush or raised islands, or on shoulders to regulate, warn, or guide traffic or if retroreflective colored pavement is used, the colored pavement is considered to be a traffic control device and shall be limited to the following colors and applications:
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.
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.

Aesthetic crosswalk treatments, not traffic control devices
Colored Pavements

In addition, FHWA has issued an Interim Approval

- For the optional use of green colored pavement in marked bicycle lanes and in extensions of bicycle lanes through intersections and other traffic conflict areas
- They reviewed available data—consider the experimental green colored pavement to be satisfactorily successful for the bicycle applications that were tested. Positive operational effects have been noted
  - Bicyclists positioning themselves more accurately as they travel across intersections and through conflict areas
  - No notable negative operational effects have been observed
  - The research has also shown that bicyclists and motorists both have a positive impression of the effect of the green colored pavement
    - bicyclists say that they feel safer when the green colored pavement is present
    - motorists say that the green colored pavement gives them an increased awareness that bicyclists might be present and where those bicyclists are likely to be positioned within the traveled way.

Part 3; Section 3G
Colored Pavements

- Careful – think about
  - Skid resistance
  - Wear resistance
  - Durability
  - UV stable

Part 3; Section 3G

Courtesy Integrated Paving Concepts
Yellow retroreflective bands are required for devices separating traffic in opposing directions.

US 113 southbound at Arrow Safety Rd

Formerly 3F

US 13 northbound at Scott Run (SR 1 “free” ramp)

White retroreflective bands are required for devices separating traffic in the same direction.

Channelizing devices shall be either orange or same color as the marking they supplement.
James St bridge, Newport

Transverse rumble strips

Longitudinal center line rumble stripe

US 301 north of Middletown
Bicycle Facilities

- Absence of a marked bike lane does not mean cyclists not permitted to travel on the roadway (§9A.02, ¶03)
- Fluorescent yellow should be used for all bike related warning signs (§9A.08, ¶02)
- Lane width $\leq 14'$ (w/out shoulder) considered too narrow for a bike and a vehicle to travel safely side by side in the same lane (§9B.06, ¶06)
Shared Lane Markings ("Sharrows")

- **Roadways with on-street parking only**
  - Reduces “dooring”
  - Assists cyclists with lateral positioning
  - Alerts drivers of likely bike positioning
  - Reduces wrong-way cycling

- **Not for:**
  - Rural areas
  - Areas without on-street parking
  - Roadways with speeds >35 mph
  - Shoulders or designated bike lanes

---

Part 9; Section 9C.07

R4-11 can be used in addition or instead
Other Bicycle Facility Markings

- Helmeted cyclist is preferred – it faces traffic lane

Part 9; Section 9C
What’s in Part 6 – TTC?

- 6A – General
- 6B – Fundamental principals
- 6C – TTC Elements
- 6D – Pedestrian and worker safety
- 6E – Flagger control
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
To whom does Part 6 apply?

- Remember in Part 1? MUTCD applies to all agencies and private concerns that have roads (etc.) open to public?
- For Part 6, we need to expand the list of those that need to sit up, take notice, and comply
  - Utility companies that perform construction, inspection, maintenance
  - Contractors for private jobs (they like to unload equipment from trailers parked on the street or perform work while positioned in the street – in some cases they have little choice)
  - Others who legitimately use the ROW
- These parties must also comply with the MUTCD
Before We Get Started...

- Utility: “It’s an emergency; we don’t have time for that”
- Road Agency: “Sure you do”
- In the understandable zeal to fix utilities, let’s make sure everyone goes home safe
Before We Get Started...

- Contractor: “We’ll just be a minute unloading this stuff in the travel lane”
- Road Agency: “Not without proper TTC you won’t”
Before We Get Started...

- As a Road Agency, you are obligated to some extent to accommodate utilities, private construction, other agencies, and their contractors
- But none of these parties are exempt from the MUTCD
- Turning a blind eye to their indiscretions only exposes you to liability – take a stand and enforce

- If you practice good work zone management, your enforcement of others will be easier
Consider needs of all road users

TTC planning begins at project scoping and extends through final design and construction

DE Guidance: TTC plan complying with “Work Zone Safety and Mobility Procedures and Guidelines”

TTC plans can deviate from typical applications
TTC Goals

- Continuity of movement, transit operations, access to property/utilities
- Reasonable safety and effective movement
  - Traveling public
  - Workers

03 When the normal function of the roadway, or a private road open to public travel, is suspended, TTC planning provides for continuity of the movement of motor vehicle, bicycle, and pedestrian traffic (including accessible passage); transit operations; and access (and accessibility) to property and utilities.

04 The primary function of TTC is to provide for the reasonably safe and effective movement of road users through or around TTC zones while reasonably protecting road users, workers, responders to traffic incidents, and equipment.

05 Of equal importance to the public traveling through the TTC zone is the safety of workers performing the many varied tasks within the work space. TTC zones present constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the workers and incident management responders on or near the roadway (see Section 6D.03). At the same time, the TTC zone provides for the efficient completion of whatever activity interrupted the normal use of the roadway.
Where Are We?

- 6A – General
- **6B – Fundamental principals**
- 6C – TTC Elements
- 6D – Pedestrian and worker safety
- 6E – Flagger control
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
• **7 fundamental principles of TTC:**

  – Develop plans to accommodate all road users, workers, and equipment
  
  – Minimize impacts on road users
  
  – Provide clear guidance to road users
  
  – Routinely inspect TTC devices
  
  – Maintain roadside safety
  
  – Train individuals involved in TTC operations
  
  – Disseminate information to public
Section 6B.01 Fundamental Principles of Temporary Traffic Control

Standard:
08 Before any new detour or temporary route is opened to traffic, all necessary signs shall be in place.
09 All TTC devices shall be removed as soon as practical when they are no longer needed. When work is suspended for short periods of time, TTC devices that are no longer appropriate shall be removed or covered.

- Install signs prior to opening detour or diversion routes
- Remove or cover TTC devices when no longer needed
Where Are We?

- 6A – General
- 6B – Fundamental principals
- 6C – TTC Elements
- 6D – Pedestrian and worker safety
- 6E – Flagger control
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
Section 6C.01 Temporary Traffic Control Plans

- Adjacent or overlapping projects should be coordinated

04 Coordination should be made between adjacent or overlapping projects to check that duplicate signing is not used and to check compatibility of traffic control between adjacent or overlapping projects.

SR 54 west of SR 1
Section 6C.02 Temporary Traffic Control Zones

A planned special event often creates the need to establish altered traffic patterns to handle the increased traffic volumes generated by the event. The size of the TTC zone associated with a planned special event can be small, such as closing a street for a festival, or can extend throughout a municipality for larger events. The duration of the TTC zone is determined by the duration of the planned special event.

Guidance:

( DE Revision) Any planned special event that impacts traffic flow on state-maintained roadways should complete a Special Event Permit Application, available for download on the DelDOT website: http://www.deldot.gov.

- Planned special events may require TTC planning

- DE Guidance: Complete DelDOT Special Event Permit Application for planned special events on state-maintained roads

  - http://deldot.gov/information/community_programs_and_services/planned_spec_events/
Section 6C.03 Components of Temporary Traffic Control Zones

- **Termination area, Part 6C.07**
- **Activity area, Part 6C.06**
- **Transition area, Part 6C.05**
- **Advance warning area, Part 6C.04**
Advanced Warning Area

- Section of roadway where users are informed about the upcoming work zone or incident area
- Roadway doesn’t physically change in this area
- Signs tell users
  - Something is ahead
  - What it is
  - How far away it begins
- Emergency incidents – emergency vehicles and strobes may take the place of signs for short duration
  - We’ll define short duration a little later
  - Hint – short means short
Section 6C.04 Advance Warning Area

- Varying minimum warning sign spacing for different types of conventional roads

- DE Support:
  - Roads ≤ 40 mph = “low speed”
  - Roads > 40 mph = “high speed”
Section 6C.04 Advance Warning Area

Table 6C-1. Recommended Advance Warning Sign Minimum Spacing
(Delaware Revision)

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance Between Signs**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Urban (low speed)*</td>
<td>100 feet</td>
</tr>
<tr>
<td>Urban (high speed)†</td>
<td>250 feet</td>
</tr>
<tr>
<td>Rural</td>
<td>500 feet</td>
</tr>
<tr>
<td>Interstate / Expressway / Freeway</td>
<td>1,600 feet</td>
</tr>
</tbody>
</table>

* 40 mph or less is “low speed” and over 40 mph is “high speed” on state-maintained roadways.
† The column headings A, B, and C are the dimensions shown in Figures 6H-1 through 6H-46. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The “first sign” is the sign in a three-sign series that is closest to the TTC zone. The “third sign” is the sign that is furthest upstream from the TTC zone.)

Advance warning sign spacing can be reduced to 100 ft for urban, low-speed roads.

SR 14 at US 13
Transition Area

- Section of roadway where users are redirected out of their normal path
- Usually involves taper sections
- Stationary channelization devices typically used
  - Concrete barrier
  - Drums, tubular markers, cones, barricades
- Mobile operations (e.g., painting, pothole repair) not practical with stationary devices; vehicle mounted traffic control devices typically used
  - Arrow boards, changeable message signs, lights (flashing/oscillating/strobe)

Part 6; Section 6C.05
Activity Area

- Section of roadway where work activity takes place
  - Work space itself
    - Portion of highway closed to road users
    - Set aside for workers, equipment, material, etc.
    - Usually delineated by channelizing devices or barriers
  - Traffic space
    - Area where road users are routed through activity area
  - Buffer space
    - Lateral and/or longitudinal area
    - Separates road users flow from work space or unsafe area
    - Can provide recovery space for errant vehicle
    - Not suitable as work area or equipment/material/vehicle storage

Part 6; Section 6C.06
Termination Area

- Section of roadway where road users are returned to their normal driving path
- Extends from the downstream end of the activity area to the last TTC device
- End Road Work sign is a suitable method to inform road users that they may resume normal operations

Part 6; Section 6C.07
**Section 6C.08 Tapers**

**Table 6C-3. Taper Length Criteria for Temporary Traffic Control Zones (Delaware Revision)**

<table>
<thead>
<tr>
<th>Type of Taper</th>
<th>Taper Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merging Taper</td>
<td>at least L</td>
</tr>
<tr>
<td>Shifting Taper</td>
<td>0.5 L to L*</td>
</tr>
<tr>
<td>Shoulder Taper</td>
<td>at least 0.33 L*</td>
</tr>
<tr>
<td>One-Lane, Two-Way Traffic Taper</td>
<td>50 feet minimum, 100 feet maximum</td>
</tr>
<tr>
<td>Downstream Taper</td>
<td>50 feet minimum, 100 feet maximum</td>
</tr>
</tbody>
</table>

Note: Use Table 6C-4 to calculate L. A shifting taper length of L is preferred on state-maintained roads.

- \( L = \frac{WS^2}{60} \) (\( S \leq 40 \text{ mph} \))
- \( L = WS \) (\( S > 40 \text{ mph} \))

- **Merging** = \( L \)
- **Shifting** = \( L \) (DE Guidance)
- **Downstream** = 50-100 ft
- **Shoulder** = \( \frac{L}{3} \)
Tapers

- Longer tapers not necessarily better than shorter tapers
  - Especially in urban areas – short block lengths, driveways
  - Extended tapers tend to:
    - Encourage sluggish operation
    - Encourage drivers to delay lane changes
  - Observe driver performance after TTC plan in effect to test adequate taper length – adjust if necessary
- Maximum distance (ft) between TTC devices in taper should be ≤ 1.0 times speed limit

Part 6; Section 6C.08
2011 DE MUTCD

Section 6C.08 Tapers

Support:

08 (DE Revision) A shifting taper is used when a lateral shift is needed. When more space is available, a longer than minimum taper distance can be beneficial. Changes in alignment can also be accomplished by using horizontal curves designed for normal highway speeds in accordance with the DelDOT Road Design Manual.

Guidance:

09 (DE Revision) A shifting taper length of $L$ is preferred on state-maintained roads (see Tables 6C-3 and 6C-4).

- Horizontal curve (per “DelDOT Road Design Manual”) in lieu of shift taper
- DE Guidance: *Shifting taper equal to $L*
- DE Option: Minimum shifting taper of 0.5$L

**Table 6C-3. Taper Length Criteria for Temporary Traffic Control Zones (Delaware Revision)**

<table>
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<th>Type of Taper</th>
<th>Taper Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merging Taper</td>
<td>at least $L$</td>
</tr>
<tr>
<td>Shifting Taper</td>
<td>0.5$L$ to $L$*</td>
</tr>
<tr>
<td>Shoulder Taper</td>
<td>at least 0.33$L$</td>
</tr>
<tr>
<td>One-Lane, Two-Way Traffic Taper</td>
<td>50 feet minimum, 100 feet maximum</td>
</tr>
<tr>
<td>Downstream Taper</td>
<td>50 feet minimum, 100 feet maximum</td>
</tr>
</tbody>
</table>

Note: Use Table 6C-4 to calculate $L$.
* A shifting taper length of $L$ is preferred on state-maintained roads.
Section 6C.08 Tapers

- Merging taper = \( L \)

SR 7 at SR 2

Taper significantly less than \( L = 320 \text{ ft} \) (\( W = 12 \text{ ft} @ 40 \text{ mph} \))
Section 6C.09 Detours and Diversions

Standard:
01A (DE Revision) All detours affecting state-maintained roadways shall have a detour plan approved by DelDOT Traffic.

Guidance:
01B (DE Revision) Under emergency conditions, personnel should be provided to ensure safe roadway closure until proper devices are in place. Proper devices should be in place within 24 hours of the start of emergency operation.

• **DE Standard:** Approved detour plan for detours affecting state-maintained roads

• **DE Guidance:** Emergency personnel provided until TTC devices are in place (within 24 hours)
Detours and Diversions

Detour plan sample

**NOTE:**
- **A:** Barricade shall extend across the southbound I-495 approach to bridge two. The southbound 1-495 travel lanes and exit 161A/Manning Rd/Ferry will remain open to traffic.
- **B:** The contractor shall install the approach southbound 1-495 through a lane with plastic sheets in advance of the 20-20 barrier for half a mile 34 and 61.
- **C:** All work requiring the closure of bridge two and corresponding detours shall be restricted to 9 PM to 5 AM Monday through Friday.

**Legend:**
- A: Detour Arrows
- B: Detour Route
- C: Detour Distance
- D: Detour Route
- E: Detour Route
- F: Button
- G: Road Closed
- H: Road Closed
- I: Road Closed
- J: Road Closed
- K: Road Closed
- L: Road Closed
- M: Road Closed
- N: Road Closed
- O: Road Closed
- P: Road Closed
- Q: Road Closed
- R: Road Closed
- S: Road Closed
- T: Road Closed

**Special Signs:**

**Changeable Message Boards:**
- Prior to Detour
- During Detour

**Traffic Must Exit:**
- 495 S TO CLOSE AT EXIT
- 9PM-5AM
- CMS-1

**Use 95 S AT EXIT:**
- 495 S CLOSED AT EXIT
- CMS-1

**CMS-2, CMS-3, CMS-4, CMS-5**

Part 6; Section 6C.09; ¶01A
One-Lane Two-Way Traffic Control

- Several options available
- ¶05 is tempting but be careful – it’s risky

Section 6C.10 One-Lane, Two-Way Traffic Control

Standard:
01 Except as provided in Paragraph 5, when traffic in both directions must use a single lane for a limited distance, movements from each end shall be coordinated.

Guidance:
02 Provisions should be made for alternate one-way movement through the constricted section via methods such as flagger control, a flag transfer, a pilot car, traffic control signals, or stop or yield control.
03 Control points at each end should be chosen to permit easy passing of opposing lanes of vehicles.
04 If traffic on the affected one-lane roadway is not visible from one end to the other, then flagging procedures, a pilot car with a flagger used as described in Section 6C.13, or a traffic control signal should be used to control opposing traffic flows.

Option:
05 If the work space on a low-volume street or road is short and road users from both directions are able to see the traffic approaching from the opposite direction through and beyond the worksite, the movement of traffic through a one-lane, two-way constriction may be self-regulating.

Part 6; Section 6C.10
One-Lane Two-Way Traffic Control

- This one we’re all familiar with
- Flagger training essential
- Again, ¶02 tempting but it’s risky – choose carefully

Section 6C.11 Flagger Method of One-Lane, Two-Way Traffic Control

Guidance:
01 Except as provided in Paragraph 2, traffic should be controlled by a flagger at each end of a constricted section of roadway. One of the flaggers should be designated as the coordinator. To provide coordination of the control of the traffic, the flaggers should be able to communicate with each other orally, electronically, or with manual signals. These manual signals should not be mistaken for flagging signals.

Option:
02 When a one-lane, two-way TTC zone is short enough to allow a flagger to see from one end of the zone to the other, traffic may be controlled by either a single flagger or by a flagger at each end of the section.

Guidance:
03 When a single flagger is used, the flagger should be stationed on the shoulder opposite the constriction or work space, or in a position where good visibility and traffic control can be maintained at all times. When good visibility and traffic control cannot be maintained by one flagger station, traffic should be controlled by a flagger at each end of the section.
One-Lane Two-Way Traffic Control

- **Other methods**
  - Flag transfer method (Section 6C.12) – last vehicle is handed a flag to tell the far flagger that he/she is the last in line
  - Pilot car method – guides or follows the queue of vehicles (Section 6C.13)
  - Temporary traffic control signal (Section 6C.14) – see Figure 6H-12 later in workshop
  - Stop or yield control (Section 6C.15) – see Figures 6H.11 and 6H.11A later

- **These other methods rarely used**
Where Are We?

- 6A – General
- 6B – Fundamental principals
- 6C – TTC Elements
- **6D – Pedestrian and worker safety**
- 6E – Flagger control
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
Pedestrian Considerations

- Would we abruptly end a vehicular path without a safe detour and directions?

- Why is a sidewalk different?
Pedestrian Considerations

Really?

And so I should walk where?
Pedestrian Considerations

- Pedestrians are reluctant to:
  - Retrace their steps to a prior intersection
  - Add distance to a destination
  - Add out of the way travel to a destination

And when we surprise them?
They make poor choices

Section 6D.01 Pedestrian Considerations

Support:
01 A wide range of pedestrians might be affected by TTC zones, including the young, elderly, and people with disabilities such as hearing, visual, or mobility. These pedestrians need a clearly delineated and usable travel path. Considerations for pedestrians with disabilities are addressed in Section 6D.02.

Standard:
02 The various TTC provisions for pedestrian and worker safety set forth in Part 6 shall be applied by knowledgeable (for example, trained and/or certified) persons after appropriate evaluation and engineering judgment.
03 Advance notification of sidewalk closures shall be provided by the maintaining agency.
04 If the TTC zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided. If the TTC zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.
Section 6D.01 Pedestrian Considerations

- Alternate ped facilities required if TTC affects existing ped facilities

SR 2 at Hazel Ave / VA Hospital

Not compliant (but getting there); stay tuned for Part 6F.74
Section 6D.01 Pedestrian Considerations

Not compliant
Section 6D.01 Pedestrian Considerations

Option:

05 If establishing or maintaining an alternate pedestrian route is not feasible during the project, an alternate means of providing for pedestrians may be used, such as adding free bus service around the project or assigning someone the responsibility to assist pedestrians with disabilities through the project limits.

• If an alternate ped route is infeasible, providing free bus service or assigning personnel to assist are options

Meeting House Rd Pedestrian Improvements

Flaggers will be used to assist pedestrians through the work zone during path reconstruction

5. DURING PHASE 3, THE CONTRACTOR SHALL MAINTAIN ACCESS FOR PEDESTRIANS THROUGH THE WORK ZONE AS FOLLOWS:


Pedestrian Considerations

- Avoid creating conflicts
- Provide convenient and accessible path
- Replicate existing path nearly as practical

Guidance:

07 The following three items should be considered when planning for pedestrians in TTC zones:
A. Pedestrians should not be led into conflicts with vehicles, equipment, and operations.
B. Pedestrians should not be led into conflicts with vehicles moving through or around the worksite.
C. Pedestrians should be provided with a convenient and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or footpath(s).

08 A pedestrian route should not be severed and/or moved for non-construction activities such as parking for vehicles and equipment.

09 Consideration should be made to separate pedestrian movements from both worksite activity and vehicular traffic. Unless an acceptable route that does not involve crossing the roadway can be provided, pedestrians should be appropriately directed with advance signing that encourages them to cross to the opposite side of the roadway. In urban and suburban areas with high vehicular traffic volumes, these signs should be placed at intersections (rather than midblock locations) so that pedestrians are not confronted with midblock worksites that will induce them to attempt skirting the worksite or making a midblock crossing.
Pedestrian Considerations

- Avoid movements of vehicle, workers, and equipment across ped paths (¶ 15)
- Avoid access to work space across ped paths (¶ 16)
- Tape, rope, (plastic) chain not detectable (¶ 28)

Support:
27  TTC devices, jersey barriers, and wood or chain link fencing with a continuous detectable edging can satisfactorily delineate a pedestrian path.

Guidance:
28  Tape, rope, or plastic chain strung between devices are not detectable, do not comply with the design standards in the “Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)” (see Section 1A.11), and should not be used as a control for pedestrian movements.
Accessibility Considerations

- Temporary ped facility must meet or exceed detectability and accessibility of existing facility
Section 6D.03 Worker Safety Considerations

**Guidance:**

02A (DE Revision) *Workers should not enter unprotected travel lanes of interstates, freeways, or expressways during planned activities, including crossing the roadway to access the median or shoulder on the opposite side from the protected work area.*

**Standard:**

04 (DE Revision) *All workers, including emergency responders, within the right-of-way who are exposed either to traffic (vehicles using the highway for purposes of travel) or to work vehicles and construction equipment within the TTC zone shall wear high-visibility safety apparel that meets or exceeds the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Safety Apparel and Headwear” (see Section 1A.11), or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure, except as provided in Paragraph 5. A person designated by the employer to be responsible for worker safety shall make the selection of the appropriate class of garment.*

- **DE Guidance:** *Workers should not enter or cross unprotected lanes on interstates, freeways, or expressways*

- **ANSI 107-2004 Class 2 apparel (MIN.)** for all workers, except flaggers, within right-of-way

**SR 2 at Delaplane Ave**

**S. Governors Ave, Webbs Ln to Water St**
Where Are We?

- 6A – General
- 6B – Fundamental principals
- 6C – TTC Elements
- 6D – Pedestrian and worker safety
- **6E – Flagger control**
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
The “warm body” mentality of the past doesn’t work for today’s work zones

A well-trained, serious-minded, attentive flagger is the best defense for workers and the traveling public

---

**Standard:**

01A (DE Revision) All flaggers working on state-maintained roadways, except for emergency personnel and law enforcement officers, shall be certified by a DelDOT-recognized flagger certification program. All flaggers, except for emergency personnel and law enforcement officers, shall be required to carry a flagger certification card and photo identification on their person at all times.

**Guidance:**

01 Because flaggers are responsible for public safety and make the greatest number of contacts with the public of all highway workers, they should be trained in safe traffic control practices and public contact techniques. Flaggers should be able to satisfactorily demonstrate the following abilities:

A. Ability to receive and communicate specific instructions clearly, firmly, and courteously;
B. Ability to move and maneuver quickly in order to avoid danger from errant vehicles;
C. Ability to control signaling devices (such as paddles and flags) in order to provide clear and positive guidance to drivers approaching a TTTC zone in frequently changing situations;
D. Ability to understand and apply safe traffic control practices, sometimes in stressful or emergency situations; and
E. Ability to recognize dangerous traffic situations and warn workers in sufficient time to avoid injury.

---

Part 6; Section 6E.01
Section 6E.01 Qualifications for Flaggers

Standard:

01A (DE Revision) All flaggers working on state-maintained roadways, except for emergency personnel and law enforcement officers, shall be certified by a DeIDOT-recognized flagger certification program. All flaggers, except for emergency personnel and law enforcement officers, shall be required to carry a flagger certification card and photo identification on their person at all times.

• DE Standard:
  – ATSSA certified
  – Laborer’s International Union of North America
  – Required to carry flagger certification card and photo identification at all times
Flagger Qualifications

- Delaware recognizes ATSSA and Laborer’s International Union of North America only at this time
- See DelDOT memorandum 11/13/2015
- Online certification now accepted

The purpose of this memorandum is to define the DelDOT-recognized flagger certification program. As of the above date, the following are DelDOT-recognized flagger certification programs:

- American Traffic Safety Services Association (ATSSA) Flagger Certification Program – In-classroom Training
- American Traffic Safety Services Association (ATSSA) Flagger Certification Program – Online Flagger Training Program
- OnlineFlagger.com – Online ATSSA Flagger Training Program
- Laborer’s International Union of North America (LIUNA) Work Zone Safety Program, provided by the Construction Craft Laborers Training and Apprenticeship Fund of New Jersey and Delaware – includes flagger certification and Traffic Control Supervisor certification

Only flaggers with flagger certifications for Delaware from these programs shall provide flagging operations on state maintained roadways for construction, maintenance and/or utility projects.

Part 6; Section 6E.01
Section 6E.02 High-Visibility Safety Apparel

**Standard:**

01  *(DE Revision)* For daytime and nighttime activity, flaggers shall wear high-visibility safety apparel that meets or exceeds the Performance Class 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Apparel and Headwear” (see Section 1A.11) and labeled as meeting the ANSI 107-2004 standard performance for Class 3 risk exposure. The apparel background (outer) material color shall be fluorescent orange-red, fluorescent yellow-green, or a combination of the two as defined in the ANSI standard. The retroreflective material shall be orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and shall be visible at a minimum distance of 1,000 feet. The retroreflective safety apparel shall be designed to clearly identify the wearer as a person.

- **DE Standard:**
  **ANSI 107-2004 Class 3 apparel for all flaggers (day and night)**
What is ANSI Class 3?

We have received many questions about ANSI/ISEA 107 standards, so here is a brief overview: ANSI, American National Standards Institute, and the ISEA, International Safety Equipment Association, jointly developed a standard for high-visibility clothing that is patterned after the EN-471 standard used in Europe. ANSI and the ISEA are not government agencies, so this standard is really a suggested standard for everyone to look at and choose to adopt on their own. Many of the states are looking at the standard and some are adopting it, or some variation of it. The standard covers many details used in the construction of high-visibility garments. Fabric, quality, color, labeling, fading, reflective quality and quantity, suggested styles, background material quantity (the orange or yellow part), shrinkage and cleaning are all discussed and specified in the standard.

The standard raises the bar for high visibility apparel. There are 5 main classes of apparel. Each state and/or local government has adopted a specification. Be sure to know what is required in your work area. Here is a brief overview of each class:

- **ANSI Class 1**: 217 square inches of visible fluorescent background material, usually orange or lime/yellow, and 155 square inches of visible reflective material.
- **ANSI Class PSV**: 450 square inches of visible fluorescent background, usually orange or lime/yellow and 201 square inches of visible reflective material.
- **ANSI Class 2**: 775 square inches of visible fluorescent background material usually orange or lime/yellow and 201 square inches of visible reflective material.
- **ANSI Class 3**: 1240 square inches of visible fluorescent background material, usually orange or lime/yellow and 310 square inches of visible reflective material.
- **ANSI Class E**: 465 square inches of visible fluorescent background material, usually orange or lime/yellow and 108 square inches of visible reflective material. Class E garments are either shorts or pants that are made to be worn with a Class 2 garment to make a Class 3 ensemble.

**WARNING** - Modifying or decorating any ANSI 107 garment may void the ANSI compliance for the intended class. Replace any high-visibility garment when soiled, faded or worn. Safetyline assumes no responsibility for any use of the products in this catalog or any custom made or modified products. Safetyline makes no warranty of fitness for any purpose.

Figure: Safety Line, Inc.
High Visibility Safety Apparel

- These are ANSI Class 3 (probably)
Section 6E.03 Hand-Signaling Devices

DE Standard:

- **STOP/SLOW** paddles shall be 24 inches wide (MIN.)
- **Black-on-orange** SLOW (W20-8) face

Non-compliant STOP/SLOW paddle
Section 6E.07 Flagger Procedures

Improper flagging procedure
Drivers must obey
- Flagger
- Uniformed law enforcement officer

Traffic control within intersections
- Flagger on each approach, at least, and one in the intersection
- Signalized? Traffic Officer, too
  - Signal placed in flash mode
  - Traffic Officer directs traffic

Traffic control close to signalized intersections
- Flaggers hold back street traffic to avoid blocking the intersection
Flagger Procedures

Work within Intersections

When work is performed within an intersection that creates the need for flaggers and/or police officers to override the existing traffic control devices, the following guidance shall apply. First, a minimum of one flagger for each intersection approach shall be provided and these flaggers shall be stationed a minimum of 50 feet upstream of the stop line. An additional flagger may be provided at the intersection and be designated as the Primary Flagger. If used, the Primary Flagger shall control the flow of traffic through the intersection by directing the actions of the other flaggers.

Second, traffic officers shall be present at signalized intersections whenever the functionality of the signal is affected. The traffic officer’s responsibility shall include the following:

1. The traffic officer shall place the traffic signal in flash mode. The officer shall remain on location as long as the traffic signal is in flash mode. At no time shall the traffic officer leave the location and relinquish control to the flaggers.

2. The traffic officer shall direct traffic through the intersection.

3. The traffic officer shall coordinate directly with the Primary Flagger who will relay information between the traffic officer and the approach flaggers.

4. The traffic officer shall place the traffic signal in normal mode once the operation is complete and the temporary traffic control devices are clear of the roadway.
Section 6E.08 Flagger Stations

Standard:
04 Except in emergency situations, flagger stations shall be preceded by an advance warning sign or signs.

Except in emergency situations, flagger stations shall be illuminated at night.

05 (DE Revision) Except in emergency situations, flagger stations shall be illuminated at night with a minimum average horizontal luminance of 50 lux (5 foot candles).

Support:
06 (DE Revision) A horizontal luminance of 50 lux (5 foot candles) can typically be achieved by a light plant featuring four (4) 1000 watt metal halide light fixtures, positioned within 15 feet of the flagging station at a minimum mounting height of 15 feet.

Guidance:
07 (DE Revision) For flagger operations at night, a minimum of one (1) light plant should be dedicated to the flagger operation. Light fixtures should be positioned so as not to cause glare problems for vehicles approaching from any direction.

- Upstream advance warning sign(s)

- Illuminated at night (DE Standard: 5 foot candles min. avg.), except emergencies

- DE Guidance: 1 light plant (MIN.) exclusively for flagger station
Crossing Guards

- Sort of a special case
  - Standard flaggers – stop/slow
    - 24” min
  - Crossing guards – stop/stop
    - 18” min

Standard:
02 Adult crossing guards shall use a STOP paddle. The STOP paddle shall be the primary hand-signaling device.
03 The STOP (R1-1) paddle shall be an octagonal shape. The background of the STOP face shall be red with at least 6-inch series upper-case white letters and a border. The paddle shall be at least 18 inches in size and have the word message STOP on both sides. The paddle shall be retroreflectors or illuminated when used during hours of darkness.
Option:
04 The STOP paddle may be modified to improve conspicuity by incorporating white or red flashing lights on both sides of the paddle. Among the types of flashing lights that may be used are individual LEDs or groups of LEDs.
05 The white or red flashing lights or LEDs may be arranged in any of the following patterns:
   A. Two white or red lights centered vertically above and below the STOP legend,
   B. Two white or red lights centered horizontally on each side of the STOP legend,
   C. One white or red light centered below the STOP legend,
   D. A series of eight or more small white or red lights having a diameter of 1/4 inch or less along the outer edge of the paddle, arranged in an octagonal pattern at the eight corners of the STOP paddle (more than eight lights may be used only if the arrangement of the lights is such that it clearly conveys the octagonal shape of the STOP paddle), or
   E. A series of white lights forming the shapes of the letters in the legend.

Part 7; Section 7D.05
Where Are We?

- 6A – General
- 6B – Fundamental principals
- 6C – TTC Elements
- 6D – Pedestrian and worker safety
- 6E – Flagger control
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
TTC Devices

- All work zone devices must be crashworthy

Support:

02 FHWA policy requires that all roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and work zone hardware used on the National Highway System meet the crashworthy performance criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350, “Recommended Procedures for the Safety Performance Evaluation of Highway Features.” The FHWA website at “http://safety.fhwa.dot.gov/programs/roadside_hardware.htm” identifies all such hardware and includes copies of FHWA acceptance letters for each of them. In the case of proprietary items, links are provided to manufacturers’ websites as a source of detailed information on specific devices. The website also contains an “Ask the Experts” section where questions on roadside design issues can be addressed.

03 Various Sections of the MUTCD require certain traffic control devices, their supports, and/or related appurtenances to be crashworthy. Such MUTCD crashworthiness provisions apply to all streets, highways, and private roads open to public travel. Also, State Departments of Transportation and local agencies might have expanded the NCHRP Report 350 crashworthy criteria to apply to certain other roadside appurtenances.

04 Crashworthiness and crash testing information on devices described in Part 6 are found in AASHTO’s “Roadside Design Guide” (see Section 1A.11).

05 As defined in Section 1A.13, “crashworthy” is a characteristic of a roadside appurtenance that has been successfully crash tested in accordance with a national standard such as the NCHRP Report 350, “Recommended Procedures for the Safety Performance Evaluation of Highway Features.”
05A (DE Revision) Information on the maintenance of TTC devices is contained in “Quality Guidelines for Work Zone Traffic Control Devices”, published by the American Traffic Safety Services Association (ATSSA) and is available at the ATSSA website “http://www.atsa.com”.

Section 6F.01 Types of Devices
General Sign Characteristics

- Regulatory signs – refer back to Table 2A-5 and Chapter 2B for colors (¶02)

Table 6F-1. Temporary Traffic Control Zone Sign and Plaque Sizes (Sheet 1 of 3) (Delaware Revision)

<table>
<thead>
<tr>
<th>Sign or Plaque</th>
<th>Sign Designation</th>
<th>Section</th>
<th>Standard</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>R1-1</td>
<td>6F.00</td>
<td>48 x 48</td>
<td>—</td>
</tr>
<tr>
<td>Stop (on Stop/Slow Paddle)</td>
<td>R1-1</td>
<td>6E.03</td>
<td>24 x 24</td>
<td>—</td>
</tr>
<tr>
<td>Yield</td>
<td>R1-2</td>
<td>6F.06</td>
<td>48 x 48 x 48, 36 x 36 x 36</td>
<td>—</td>
</tr>
<tr>
<td>To Oncoming Traffic (plaque)</td>
<td>R1-2aP</td>
<td>6F.06</td>
<td>48 x 36</td>
<td>24 x 18</td>
</tr>
<tr>
<td>Wait on Stop</td>
<td>R1-7</td>
<td>6E.05</td>
<td>24 x 30</td>
<td>—</td>
</tr>
<tr>
<td>Go on Slow</td>
<td>R1-8</td>
<td>6E.05</td>
<td>24 x 30</td>
<td>—</td>
</tr>
<tr>
<td>Speed Limit</td>
<td>R2-1</td>
<td>6F.12</td>
<td>36 x 48</td>
<td>—</td>
</tr>
<tr>
<td>Fines Higher (plaque)</td>
<td>R2-6P</td>
<td>6F.12</td>
<td>36 x 24</td>
<td>—</td>
</tr>
<tr>
<td>Fines Double (plaque)</td>
<td>R2-6dP</td>
<td>6F.12</td>
<td>36 x 24</td>
<td>—</td>
</tr>
<tr>
<td>$XX Fine (plaque)</td>
<td>R2-6fP</td>
<td>6F.12</td>
<td>36 x 24</td>
<td>—</td>
</tr>
<tr>
<td>Begin Higher Fines Zone</td>
<td>R2-6P</td>
<td>6F.12</td>
<td>36 x 48</td>
<td>—</td>
</tr>
<tr>
<td>End Higher Fines Zone</td>
<td>R2-6P</td>
<td>6F.12</td>
<td>36 x 48</td>
<td>—</td>
</tr>
<tr>
<td>End Work Zone Speed Limit</td>
<td>R2-6P</td>
<td>6F.12</td>
<td>36 x 56</td>
<td>—</td>
</tr>
<tr>
<td>Movement Prohibition</td>
<td>R3-1,2,3,4,18,27</td>
<td>6F.06</td>
<td>36 x 36</td>
<td>—</td>
</tr>
<tr>
<td>Mandatory Movement (1 lane)</td>
<td>R3-5</td>
<td>6F.06</td>
<td>30 x 30</td>
<td>—</td>
</tr>
<tr>
<td>Optional Movement (1 lane)</td>
<td>R3-6</td>
<td>6F.06</td>
<td>30 x 30</td>
<td>—</td>
</tr>
<tr>
<td>Mandatory Movement (text)</td>
<td>R3-7</td>
<td>6F.06</td>
<td>30 x 30</td>
<td>—</td>
</tr>
<tr>
<td>Advance Intersection Lane Control</td>
<td>R3-8</td>
<td>6F.06</td>
<td>Varies x 30</td>
<td>—</td>
</tr>
<tr>
<td>Do Not Pass</td>
<td>R4-1</td>
<td>6F.06</td>
<td>36 x 48</td>
<td>—</td>
</tr>
<tr>
<td>Pass With Care</td>
<td>R4-2</td>
<td>6F.06</td>
<td>36 x 48</td>
<td>—</td>
</tr>
<tr>
<td>Keep Right</td>
<td>R4-7</td>
<td>6F.06</td>
<td>36 x 48</td>
<td>—</td>
</tr>
<tr>
<td>Narrow Keep Right</td>
<td>R4-7c</td>
<td>6F.06</td>
<td>18 x 30</td>
<td>—</td>
</tr>
<tr>
<td>Stay in Lane</td>
<td>R4-9</td>
<td>6F.11</td>
<td>36 x 48</td>
<td>—</td>
</tr>
</tbody>
</table>

- (DE revision) most warning signs shall have black legend on fluorescent orange background (¶02); exceptions like grade crossings or fluorescent yellow-green recommendations in Chapters 2 & 7
Section 6F.02 General Characteristics of Signs

Standard:

18 (DE Revision) All TTC signs, including those made of flexible material (i.e. roll-up signs), shall be made of prismatic retroreflective sign sheeting.

19 (DE Revision) Flexible signs made of mesh material shall not be used for TTC operations within the State of Delaware.

• DE Standard:
  
  – Prismatic, retroreflective sheeting used for all TTC signs
  
  – Mesh flexible signs prohibited

Shallcross Lake Rd at Greylag Rd
Section 6F.02 General Characteristics of Signs

Guidance:

20  (DE Revision) The backs of all signs should be clearly marked with the owner’s name and contact information.

• DE Guidance: Owner’s name and contact information on back of sign

Main Street, Newark
• **Right-hand side of road**

• DE Guidance: *Signs installed on left and right-hand side of multi-lane, divided highways*
Section 6F.03 Sign Placement

Standard:

04 **(DE Revision)** The minimum height, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement, of signs installed at the side of the road in rural areas shall be 7 feet (see Figure 6F-1).

05 The minimum height, measured vertically from the bottom of the sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way, of signs installed at the side of the road in business, commercial, or residential areas where parking or pedestrian movements are likely to occur, or where the view of the sign might be obstructed, shall be 7 feet (see Figure 6F-1).

06 The minimum height, measured vertically from the bottom of the sign to the sidewalk, of signs installed above sidewalks shall be 7 feet.

So in other words...

7 feet

- DE Standard: **7-ft (MIN.)** mounting height along rural roads
- **7-ft (MIN.)** mounting height along urban roads
- **7-ft (MIN.)** mounting height above sidewalks
Section 6F.03 Sign Placement

Sign post spacing and lateral offset should comply with Figure 6F-1

Mounting height shall comply with Figure 6F-1

S. Governors Ave, Webbs Ln to Water St
Section 6F.03 Sign Placement

DE Guidance: 5-ft (MIN.) portable sign mounting height ≤ 3 days

DE Guidance: 1-ft (MIN.) portable sign mounting height ≤ 1 hr

Portable signs with a mounting height < 5 ft should be in place for 1 hr or less

S. Governors Ave, Webbs Ln to Water St

BR 1-325 on Otts Chapel Rd over Persimmon Run
Sign Placement

- Neither portable nor permanent sign supports should be located on sidewalks, bicycle facilities, etc. (¶08)
- Figure 6F-2 allowances for <7’ height for the limited durations shown only.
Section 6F.03 Sign Placement

Standard:

19  (DE Revision) When portable signs are no longer in use, the signs and their supports shall be removed or placed behind positive protection.

- DE Standard: **Remove or place behind positive protection when not in use**

SR 1 north of SR 16
Avoid mixed messages

The ROAD (STREET) CLOSED sign shall not be used where road user flow is maintained through the TTC zone with a reduced number of lanes on the existing roadway or where the actual closure is some distance beyond the sign.

Section 6F.09 Local Traffic Only Signs (R11-3a, R11-4)

Guidance:
01 The Local Traffic Only signs (see Figure 6F-3) should be used where road user flow detours to avoid a closure some distance beyond the sign, but where local road users can use the roadway to the point of closure. These signs should be accompanied by appropriate warning and detour signing.

02 In rural applications, the Local Traffic Only sign should have the legend ROAD CLOSED XX MILES AHEAD, LOCAL TRAFFIC ONLY (R11-3a).

Option:
03 In urban areas, the legend ROAD (STREET) CLOSED TO THRU TRAFFIC (R11-4) or ROAD CLOSED, LOCAL TRAFFIC ONLY may be used.

04 In urban areas, a word message that includes the name of an intersecting street name or well-known destination may be substituted for the words XX MILES AHEAD on the R11-3a sign where applicable.

05 The words BRIDGE OUT (or BRIDGE CLOSED) may be substituted for the words ROAD (STREET) CLOSED on the R11-3a or R11-4 sign where applicable.
Poorly done, we create unnecessary jaywalking and accessibility barriers.
Closing Sidewalks

Not so good

Part 6; Section 6F.14
Closing Sidewalks

Abysmal

- Both sides closed
- No advance signs
- No ADA accommodation

Upstream of the intersection
Downstream of the intersection

Part 6; Section 6F.14
Closing Sidewalks

Part 6; Section 6F.14
Closing Sidewalks

Part 6; Section 6F.14
Closing Sidewalks

Much better
Closing Sidewalks

Better still?
Section 6F.16 Warning Sign Function, Design, and Application

Standard:
02 (DE Revision) TTC warning signs shall comply with the Standards for warning signs presented in Part 2 and in FHWA’s “Standard Highway Signs and Markings” book (see Section 1A.11). Except as provided in Paragraph 3, TTC warning signs shall be diamond-shaped with a black legend and border on an fluorescent orange background, except for the W10-1 sign which shall have a black legend and border on a yellow background, and except for signs that are required or recommended in Parts 2 or 7 to have fluorescent yellow-green backgrounds.

• DE Standard: TTC warning signs consisting of black legend on fluorescent orange sheeting
Position of Advance Warning Signs

Guidance:
01 Where highway conditions permit, warning signs should be placed in advance of the TTC zone at varying distances depending on roadway type, condition, and posted speed. Table 6C-1 contains information regarding the spacing of advance warning signs. Where a series of two or more advance warning signs is used, the closest sign to the TTC zone should be placed approximately 100 feet for low-speed urban streets to 1,000 feet or more for freeways and expressways.
02 Where multiple advance warning signs are needed on the approach to a TTC zone, the ROAD WORK AHEAD (W20-1) sign should be the first advance warning sign encountered by road users.
02A (DE Revision) Signs erected for individual operations within the TTC zone limits of a construction project should be placed with appropriate spacing and should not conflict with advance warning signs that are to remain for the entire duration of the project.
Support:
03 Various conditions, such as limited sight distance or obstructions that might require a driver to reduce speed or stop, might require additional advance warning signs.
Option:
04 As an alternative to a specific distance on advance warning signs, the word AHEAD may be used.

Table 6C-1. Recommended Advance Warning Sign Minimum Spacing
(Delaware Revision)

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance Between Signs**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Urban (low speed)*</td>
<td>100 feet</td>
</tr>
<tr>
<td>Urban (high speed)*</td>
<td>350 feet</td>
</tr>
<tr>
<td>Rural</td>
<td>500 feet</td>
</tr>
<tr>
<td>Interstate / Expressway / Freeway</td>
<td>1,000 feet</td>
</tr>
</tbody>
</table>

* 40 mph or less is "low speed" and over 40 mph is "high speed" on state-maintained roadways.
** The column headings A, B, and C are the dimensions shown in Figures 6H-1 through 6H-46. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The "first sign" is the sign in a three-sign series that is closest to the TTC zone. The "third sign" is the sign that is furthest upstream from the TTC zone.)
Road Work, Detour, Street Closed

- i.e., work zones begin with W20-1
- Detour, by itself, meaningless

Section 6F.18 ROAD (STREET) WORK Sign (W20-1)

Guidance:
01 The ROAD (STREET) WORK (W20-1) sign (see Figure 6F-4), which serves as a general warning of obstructions or restrictions, should be located in advance of the work space or any detour, on the road where the work is taking place.
02 Where traffic can enter a TTC zone from a crossroad or a major (high-volume) driveway, an advance warning sign should be used on the crossroad or major driveway.

Standard:
03 The ROAD (STREET) WORK (W20-1) sign shall have the legend ROAD (STREET) WORK, XX FEET, XX MILES, or AHEAD.

Section 6F.19 DETOUR Sign (W20-2)

Guidance:
01 The DETOUR (W20-2) sign (see Figure 6F-4) should be used in advance of a road user detour over a different roadway or route.

Standard:
02 The DETOUR sign shall have the legend DETOUR, XX FEET, XX MILES, or AHEAD.

Section 6F.20 ROAD (STREET) CLOSED Sign (W20-3)

Guidance:
01 The ROAD (STREET) CLOSED (W20-3) sign (see Figure 6F-4) should be used in advance of the point where a highway is closed to all road users, or to all but local road users.

Standard:
02 The ROAD (STREET) CLOSED sign shall have the legend ROAD (STREET) CLOSED, XX FEET, XX MILES, or AHEAD.

Part 6; Section 6F.18-20
Flagger Signs

- Refer back also to Section 6E Flagger Control
- Worded message sign also permitted

Section 6F.31 Flagger Signs (W20-7, W20-7-DE, W20-7a)

Guidance:
01 (DE Revision) The Flagger (W20-7) symbol sign or FLAGGER AHEAD (W20-7-DE) sign (see Figure 6F-4) should be used in advance of any point where a flagger is stationed to control road users.

Option:
02 A distance legend may be displayed on a supplemental plaque below the Flagger sign. The sign may be used with appropriate legends or in conjunction with other warning signs, such as the BE PREPARED TO STOP (W3-4) sign (see Figure 6F-4).
03 The FLAGGER (W20-7a) word message sign with distance legends may be substituted for the Flagger (W20-7) symbol sign.
Shoulder Work

- May use alone or in combination with Road Work signage

Section 6F.37 Shoulder Work Signs (W21-5, W21-5a, W21-5b)

Support:

01 Shoulder Work signs (see Figure 6F-4) warn of maintenance, reconstruction, or utility operations on the highway shoulder where the roadway is unobstructed.

Standard:

02 The Shoulder Work sign shall have the legend SHOULDER WORK (W21-5), RIGHT (LEFT) SHOULDER CLOSED (W21-5a), or RIGHT (LEFT) SHOULDER CLOSED XX FT or AHEAD (W21-5b).

Option:

03 The Shoulder Work sign may be used in advance of the point on a non-limited access highway where there is shoulder work. It may be used singly or in combination with a ROAD WORK NEXT XX MILES or ROAD WORK AHEAD sign.
Section 6F.50 Other Warning Signs

- Besides the warning signs specifically related to TTC zones, several other warning signs in Part 2 may apply in TTC zones.

- (DE Revision) When shoulder or lane closures affect bicycle facilities, the Bicycle Warning (W11-1) sign and Share the Road (W16-1P) plaque may be used to warn of unexpected entries by bicycles into the roadway.

- Other warning signs in Part 2 may be applicable to TTC operations

- Bicycle warning (W11-1) sign with SHARE THE ROAD (W16-1P) plaque used when TTC affects existing bicycle facility
08A (DE Revision) A One-Direction Large Arrow (W1-6) sign shall be centered below and attached to the bottom of all trailer-mounted arrow boards.

08B (DE Revision) The One-Direction Large Arrow (W1-6) sign shall point in the direction that traffic should merge and shall be covered or removed when not in use or when caution mode is being displayed on the trailer mounted arrow board.

- **DE Standard:** **W1-6** sign shall match direction of arrow board
- **DE Standard:** **W1-6** sign removed or covered during caution mode

Boyds Corner Intersection Improvements
An arrow board shall have the following three mode selections:
A. A Flashing Arrow, Sequential Arrow, or Sequential Chevron mode;
B. A Flashing Double Arrow mode; and
C. A Flashing Caution or Alternating Diamond mode.

Guidance:
16A (DE Revision) Only the Flashing Arrow or Flashing Caution operating modes should be used on state-maintained roadways.
25 Arrow boards shall only be used to indicate a lane closure. Arrow boards shall not be used to indicate a lane shift.

**DE Guidance:**
**Flashin Arrow or Flashing Caution modes on state-maintained roads**

**Shall not be used for lane shifts**
Section 6F.61 Arrow Boards

Flashing Arrow mode used for lane closures along state-maintained roads

Elkton Rd, Casho Mill Rd to Delaware Ave
Standard:

01 (DE Revision) Designs of various channelizing devices shall be as shown in Figure 6F–7. All channelizing devices shall be crashworthy and shall have retroreflective sheeting.

Guidance:

01A (DE Revision) The retroreflective material used on channelizing devices shall have a smooth, sealed outer surface that will display a similar color day or night.

Guidance:

01B (DE Revision) The retroreflective material used on channelizing devices should be prismatic.

• DE Standard: Crashworthy devices with retroreflective sheeting displaying similar color day or night

• DE Guidance:
  
  – Prismatic retroreflective sheeting
  
  – Vertical panels should not be used on state-maintained roads
Support:

02 The function of channelizing devices is to warn road users of conditions created by work activities in or near the roadway and to guide road users. Channelizing devices include cones, tubular markers, vertical panels, drums, barricades, and longitudinal channelizing devices.

03 Channelizing devices provide for smooth and gradual vehicular traffic flow from one lane to another, onto a bypass or detour, or into a narrower traveled way. They are also used to channelize vehicular traffic away from the work space, pavement drop-offs, pedestrian or shared-use paths, or opposing directions of vehicular traffic.

Standard:

04 Devices used to channelize pedestrians shall be detectable to users of long canes and visible to persons having low vision.

05 Where channelizing devices are used to channelize pedestrians, there shall be continuous detectable bottom and top surfaces to be detectable to users of long canes. The bottom of the bottom surface shall be no higher than 2 inches above the ground. The top of the top surface shall be no lower than 32 inches above the ground.

Option:

06 A gap not exceeding 2 inches between the bottom rail and the ground surface may be used to facilitate drainage.

Guidance:

07 Where multiple channelizing devices are aligned to form a continuous pedestrian channelizer, connection points should be smooth to optimize long-cane and hand trailing.
DE Guidance:

- Longitudinal spacing (ft) = Speed limit (mph); 60 ft MAX.
- Spacing of first 4 devices in taper = 25 ft MAX.

25-ft maximum spacing used for first 4 drums in shoulder closure taper in advance of lane closure taper.
Section 6F.64 Cones

DE Standard: **Shall not be used at night**

DE Option: May only be used at night during:

- Special events requiring complex traffic shifts for ingress and egress traffic
- Emergencies
- Mobile striping operations to protect wet markings
Section 6F.64 Cones

Should have longitudinal spacing ≤ 55 ft, not 80 ft

Shall have retroreflective bands for both day and night work per Section 6F.63

I-95 Sign Structure Inspection
Section 6F.65 Tubular Markers

Standard:

01 (DE Revision) Tubular markers (see Figure 6F-7) shall be predominantly orange and shall be not less than 28 inches high and 2 inches wide facing road users. They shall be made of a material that can be struck without causing damage to the impacting vehicle.

02 (DE Revision) Paragraph deleted.

03 (DE Revision) Tubular markers shall be retroreflectORIZED. RetroreflectORIZATION of tubular markers that have a height of less than 42 inches shall be provided by two 3-inch wide white bands placed a maximum of 2 inches from the top with a maximum of 6 inches between the bands. RetroreflectORIZATION of tubular markers that have a height of 42 inches or more shall be provided by four 4- to 6-inch wide alternating orange and white stripes with the top stripe being orange.

Guidance:

04 Tubular markers have less visible area than other devices and should be used only where space restrictions do not allow for the use of other more visible devices.

05 (DE Revision) Tubular markers should be stabilized by affixing them to the pavement with epoxy, nails, or other forms of rigid mounting.

Option:

06 Tubular markers may be used effectively to divide opposing lanes of road users, divide vehicular traffic lanes when two or more lanes of moving vehicular traffic are kept open in the same direction, and to delineate the edge of a pavement drop off where space limitations do not allow the use of larger devices.

Standard:

07 A tubular marker shall be attached to the pavement to display the minimum 2-inch width to the approaching road users.
Section 6F.68 Type 1, 2, or 3 Barricades

Standard:
01A (DE Revision) Type 1 Barricades shall not be used for TTC operations on state-maintained roads.
01B (DE Revision) Type 2 Barricades shall only be used for pedestrian channelization along temporary pedestrian paths. Type 2 Barricades shall not be used to close a roadway, sidewalk or crosswalk.
01C (DE Revision) When used for pedestrian channelization, Type 2 Barricades shall be continuous and the rails shall be mounted in accordance with ADA in order to provide for a cane rail (bottom rail) and hand rail (top rail).

- **DE Standard:**
  - **Type 1 barricades prohibited**
  - **If used, Type 2 barricades for ped diversions only**

Type 1 and Type 2 barricades shall not be used for road closures.
Standard:

19 (DE Revision) Type 3 Barricades used at a road closure shall be placed completely across a roadway, from curb to curb, or from edge of road to edge of road, with the stripes positioned downward toward the center of the roadway.

- DE Standard: **At road closure, Type 3 barricades placed completely across roadway with stripes pointing toward center of road**

**SR 15, Choptank Rd from N437 to N433**
Option:

23 Signs may be installed on barricades (see Section 6F.03).

Guidance:

24 (DE Revision) Signs mounted on Type 3 Barricades should not cover more than 50 percent of the top two rails or 33 percent of the total area of the three rails.

DE Guidance: Signs should not cover more than 50 percent of top two rails or 33 percent of all three rails

SR 9 at St. Augustine Rd / Bayview Rd
Section 6F.74 Detectable Edging for Pedestrians

Guidance:

02 (DE Revision) When it is determined that a facility should be accessible to and detectable by pedestrians with visual disabilities, a continuously detectable edging should be provided throughout the length of the facility such that it can be followed by pedestrians using long canes for guidance. This edging should protrude at least 6 inches above the surface of the sidewalk or pathway, with the bottom of the edging a maximum of 2 inches above the surface. This edging should be continuous throughout the length of the facility except for gaps at locations where pedestrians or vehicles will be turning or crossing. This edging should consist of a prefabricated or formed-in-place curbing or other continuous device that is placed along the edge of the sidewalk or walkway. This edging should be firmly attached to the ground or to other devices. Adjacent sections of this edging should be interconnected such that the edging is not displaced by pedestrian or vehicular traffic or work operations, and such that it does not constitute a hazard to pedestrians, workers, or other road users.

- Continuous detectable edging provided for accessible temporary facilities
- Extend ≥ 6 in above surface
- Bottom of edging ≤ 2 in above surface

SR 2 at Hazel Ave / VA Hospital
Section 6F.74 Detectable Edging for Pedestrians

Support:
01 Individual channelizing devices, tape or rope used to connect individual devices, other discontinuous barriers and devices, and pavement markings are not detectable by persons with visual disabilities and are incapable of providing detectable path guidance on temporary or realigned sidewalks or other pedestrian facilities.

Channelizing devices and caution tape are undetectable

Dover Transit Center

Town of Clayton Sidewalk Improvements

Continuous barrier is detectable
Section 3B.01 Yellow Center Line Pavement Markings and Warrants

Standard:

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

S. Governors Ave, Webbs Ln to Water St

Single solid yellow center line prohibited on a two-way road per Part 3
Section 6F.78 Temporary Pavement Markings

Minimum width of temporary longitudinal markings is 4 inches per DelDOT’s *Temporary Pavement Markings Policy*.
Section 6F.81 Lighting Devices

Standard:

01A (DE Revision) All work-related vehicles and equipment operating within a TTC zone shall be equipped with and display flashing lights.

06 (DE Revision) Flashing lights shall be either a separate large rotating amber beacon or strobe light(s). Flashing lights shall be mounted on the vehicle in such a manner as to be clearly visible for 360 degrees around the vehicle. The flashing lights shall be visible from a distance of not less than 3,000 feet under normal atmospheric conditions at night.

• DE Standard:

  - Flashing lights on all work-related vehicles and equipment
  - Large rotating amber beacon or strobe light(s) visible for 360 degrees for ≥ 3,000 ft
Except in emergency situations, flagger stations shall be illuminated at night.

Floodlighting shall not produce a disabling glare condition for approaching road users, flaggers, or workers.

Guidance:

The adequacy of the floodlight placement and elimination of potential glare should be determined by driving through and observing the floodlighted area from each direction on all approaching roadways after the initial floodlight setup, at night, and periodically.

Support:

Desired illumination levels vary depending upon the nature of the task involved. An average horizontal luminance of 5 foot candles can be adequate for general activities. Tasks requiring high levels of precision and extreme care can require an average horizontal luminance of 20 foot candles.
Section 6F.83 Warning Lights

Guidance:
01A  (DE Revision) Except as provided in Paragraph 1B, warning lights should not be used on state-maintained roads.

Option:
01B  (DE Revision) When added conspicuity is desired, only Type B warning lights may be used.

- DE Guidance: *Warning lights no longer used on TTC devices*

Type B warning lights should not be used on TTC devices (e.g., barricades and temporary traffic barriers)

SR 2 at Hazel Ave / VA Hospital
Section 6F.86 Crash Cushions

DE Standard: **Truck-mounted attenuator (TMA) required for shoulder and lane closures for long-term, intermediate, short-term, and mobile operations on roads > 40 mph**

DE Option: TMA can be omitted for short duration work less than 15 min if vehicle displays high-intensity, flashing, oscillating, or strobe lights

DE Option: TMA can be omitted from specialized work vehicles that cannot support TMA installation
Where Are We?

- 6A – General
- 6B – Fundamental principals
- 6C – TTC Elements
- 6D – Pedestrian and worker safety
- 6E – Flagger control
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
Section 6G.02 Work Duration

Support:
01 Work duration is a major factor in determining the number and types of devices used in TTC zones. The duration of a TTC zone is defined relative to the length of time a work operation occupies a spot location.

Standard:
02 The five categories of work duration and their time at a location shall be:
   A. Long-term stationary is work that occupies a location more than 3 days.
   B. Intermediate-term stationary is work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.
   C. Short-term stationary is daytime work that occupies a location for more than 1 hour within a single daylight period.
   D. Short duration is work that occupies a location up to 1 hour.
   E. Mobile is work that moves intermittently or continuously.

- Long-term stationary: > 3 days
- Intermediate stationary: > 1 daylight period or 1 hr at night
- Short-term stationary: > 1 hr within single daylight period
- Short duration: ≤ 1 hr
- Mobile: Moving intermittently or continuously
Section 6G is primarily support and guidance material for Typical Applications in Chapter 6H.

Section 6G.10 Work Within the Traveled Way of a Two-Lane Highway

Support:
01 Chapter 6D and Sections 6F.74 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.
02 (DE Revision) Detour signs are used to direct road users onto another roadway. At diversions, road users are directed onto a temporary roadway or alignment placed within or adjacent to the right-of-way. Typical applications for detouring or diverting road users on two-lane highways are shown in Figures 6H-7 and 6H-20. Figure 6H-7 illustrates the controls around an area where a section of roadway has been closed and a diversion has been constructed. Channelizing devices and pavement markings are used to indicate the transition to the temporary roadway.

Guidance:
03 When a detour is long, Detour (M4-8, M4-9) signs should be installed to remind and reassure road users periodically that they are still successfully following the detour.
04 (DE Revision) When an entire roadway is closed, as illustrated in Figure 6H-20, a detour should be provided and road users should be warned in advance of the closure. If local road users are allowed to use the roadway up to the closure, the ROAD CLOSED AHEAD, LOCAL TRAFFIC ONLY (R11-3a) sign should be used. The portion of the road open to local road users should have adequate signing, marking, and delineation.
05 (DE Revision) Detours should be signed so that road users will be able to traverse the entire detour route and back to the original roadway as shown in Figure 6H-20.

Support:
06 Techniques for controlling vehicular traffic under one-lane, two-way conditions are described in Section 6C.10.
07 Flaggers may be used as shown in Figure 6H-10.
08 (DE Revision) STOP/YIELD sign control may be used on roads with low traffic volumes as shown in Figures 6H-11 and 6H-11A. Where the opposite shoulder is suitable for carrying vehicular traffic and of adequate width, lanes may be shifted along two-lane roads with low traffic volumes as shown in Figure 6H-11B.
09 A temporary traffic control signal may be used as shown in Figure 6H-12.

Note: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.
Section 6G.11 Work Within the Traveled Way of an Urban Street

Support:
01 Chapter 6D and Sections 6F.74 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.
02 In urban TTC zones, decisions are needed on how to control vehicular traffic, such as how many lanes are required, whether any turns need to be prohibited at intersections, and how to maintain access to business, industrial, and residential areas.
03 Pedestrian traffic needs separate attention. Chapter 6D contains information regarding pedestrian movements near TTC zones.

Standard:
04 If the TTC zone affects the movement of bicyclists, adequate access to the roadway or shared-use paths shall be provided (see Part 9).
05 Where transit stops are affected or relocated because of work activity, both pedestrian and vehicular access to the affected or relocated transit stops shall be provided.

Guidance:
06 If a designated bicycle route is closed because of the work being done, a signed alternate route should be provided. Bicyclists should not be directed onto the path used by pedestrians.
07 Work sites within the intersection should be protected against inadvertent pedestrian incursion by providing detectable channelizing devices.

Support:
08 Utility work takes place both within and outside the roadway to construct and maintain services such as power, gas, light, water, or telecommunications. Operations often involve intersections, since that is where many of the network junctions occur. The work force is usually small, only a few vehicles are involved, and the number and types of TTC devices placed in the TTC zone is usually minimal.

Standard:
09 All TTC devices shall be retroreflective or illuminated if utility work is performed during nighttime hours.

Guidance:
10 As discussed under short-duration projects, however, the reduced number of devices in utility work zones should be offset by the use of high-visibility devices, such as high-intensity rotating, flashing, oscillating, or strobe lights on work vehicles or high-level warning devices.

Support:
11 (DE Revision) Figures 6H-6, 6H-10, 6H-15, 6H-18, 6H-21, 6H-23, and 6H-33 are examples of typical applications for utility operations. Other typical applications might apply as well.
Section 6G.13 Work Within the Traveled Way at an Intersection

Support:
01 Chapter 6D and Sections 6F.74 and 6G.05 contain additional information regarding the steps to follow when pedestrian or bicycle facilities are affected by the worksite.
02 The typical applications for intersections are classified according to the location of the work space with respect to the intersection area (as defined by the extension of the curb or edge lines). The three classifications are near side, far side, and in-the-intersection. Work spaces often extend into more than one portion of the intersection. For example, work in one quadrant often creates a near-side work space on one street and a far-side work space on the cross street. In such instances, an appropriate TTC plan is obtained by combining features shown in two or more of the intersection and pedestrian typical applications.
03 TTC zones in the vicinity of intersections might block movements and interfere with normal road user flows. Such conflicts frequently occur at more complex signalized intersections having such features as traffic signal heads over particular lanes, lanes allocated to specific movements, multiple signal phases, signal detectors for actuated control, and accessible pedestrian signals and detectors.

Guidance:
04 The effect of the work upon signal operation should be considered, and temporary corrective actions should be taken, if necessary, such as revising signal phasing and/or timing to provide adequate capacity, maintaining or adjusting signal detectors, and relocating signal heads to provide adequate visibility as described in Part 4.

Standard:
05 When work will occur near an intersection where operational, capacity, or pedestrian accessibility problems are anticipated, the highway agency having jurisdiction shall be contacted.

Option:
13 If there are a significant number of vehicles turning from a near-side lane that is closed on the far side, the near-side lane may be converted to an exclusive turn lane.

Support:
14 (DE Revision) Figure 6H-27 provides guidance on applicable procedures for work performed within the intersection.

Option:
15 (DE Revision) If the work is within the intersection, any of the following strategies may be used:
   A. A small work space so that road users can move around it;
   B. Flaggers or uniformed law enforcement officers to direct road users, as shown in Figure 6H-27;
   C. Work in stages so the work space is kept to a minimum; and
   D. Road closures or upstream diversions to reduce road user volumes.

Guidance:
16 Depending on road user conditions, a flagger(s) and/or a uniformed law enforcement officer(s) should be used to control road users.
### Section 6G.20 Vertical Difference

<table>
<thead>
<tr>
<th>Type of Vertical Difference</th>
<th>Criteria</th>
<th>Height (H) of Vertical Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No channelizing devices required</td>
<td><strong>H ≤ 1 in</strong></td>
</tr>
<tr>
<td>Transverse</td>
<td>Standard</td>
<td>- Except for roadway obstacles such as manholes and utility valves, BUMP (W8-1) or DIP (W8-2) signs shall be installed</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>1 in &lt; H ≤ 2 in</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- A ramp of bituminous temporary roadway material shall be installed at a slope of 20 to 1 across the limits of the vertical difference, including the perimeter of an obstacle</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>2 in &lt; H ≤ 6 in</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- A ramp of bituminous temporary roadway material shall be installed at a slope of 20 to 1 across the limits of the vertical difference, including the perimeter of an obstacle</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>H &gt; 6 in</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Except for roadway obstacles such as manholes and utility valves, BUMP (W8-1) or DIP (W8-2) signs shall be installed</td>
</tr>
</tbody>
</table>

- **DE Standard:** Bituminous temporary roadway material (TRM) at 20:1 slope around perimeter of transverse obstacle

S. Governors Ave, Webbs Ln to Water St
Section 6G.21 Storage of Equipment

### Table 6G-2. Storage of Equipment (Delaware Revision)

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance (L) from Edge of Traveled Way</th>
<th>Posted Speed Limit or 85th Percentile Speed</th>
<th>Minimum Required Channelizing Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment and Non-flammable Materials</td>
<td>L ≤ 30 ft</td>
<td>All</td>
<td>Temporary traffic barrier</td>
</tr>
<tr>
<td>Interstate, Freeway, or Expressway</td>
<td>L &gt; 30 ft</td>
<td>All</td>
<td>Drums</td>
</tr>
<tr>
<td>All other roadways</td>
<td>0 ≤ L ≤ 10 ft</td>
<td>25 mph or less</td>
<td>Drums</td>
</tr>
<tr>
<td></td>
<td>10 ft &lt; L ≤ 30 ft</td>
<td>More than 25 mph</td>
<td>Temporary traffic barrier</td>
</tr>
<tr>
<td></td>
<td>L &gt; 30 ft</td>
<td>25 mph or less</td>
<td>None</td>
</tr>
<tr>
<td>Flammable Materials (fuel, propane, etc.)</td>
<td>L ≤ 30 ft</td>
<td>All</td>
<td>Temporary traffic barrier</td>
</tr>
<tr>
<td>Interstate, Freeway, or Expressway</td>
<td>L &gt; 30 ft</td>
<td>All</td>
<td>Drums</td>
</tr>
<tr>
<td>All other roadways</td>
<td>L ≤ 30 ft</td>
<td>All</td>
<td>Temporary traffic barrier</td>
</tr>
</tbody>
</table>

DE Standard: **Treated as roadside obstacle per Table 6G-2**
Where Are We?

- 6A – General
- 6B – Fundamental principals
- 6C – TTC Elements
- 6D – Pedestrian and worker safety
- 6E – Flagger control
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
Typical Applications

- Generally, the TAs represent the minimum solutions for situations depicted (¶03)
- Many projects will require incorporation of more than one TA
- Other devices may be needed to supplement
- Table 6H-1 is an index to TAs that can help choose the correct TA(s) on which to base the project’s temporary traffic control (TTC) plan
### Cases are now Typical Applications (TAs)

- Table 6H-1 provides index for TAs
Typical Applications

- Taper length
- Sign separation distances

Table 6H-4. Formulas for Determining Taper Length (Delaware Revision)

<table>
<thead>
<tr>
<th>Speed (S)</th>
<th>Taper Length (L) in feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 mph or less</td>
<td>( L = \frac{WS^2}{80} )</td>
</tr>
<tr>
<td>More than 40 mph</td>
<td>( L = WS )</td>
</tr>
</tbody>
</table>

Where:
- \( L \) = taper length in feet
- \( W \) = width of offset in feet
- \( S \) = posted speed limit, or off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in mph

Table 6H-3. Meaning of Letter Codes on Typical Application Diagrams (Delaware Revision)

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance Between Signs**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Urban (low speed)*</td>
<td>100 feet</td>
</tr>
<tr>
<td>Urban (high speed)*</td>
<td>350 feet</td>
</tr>
<tr>
<td>Rural</td>
<td>500 feet</td>
</tr>
<tr>
<td>Interstate / Expressway / Freeway</td>
<td>1,000 feet</td>
</tr>
</tbody>
</table>

* 40 mph or less is “low speed” and over 40 mph is “high speed” on state-maintained roadways.

** The column headings A, B, and C are the dimensions shown in Figures 6H-1 through 6H-46. A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The “first sign” is the sign in a threesign series that is closest to the TTC zone. The “third sign” is the sign that is furthest upstream from the TTC zone.)

- Notice these distances are not necessarily minimums
- Too long can be just as bad

Part 6; Section 6H.01
• **Off-roadway work**
  – Mowing

• **Shoulder work**

<table>
<thead>
<tr>
<th>Typical Application Description</th>
<th>Typical Application Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Outside of the Shoulder (see Section 6G.06)</td>
<td></td>
</tr>
<tr>
<td>Work Beyond the Shoulder &gt; 10 Feet from the Edge of the Traveled Way</td>
<td>TA-1</td>
</tr>
<tr>
<td>Work Beyond the Shoulder ≤ 10 Feet from the Edge of the Traveled Way</td>
<td>TA-3</td>
</tr>
<tr>
<td>Off-Roadway Mowing Operations</td>
<td>TA-1A</td>
</tr>
<tr>
<td>Blasting Zone</td>
<td>TA-2</td>
</tr>
<tr>
<td>Work on the Shoulder (see Sections 6G.07 and 6G.08)</td>
<td></td>
</tr>
<tr>
<td>Work on the Shoulders</td>
<td>TA-3</td>
</tr>
<tr>
<td>Short Duration or Mobile Operation on a Shoulder</td>
<td>TA-4</td>
</tr>
<tr>
<td>Shoulder Work with Minor Encroachment</td>
<td>TA-6 (≤ 40 MPH) or TA-10 (&gt; 40 MPH)</td>
</tr>
</tbody>
</table>
• Case 1 = TA-1

• **Additional ROAD WORK AHEAD** sign on left-hand side of divided highway when working in median

So “A” is 100’ in the low speed (<40 mph) urban environment, 350’ in the high speed urban, and 500’ in the rural setting (Table 6H-3)
• **Case 24 = TA-1A**

• **DE Standard:**
  - *Performed during daylight hours only*
  - *Work area limited to 2 miles or less*

• **DE Guidance:** *Use mobile shoulder closure (TA-4) or mobile lane closure (TA-17) if mowing encroaches upon shoulder or traveled way*
TA-3. Work on the Shoulder of a Two-Lane Road

- Case 2 = TA-3

- At least 1 sign when closing shoulder ≥ 8 ft

- Arrow board(s) in caution mode

- Omit SHOULDER CLOSED on side road if turning motorists will encounter mainline sign

- DE Standard: **Warning signs in opposing direction when closure occurs in passing zone**
### Work within traveled way of a two-lane road

<table>
<thead>
<tr>
<th>Typical Application Description</th>
<th>Typical Application Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Closed with a Diversion</td>
<td>TA-7</td>
</tr>
<tr>
<td>Roads Closed with an Off-Site Detour</td>
<td>TA-20</td>
</tr>
<tr>
<td>Overlapping Routes with a Detour</td>
<td>TA-20</td>
</tr>
<tr>
<td>Lane Closure on a Two-Lane Road Using Flaggers</td>
<td>TA-10</td>
</tr>
<tr>
<td>Lane Closure on a Two-Lane Road with Low Traffic Volumes</td>
<td>TA-11 or TA-11A</td>
</tr>
<tr>
<td>Lane Diversion on a Two-Lane Road with Low Traffic Volumes</td>
<td>TA-11B</td>
</tr>
<tr>
<td>Lane Closure on a Two-Lane Road Using Traffic Control Signals</td>
<td>TA-12</td>
</tr>
<tr>
<td>Temporary Road Closure</td>
<td>TA-13</td>
</tr>
<tr>
<td>Haul Road Crossing</td>
<td>TA-14</td>
</tr>
<tr>
<td>Work in the Center of a Road with Low Traffic Volumes</td>
<td>TA-15</td>
</tr>
<tr>
<td>Surveying Along a Two-Lane Road</td>
<td>TA-16</td>
</tr>
<tr>
<td>Mobile Operations on a Two-Lane Road</td>
<td>TA-17</td>
</tr>
<tr>
<td>Mobile Striping Operations on a Two-Lane Road</td>
<td>TA-17A or TA-17B</td>
</tr>
</tbody>
</table>
• Case 6 = TA-10

• DE Option: TMA on downstream end of work area

• **One-lane, two-way taper now 50 ft to 100 ft**

• **Downstream taper also 50 ft to 100 ft**

Again, “A” is 100’ in the low speed (<40 mph) urban environment, 350’ in the high speed urban, and 500’ in the rural setting (Table 6H-3)
TA-10. Lane Closure on a Two-Lane Road using Flaggers

Figure 6H-10. Lane Closure on a Two-Lane Road Using Flaggers (TA-10)
(Delaware Revision)

Signs should follow TA-10

SR 18 / SR 404, west of Georgetown
TA-10. Lane Closure on a Two-Lane Road using Flaggers

Optional single flagger application reserved for short work zones along low-volume roads

Utility work along Old Lancaster Pk
TA-11 & TA-11A Lane Closure on a Two-Lane Road with YIELD or STOP Signs

- Alternate applications for TA-10 (flagger control) reserved for low-volume roads

TA-11 requires DelDOT Traffic approval
TA-11A. Lane Closure on a Two-Lane Road with Low Traffic Volumes using STOP Signs

James St bridge, Newport
Emergency one-lane bridge conversion

Horizontal curve and adjacent intersection restricted use of self-regulating, YIELD control; therefore, STOP control used during bridge repairs
Case 10 = TA-11B

DE Option: Alternative to lane closure where opposing shoulder is travel-bearing and of adequate width

DE Guidance:
- 10-ft (MIN.) lane widths
- Shift taper = L
- Illuminate shift area at night
TA-13. Temporary Road Closure &
TA-16. Surveying along a Two-Lane Road

- Reserve for closures < 20 min during off-peak hours
- **Use flaggers or law enforcement officers**

**DE Standard:**
- **MAX. work area** = ½ day’s operation or 1 mile
- Flaggers within sight or in communication at all times

See Next Slide for more detail on TA-16
Notes for Figure 6H-16—Typical Application 16
Surveying Along a Two-Lane Road
(Delaware Revision)

Standard:
1. The length of the work area shall be limited to a half day’s surveying operation or 1 mile, whichever is less.
2. The flaggers shall be in sight of each other or in communication with each other at all times.

Guidance:
3. Where a side road or major access point, such as a commercial, industrial, or subdivision entrance, intersects the work zone, additional flagger(s) should be located in the vicinity of the intersection(s).
4. Where drivers emerging from an intersecting roadway will not encounter an advance warning sign prior to the work zone, additional signs should be placed on the intersecting road.

Option:
5. Additional shadow vehicles to warn and reduce the speed of oncoming or opposing vehicular traffic may be used on roadways with a posted speed limit or 85th-percentile speed greater than 40 mph. Law enforcement vehicles may be used for this purpose.
6. ROAD WORK AHEAD signs may be used in place of the SURVEY CREW signs.
7. A BE PREPARED TO STOP sign may be added to the sign series.

Guidance:
8. When used, the BE PREPARED TO STOP sign should be located before the Flagger symbol (or FLAGGER AHEAD) sign.

Standard:
9. For short-term operations, a truck-mounted attenuator shall be used on roadways with a posted speed limit or 85th-percentile speed greater than 40 mph.

Option:
10. For short duration operations of 15 minutes or less, along roadways with a posted speed limit or 85th-percentile speed greater than 40 mph, a truck-mounted attenuator may be omitted if a vehicle with activated high-intensity rotating, flashing, oscillating, or strobe lights is used.
11. Truck-mounted attenuators may be used for all operations along roadways with a posted speed limit or 85th-percentile speed less than or equal to 40 mph.

Guidance:
12. For surveying operations along multi-lane roads, the off-roadway surveying operations should be completed first and then the applicable typical application for a shoulder closure (TA-4A) or lane closure (TA-35) should be used with the exception of the use of SURVEY WORK signs.
• Case 20-B = TA-17

• DE Standard: **TMAs required for mobile operations on roads > 40 mph**

• DE Option: TMA and arrow board omitted from work vehicles that cannot support devices

• **Arrow board(s) in caution mode**
• Case 23-A = TA-17A
• DE Option: 2 separate convoys (TA-17B) – application and cone recovery
  – TA-17 (mobile lane closure) required for cone recovery convoy

![Diagram of TA-17A Mobile Striping Operations]( Typical Application 17A)

![Diagram of TA-17B Mobile Striping Operations]( Typical Application 17B)
• Work within traveled way of urban street
  – Lane closure on subdivision street
  – Detour

<table>
<thead>
<tr>
<th>Typical Application Description</th>
<th>Two-Lane Conventional Road</th>
<th>Multi-Lane Conventional Road</th>
<th>Interstate, Freeway, or Expressway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Within the Traveled Way of an Urban Street (see Section 6G.11) – also applicable to other roadway types, as noted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane Closure on a Minor Street</td>
<td>TA-18</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Detour for One Travel Direction</td>
<td>TA-20</td>
<td>TA-20</td>
<td>TA-20</td>
</tr>
<tr>
<td>Detour for a Closed Street</td>
<td>TA-20</td>
<td>TA-20</td>
<td>TA-20</td>
</tr>
</tbody>
</table>
• DE Standard: **Only for low-speed roads with low traffic volumes, such as subdivision streets**

• **Use TA-10 (lane closure with flaggers) where traffic cannot self regulate**
• Case 15 = TA-20

• DE Guidance:
  
  – Detour signs on both left and right-hand side of multi-lane, divided roads
  
  – Street name plaque for complex or overlapping detours
  
  – 6-inch (MIN.) legend on two-lane roads and multi-lane roads ≤ 40 mph
  
  – 8-inch (MIN.) legend on multi-lane roads > 40 mph
TA-20. Detour for a Closed Street

- DE Standard: **Approved detour plan for detours affecting state-maintained roads**
TA-20. Detour for a Closed Street

Contradicting Detour signs

Confusing barricade signing at “T” intersection

SR 9 at St. Augustine Rd / Bayview Rd
Work at an intersection and on sidewalks

<table>
<thead>
<tr>
<th>Typical Application Description</th>
<th>Two-Lane Conventional Road</th>
<th>Multi-Lane Conventional Road</th>
<th>Interstate, Freeway, or Expressway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Within the Traveled Way at an Intersection and on Sidewalks (see Section 6G.13)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lane Closure on the Near Side of an Intersection</td>
<td>TA-21 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
<td>TA-21 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
<td>-</td>
</tr>
<tr>
<td>Right-Hand Lane Closure on the Far Side of an Intersection</td>
<td>TA-23 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
<td>TA-23 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
<td>-</td>
</tr>
<tr>
<td>Left-Hand Lane Closure on the Far Side of an Intersection</td>
<td>TA-23 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
<td>TA-23 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
<td>-</td>
</tr>
<tr>
<td>Half Road Closure on the Far Side of an Intersection</td>
<td>Not applicable in Delaware</td>
<td>Not applicable in Delaware</td>
<td>-</td>
</tr>
<tr>
<td>Multiple Lane Closures at an Intersection</td>
<td>TA-23 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
<td>TA-23 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
<td>-</td>
</tr>
<tr>
<td>Closure in the Center of an Intersection</td>
<td>Not applicable in Delaware</td>
<td>Not applicable in Delaware</td>
<td>-</td>
</tr>
<tr>
<td>Closure at the Side or Center of an Intersection</td>
<td>TA-27</td>
<td>TA-27</td>
<td>-</td>
</tr>
<tr>
<td>Sidewalk Detour or Diversion</td>
<td>TA-28</td>
<td>TA-28</td>
<td>-</td>
</tr>
<tr>
<td>Crosswalk Closures and Pedestrian Detours</td>
<td>TA-29</td>
<td>TA-29</td>
<td>-</td>
</tr>
</tbody>
</table>
• Upstream lane closure(s) in advance of intersection
  – DE Guidance: *Use TA-33 for roads > 40 mph*
Far side intersection lane closures should follow TA-23 with merging taper farther upstream of intersection
Flagger Procedures - Reminder

- Drivers must obey (per Delaware Code)
  - Flagger
  - Uniformed law enforcement officer
  - Even if they contradict TCDs
  - However, contradicting TCDs is not the safest way, so...

- Traffic control within intersections
  - Flagger on each approach, at least, and one in the intersection
  - Signalized? Traffic Officer, too
    - Signal placed in flash mode
    - Traffic Officer directs traffic

- Traffic control close to signalized intersections
  - Flaggers hold back street traffic to avoid blocking the intersection

Title 21, Chapter 41

Don’t over-ride the signal
Pedestrian detours are generally preferred over in-street diversions on state-maintained roads.
DE Standard:

- Approved detour plan for pedestrian detours along state-maintained roads

- Temporary midblock crosswalks require DelDOT Traffic approval

- If approved, temporary midblock crosswalks signed and marked in accordance with Parts 2 and 3
TA-29 requires a DelDOT Traffic approved pedestrian detour plan
## Work in the vicinity of a grade crossing

<table>
<thead>
<tr>
<th>Typical Application Description</th>
<th>Typical Application Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Two-Lane Conventional Road</strong></td>
<td><strong>Multi-Lane Conventional Road</strong></td>
</tr>
<tr>
<td>Work Within the Traveled Way of an Interstate, Freeway, or Expressway (see Section 6G.14) – also applicable to other roadway types, as noted</td>
<td>TA-36</td>
</tr>
<tr>
<td>Lane Shift on a Multi-Lane, Divided Highway</td>
<td>-</td>
</tr>
<tr>
<td>Double Lane Closure on a Multi-Lane, Divided Highway</td>
<td>-</td>
</tr>
<tr>
<td>Interior Lane Closure on a Multi-Lane, Divided Highway</td>
<td>-</td>
</tr>
<tr>
<td>Median Crossover on a Multi-Lane, Divided Highway</td>
<td>-</td>
</tr>
<tr>
<td>Median Crossover for an Entrance Ramp</td>
<td>-</td>
</tr>
<tr>
<td>Median Crossover for an Exit Ramp</td>
<td>-</td>
</tr>
<tr>
<td>Work in the Vicinity of an Exit Ramp</td>
<td>-</td>
</tr>
<tr>
<td>Partial Exit Ramp Closure</td>
<td>-</td>
</tr>
<tr>
<td>Work in the Vicinity of an Entrance Ramp</td>
<td>-</td>
</tr>
<tr>
<td>Work in the Vicinity of a Grade Crossing (see Section 6G.18)</td>
<td>TA-46</td>
</tr>
</tbody>
</table>

Temporary Reversible Lane Using Moveable Barriers: Not applicable in Delaware

Work in the Vicinity of a Grade Crossing: TA-46, TA-33
• Case 17-A = TA-46

• DE Guidance: *TA-33 on multi-lane roads* (former Case 17-B)

• DE Guidance: 50-ft “influence area” on both sides of grade crossing

• Begin TTC zone upstream of crossing to reduce potential for queuing problems

• Provide law enforcement or flagger at crossing when queues extend across crossing

• DE Standard: **TMA roll-ahead buffer space shall not extend across crossing**
Where Are We?

- 6A – General
- 6B – Fundamental principals
- 6C – TTC Elements
- 6D – Pedestrian and worker safety
- 6E – Flagger control
- 6F – TTC zone devices
- 6G – Type of TTC zone activities
- 6H – Typical applications
- 6I – Traffic incident management areas
Section 6I.01 General

Traffic incidents can be divided into three general classes of duration, each of which has unique traffic control characteristics and needs. These classes are:

A. Major—expected duration of more than 2 hours,
B. Intermediate—expected duration of 30 minutes to 2 hours, and
C. Minor—expected duration under 30 minutes.

- 3 general classes of incidents
  - Major: > 2 hrs
  - Intermediate: 30 min – 2 hrs
  - Minor: < 30 min

- Optional black-on-fluorescent pink warning and guide signs

Figure 6I-1. Examples of Traffic Incident Management Area Signs
Support:

01 Major traffic incidents are typically traffic incidents involving hazardous materials, fatal traffic crashes involving numerous vehicles, and other natural or man-made disasters. These traffic incidents typically involve closing all or part of a roadway facility for a period exceeding 2 hours.

Guidance:

02 If the traffic incident is anticipated to last more than 24 hours, applicable procedures and devices set forth in other Chapters of Part 6 should be used.

07 All traffic control devices needed to set up the TTC at a traffic incident should be available so that they can be readily deployed for all major traffic incidents. The TTC should include the proper traffic diversions, tapered lane closures, and upstream warning devices to alert traffic approaching the queue and to encourage early diversion to an appropriate alternative route.

08 Attention should be paid to the upstream end of the traffic queue such that warning is given to road users approaching the back of the queue.

- Partial or full road closure > 2 hrs
- TTC complying with Chapters 6A – 6H for incidents lasting > 24 hrs
- TTC including diversions, tapered lane closures, and upstream warning devices
- Warning devices at back of queue
Intermediate traffic incidents typically affect travel lanes for a time period of 30 minutes to 2 hours, and usually require traffic control on the scene to divert road users past the blockage. Full roadway closures might be needed for short periods during traffic incident clearance to allow traffic incident responders to accomplish their tasks.

**Guidance:**

01 All traffic control devices needed to set up the TTC at a traffic incident should be available so that they can be readily deployed for intermediate traffic incidents. The TTC should include the proper traffic diversions, tapered lane closures, and upstream warning devices to alert traffic approaching the queue and to encourage early diversion to an appropriate alternative route.

04 Attention should be paid to the upstream end of the traffic queue such that warning is given to road users approaching the back of the queue.

- Lane closures 30 min to 2 hrs
- Intermittent road closure to clear incident
- *TTC including diversions, tapered lane closures, and upstream warning devices*
- Warning devices at back of queue
Section 61.04 Minor Traffic Incidents

Support:
01 Minor traffic incidents are typically disabled vehicles and minor crashes that result in lane closures of less than 30 minutes. On-scene responders are typically law enforcement and towing companies, and occasionally highway agency service patrol vehicles.

02 Diversion of traffic into other lanes is often not needed or is needed only briefly. It is not generally possible or practical to set up a lane closure with traffic control devices for a minor traffic incident. Traffic control is the responsibility of on-scene responders.

Guidance:
03 When a minor traffic incident blocks a travel lane, it should be removed from that lane to the shoulder as quickly as possible.

- Disabled vehicles and minor crashes
- Lane closures < 30 min
- Responders include law enforcement, tow companies, and highway patrol vehicles (e.g., DelDOT MAP)
- Generally impractical to install TTC devices
Where Can I Find This Stuff?

- Delaware MUTCD: [www.mutcd.deldot.gov](http://www.mutcd.deldot.gov)
- Delaware T² Center: [http://sites.udel.edu/dct/t2-center/](http://sites.udel.edu/dct/t2-center/)
- These slides: [http://sites.udel.edu/dct/t2-center/technical-briefs-case-summaries/](http://sites.udel.edu/dct/t2-center/technical-briefs-case-summaries/)
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