PRESENTED BY:
DELWARE T² CENTER

Manual on Uniform Traffic Control Devices (MUTCD)

Module: Part 6
Temporary Traffic Control
Delaware $T^2$ Center

- $T^2$ 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 $T^2$ hosted by University of Delaware, part of Delaware Center for Transportation
- Delaware $T^2$ funded by FHWA and DelDOT
The Preliminaries

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
More Preliminaries

- Questions – any time
- We’re a small crowd – let’s keep it interactive and informal
- Sharing of thoughts or examples – any time
- These slides will be posted on our website – see link on your notes
The T² Center MUTCD Program

What we cover directly:
- Introduction and Part 1 (General) – the basics
- Part 2 (Signs)
- Part 3 (Markings)
- Part 6 (Temporary Traffic Control/Work Zones) – today’s module

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
Introduction

In this module:
- General and fundamental principals
- TTC (aka, Work Zone) elements
- Pedestrian and worker safety
- Flagger control
- Work zone devices
- Types of work zone activities
- Typical applications/cases
- Incident management areas
Where Are You in the Game?

Show of hands – where do you fit in?

- I can’t spell MUTCD – I’ve never opened it
- I have a passing familiarity – but I’ve always thought it was out of my wheel house
- I was at the Intro module (which was fantastic) and am now a developing MUTCD geek
- I’ve read parts of it over time and applied it as I need
- I’ve been called a Work Zone Wizard
- I know the MUTCD – I could teach this course (careful, you’re now our “go to” person)
Where Are You in the Game?

Regardless of where are you now:

- We hope you’ll have a greater command when we’re done
- Don’t imagine this workshop will make you an expert (unless you already are one) – practice will do that
- As we go, share your challenges, experiences, and solutions – let’s all learn from each other

Ok – let’s get into it
• Federal MUTCD published in Dec. 2009

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

New Shortcut to this page

Notice there are other documents here too – complimentary guidance, memoranda, etc.

www.mutcd.deldot.gov
• 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”
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
Before We Get Started…

- 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 all 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
Section 6A.01 General

Standard:
02 The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, or on private roads open to public travel (see definition in Section 1A.13), including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Guidance:
12 The TTC plan should start in the planning phase and continue through the design, construction, and restoration phases. The TTC plans and devices should follow the principles set forth in Part 6. The management of traffic incidents should follow the principles set forth in Chapter 6I.

12A (DE Revision) TTC plan should comply with the latest version of DelDOT’s “Work Zone Safety and Mobility Procedures and Guidelines”, available for download on the DelDOT website at http://www.deldot.gov.

Option:
13 TTC plans may deviate from the typical applications described in Chapter 6H to allow for conditions and requirements of a particular site or jurisdiction.

- 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
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

Brights Branch Rd
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

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.

- **Adjacent or overlapping projects should be coordinated**

SR 54 west of SR 1
DE Guidance: *Design based on posted speed limit or 85th-percentile speed*

*If design is restricted or special conditions exist:*

- *Speed limit reduction should not exceed 10 mph*
- *Reduction > 10 mph should be “stepped down”*
- DE Guidance: *Reductions should be approved by DelDOT Traffic*
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:**

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 at http://www.del-dot.gov.

- Planned special events may require TTC planning
- **DE Guidance:** Complete DelDOT Special Event Permit Application for planned special events on state-maintained roads
  
  [Image: Delaware Department of Transportation Special Event Permit Application]

  [Hyperlink: http://www.deldot.gov/information/community_programs_and_services/planned_spec_events/index.shtml]
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 is 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)
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
Section 6C.06 Activity Area

11 If a longitudinal buffer space is used, the values shown in Table 6C-2 may be used to determine the length of the longitudinal buffer space.

Guidance:

15 (DE Revision) The width of a lateral buffer space should be determined by engineering judgment. On interstates, freeways, or expressways, a lateral buffer space of one travel lane should be used, except where temporary traffic barrier is used to separate the work area from the traveled way, or if other conditions prevent the use of a lateral buffer space.

- Optional longitudinal buffer based on Table 6C-2

- DE Guidance: Lateral buffer of one travel lane on interstates, freeways, and expressways unless behind barrier
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>$0.5L$ to $L^*$</td>
</tr>
<tr>
<td>Shoulder Taper</td>
<td>at least $0.33L$</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*

- $L = WS^2/60$ (S≤40 mph)
- $L = WS$ (S>40 mph)

**Merging** = $L$

**Shifting** = $L$ (DE Guidance)

**Downstream** = 50-100 ft

**Shoulder** = $L/3$
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
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 0.5L

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

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<td>0.5 L to L*</td>
</tr>
<tr>
<td>Shoulder Taper</td>
<td>at least 0.33 L</td>
</tr>
<tr>
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<td>50 feet minimum, 100 feet maximum</td>
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<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 ft**
  - \( W = 12 \text{ ft} @ 40 \text{ mph} \)
Section 6C.09 Detours and Diversions

**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

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.
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

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.
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.

- Alternate ped facilities required if TTC affects existing ped facilities

Not compliant (but getting there); stay tuned for Part 6F.74

SR 2 at Hazel Ave / VA Hospital
Section 6D.01 Pedestrian Considerations

Not compliant
If an alternate ped route is infeasible, providing free bus service or assigning personnel to assist are options.
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.
Guidance:

11. To accommodate the needs of pedestrians, including those with disabilities, the following considerations should be addressed when temporary pedestrian pathways in TTC zones are designed or modified:

A. Provisions for continuity of accessible paths for pedestrians should be incorporated into the TTC plan.

B. Access to transit stops should be maintained.

C. A smooth, continuous hard surface should be provided throughout the entire length of the temporary pedestrian facility. There should be no curbs or abrupt changes in grade or terrain that could cause tripping or be a barrier to wheelchair use. The geometry and alignment of the facility should meet the applicable requirements of the “Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)” (see Section 1A.11).

D. The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 60 inches throughout the entire length of the pedestrian pathway, a 60 x 60-inch passing space should be provided at least every 200 feet to allow individuals in wheelchairs to pass.

E. Blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing devices such as audible information devices, accessible pedestrian signals, or barriers and channelizing devices that are detectable to the pedestrians traveling with the aid of a long cane or who have low vision. Where pedestrian traffic is detoured to a TTC signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals should be considered for crossings along an alternate route.

F. When channelization is used to delineate a pedestrian pathway, a continuous detectable edging should be provided throughout the length of the facility such that pedestrians using a long cane can follow it. These detectable edgings should comply with the provisions of Section 6F.74.

G. Signs and other devices mounted lower than 7 feet above the temporary pedestrian pathway should not project more than 4 inches into accessible pedestrian facilities.
Pedestrian Considerations

- Avoid movements of vehicle, workers, and equipment across ped paths (¶ 15)
- Avoid access to work space across ped paths (¶ 16)

Guidance:
26. If a significant potential exists for vehicle incursions into the pedestrian path, pedestrians should be rerouted or temporary traffic barriers should be installed.
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.
29. In general, pedestrian routes should be preserved in urban and commercial suburban areas. Alternative routing should be discouraged.
30. The highway agency in charge of the TTC zone should regularly inspect the activity area so that effective pedestrian TTC is maintained.
Accessibility Considerations

- Temporary ped facility must meet or exceed detectability and accessibility of existing facility

Support:
01 Additional information on the design and construction of accessible temporary facilities is found in publications listed in Section 1A.11 (see Publications 12, 38, 39, and 42).

Guidance:
02 The extent of pedestrian needs should be determined through engineering judgment or by the individual responsible for each TTC zone situation. Adequate provisions should be made for pedestrians with disabilities.

Standard:
03 When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Where pedestrians with visual disabilities normally use the closed sidewalk, a barrier that is detectable by a person with a visual disability traveling with the aid of a long cane shall be placed across the full width of the closed sidewalk.

Support:
04 Maintaining a detectable, channelized pedestrian route is much more useful to pedestrians who have visual disabilities than closing a walkway and providing audible directions to an alternate route involving additional crossings and a return to the original route. Braille is not useful in conveying such information because it is difficult to find. Audible instructions might be provided, but the extra distance and additional street crossings might add complexity to a trip.
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
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
Flagger Qualifications

- 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 TTC 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.
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 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.

MEMORANDUM

TO: All Users of the Delaware Manual on Traffic Control Devices
VIA: Don Weber, P.E.
     Chief Traffic Engineer
FROM: Adam Weiser, P.E., PTOE
      Safety Programs Manager
DATE: March 1, 2011
SUBJECT: Acceptable Flagger Certification

Section 6E.01 of the Delaware Manual on Uniform Traffic Control Devices (MUTCD) provides the following standard statement:

“A flagger shall be a person who provides TTC. All flaggers, 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.”

The purpose of this memorandum is to define the DelDOT-recognized flagger certification program. As of the above date, the only DelDOT-recognized flagger certification program is the American Traffic Safety Services Association (ATSSA) Flagger Certification Program. Only flaggers with ATSSA flagger certification shall provide flagging operations on state maintained roadways for construction, maintenance and/or utility projects.

This memorandum, effective immediately, supersedes any previous allowances for other flagger certification beyond the ATSSA Flagger Certification Program.

Please contact the Traffic Safety Section at (302) 659-4060 for questions regarding this information.

• DE Standard:
  - ATSSA certified
  - Required to carry flagger certification card and photo identification at all times
Section 6E.02 High-Visibility Safety Apparel

DE Standard:
ANSI 107-2004
Class 3 apparel for all flaggers (day and night)
High Visibility Safety Apparel

- What is ANSI Class 3?

What is ANSI?

We have received many questions about ANSI/ISEA 107 standards, so here's 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: Safetyline, Inc.
High Visibility Safety Apparel

- These are **NOT** ANSI Class 3

It's yellow, it's ugly, it doesn't match anything, but it can save lives.

Photo: MoDOT

Photo: Brett Jordon

Photo: Steven Vance

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

- These are ANSI Class 3 (probably)

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

- ANSI Class E
Section 6E.03 Hand-Signaling Devices

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

Standard:

02 (DE Revision) The STOP/SLOW paddle shall have an octagonal shape on a rigid handle. STOP/SLOW paddles shall be at least 24 inches wide with letters at least 8 inches high. The STOP (R1-1) face shall have white letters and a white border on a red background. The SLOW (W20-8) face shall have black letters and a black border on an orange background. When used at night, the STOP/SLOW paddle shall be retroreflectORIZED.
Section 6E.07 Flagger Procedures

Improper flagging procedure
Flagger Procedures

- 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

Title 21, Chapter 41
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

Part 7; Section 7D.05

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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 retroreflectorized 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.
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.”
Section 6F.01 Types of Devices

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.atssa.com.”
General Sign Characteristics

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

- (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
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
Section 6F.03 Sign Placement

Guidance:

01 Signs should be located on the right-hand side of the roadway unless otherwise provided in this Manual.

02 (DE Revision) Typically, on multi-lane divided highways, signs should be placed on both the left-hand and right-hand sides of the roadway.

• Right-hand side of road

• DE Guidance: Signs installed on left and right-hand side of multi-lane, divided highways

Should be located on right-hand side of road

US 13 / DE 404 Intersection Realignment and Bridgeville Service Road
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.

Figure 6F-1. Height and Lateral Location of Signs—Typical Installations (Delaware Revision)

- 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

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08A (DE Revision) Except as provided in Paragraph 8C, signs mounted on portable sign supports with a minimum mounting height of 5 feet should not be used for a duration of longer than 3 days.

08B (DE Revision) Except as provided in Paragraph 8C, signs mounted on portable sign supports with a minimum mounting height of 1 foot should not be used for a duration of longer than 1 hour.

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 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
Standard:
02 Regulatory signs shall be authorized by the public agency or official having jurisdiction and shall conform with Chapter 2B.

Guidance:
03 (DE Revision) A Traffic Control Device Authorization should be approved by DelDOT Traffic prior to the installation of a TTC regulatory sign or modification to an existing TTC regulatory sign.

• DE Guidance: Traffic Control Device Authorization approved by DelDOT Traffic for modifications to regulatory conditions

Signed authorization on file for speed reduction from 45 mph to 30 mph on temporary road

SR 15, Choptank Rd from N437 to N433
Local Traffic Only

- Avoid mixed messages

04. 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.
Section 6F.12 Work Zone and Higher Fines
Signs and Plaques

Guidance:
02 A BEGIN HIGHER FINES ZONE (R2-10) sign (see Figure 6F-3) should be installed at the upstream end of a work zone where increased fines are imposed for traffic violations, and an END HIGHER FINES ZONE (R2-11) sign (see Figure 6F-3) should be installed at the downstream end of the work zone.

04A (DE Revision) The BEGIN HIGHER FINES ZONE sign and FINES HIGHER plaque may be omitted within TTC zones per §4105 of Title 21 of the Delaware Code.

- Occasionally used in work zones because fines are doubled per DE Code
- DE Option: May be omitted within TTC zones per DE Code
Closing Sidewalks

- Poorly done, we create unnecessary jaywalking and accessibility barriers

Section 6F.14 SIDEWALK CLOSED Signs (R9-9, R9-10, R9-11, R9-11a)

Guidance:
01 SIDEWALK CLOSED signs (see Figure 6F-3) should be used where pedestrian flow is restricted. Bicycle/Pedestrian Detour (M4-9a) signs or Pedestrian Detour (M4-9b) signs should be used where pedestrian flow is rerouted (see Section 6F.59).
02 The SIDEWALK CLOSED (R9-9) sign should be installed at the beginning of the closed sidewalk, at the intersections preceding the closed sidewalk, and elsewhere along the closed sidewalk as needed.
03 The SIDEWALK CLOSED, (ARROW) USE OTHER SIDE (R9-10) sign should be installed at the beginning of the restricted sidewalk when a parallel sidewalk exists on the other side of the roadway.
04 The SIDEWALK CLOSED AHEAD, (ARROW) CROSS HERE (R9-11) sign should be used to indicate to pedestrians that sidewalks beyond the sign are closed and to direct them to open crosswalks, sidewalks, or other travel paths.
05 The SIDEWALK CLOSED, (ARROW) CROSS HERE (R9-11a) sign should be installed just beyond the point to which pedestrians are being redirected.

Support:
06 These signs are typically mounted on a detectable barricade to encourage compliance and to communicate with pedestrians that the sidewalk is closed. Printed signs are not useful to many pedestrians with visual disabilities. A barrier or barricade detectable by a person with a visual disability is sufficient to indicate that a sidewalk is closed. If the barrier is continuous with detectable channelizing devices for an alternate route, accessible signing might not be necessary. An audible information device is needed when the detectable barricade or barrier for an alternate channelized route is not continuous.

Part 6; Section 6F.14
Closing Sidewalks

Not so good

Part 6; Section 6F.14
Closing Sidewalks

Abysmal

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

Part 6; Section 6F.14
Closing Sidewalks

Much better
Closing Sidewalks

Better still?

Part 6; Section 6F.14
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.)
Section 6F.17 Position of Advance Warning Signs

DE Guidance: Specific TTC “application” signs should not conflict with “permanent” advance warning signs.

Elkton Rd, Casho Mill Rd to Delaware Ave
Road Work, Detour, Street Closed

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.

See also Section 6F.08 and 6F.09 for management of local traffic.
Flagger Signs

- Refer back also to Section 6E Flagger Control

**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.

Part 6; Section 6F.31
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.
• Used in accordance with Table 6G-1: Vertical Difference

Table 6G-1. Vertical Difference (Delaware Revision)

<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></td>
<td>$H \leq 1\text{ in}$</td>
</tr>
<tr>
<td>Standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longitudinal ≤ 10 ft from</td>
<td></td>
<td></td>
</tr>
<tr>
<td>edge of traveled way</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- For differences along or between traveled ways, the UNEVEN LANES (W8-11) sign shall be used.
- For differences between the traveled way and shoulder or at the edge of pavement, the LOW SHOULDER (W8-9) sign shall be used.

- No shoulder or shoulder < 4 ft wide: If the vertical difference is not eliminated by the end of the work day, a 4 to 1 fillet of wedge material shall be placed or temporary traffic barrier shall be installed. During the day of construction, channelizing devices shall be used to delineate the vertical difference until the vertical difference is eliminated, a 4 to 1 fillet of wedge material is placed, or temporary traffic barrier is installed.
- Shoulder ≥ 4 ft wide: Drums shall be used to delineate the vertical difference for up to 5 calendar days. If the vertical difference is not eliminated by the end of the 5th calendar day, a 4 to 1 fillet of wedge material shall be placed or temporary traffic barrier shall be installed.
- The Shoulder Drop Off (W8-17) sign shall be used until the vertical difference is eliminated.

- No channelizing devices required
- The UNEVEN LANES (W8-11) sign shall be used in accordance with Table 6G-1.
Besides the warning signs specifically related to TTC zones, several other warning signs in Part 2 may apply in TTC zones.

02A (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
Section 6F.60 Portable Changeable Message Signs

Design principles per Chapter 2A

Display only operational, regulatory, warning, or guidance information

DE Standard: **Installations approved by DelDOT Traffic**

- PCMS approval form if display messages are omitted from plan set
Section 6F.60 Portable Changeable Message Signs

10 (DE Revision) All sign lettering shall be in upper-case letters as provided in the “Standard Highway Signs and Markings” book (see Section 1A.11) and the Delaware Standard Signs book, unless otherwise provided in this Manual for a particular sign or type of message. (from Section 2A.13)

- Word messages in all upper-case, unless otherwise stated

PCMS message shall be in all upper-case letters
• Table 1A-2 lists acceptable PCMS abbreviations

“RR XING” is acceptable abbreviation for PCMS displays, not “RR”

SR 4 Railroad Crossing Improvement
Section 6F.60 Portable Changeable Message Signs

Guidance:
27 Portable changeable message signs should be used as a supplement to and not as a substitute for conventional signs and pavement markings.

30 (DE Revision) Portable changeable message signs should be placed off the shoulder of the roadway and behind a traffic barrier, if practical. Where a traffic barrier is not available to shield the portable changeable message sign, it should be placed off the shoulder and outside of the clear zone.

- Supplement conventional signs and markings
- Not crashworthy; placed behind barrier or outside clear zone, if practical
Section 6F.60 Portable Changeable Message Signs

Guidance:

13  A portable changeable message sign should be limited to three lines of eight characters per line or should consist of a full matrix display.

17  Messages on a portable changeable message sign should consist of no more than two phases, and a phase should consist of no more than three lines of text. Each phase should be capable of being understood by itself, regardless of the order in which it is read. Messages should be centered within the line of legend. If more than one portable changeable message sign is simultaneously legible to road users, then only one of the signs should display a sequential message at any given time.

30B (DE Revision) Six (6) channelizing devices (drums or cones) shall be provided to close the shoulder in advance of each portable changeable message sign located within the shoulder during the daytime. When a portable changeable message sign will be on site at night, drums shall be utilized.

32B (DE Revision) All portable changeable message signs no longer in use shall be removed from the work area within 48 hours, unless approved by DelDOT Traffic.

- **Maximum message criteria:**
  - 2 phases per PCMS
  - 3 lines per phase
  - 8 characters per line

- **DE Standard:** 6 drums close shoulder in advance of PCMS

- **DE Standard:** PCMSs no longer in use removed within 48 hrs
6 drums shall be used to close shoulder in advance of PCMS

SR 4 Railroad Crossing Improvement
Section 6F.61 Arrow Boards

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
Section 6F.61 Arrow Boards

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.

Arrow boards shall only be used to indicate a lane closure. Arrow boards shall not be used to indicate a lane shift.

**Figure 6F-6. Advance Warning Arrow Board Display Specifications (Delaware Revision)**

1. At least one of the three following modes shall be provided:
   - Flashing Arrow
   - Sequential Arrow
   - Sequential Chevron

2. The following mode shall be provided:
   - Flashing Double Arrow

3. The following mode shall be provided:
   - Flashing Caution

- **DE Guidance:** Flashing Arrow or Flashing Caution modes on state-maintained roads
- **Shall not be used for lane shifts**
Section 6F.61 Arrow Boards

Elkton Rd, Casho Mill Rd to Delaware Ave

Flashing Arrow mode used for lane closures along state-maintained roads
Section 6F.63 Channelizing Devices

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.

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
Channelizing Devices

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.
Section 6F.63 Channelizing Devices

**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

Elkton Rd, Casho Mill Rd to Delaware Ave
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
**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 retroreflectors. Retroreflectors 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. Retroreflectors 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.67 Drums

Option:
06  (DE Revision) Two ballast rings ("tire rings") may be used to minimize drum displacement due to passing vehicles or high winds.

Support:
07  (DE Revision) The use of two ballast rings has been found to minimize the chance a drum could be blown over by a truck or other vehicle passing by at high speed, particularly on roads with posted speed limits of 55 mph or higher, or having the drum blow over due to high winds.

- DE Option: Two ballast rings to minimize drum displacement on high-speed roads or in areas with high winds

Two ballast rings used on drums along I-495 due to high speeds

Interstate Bridge Maintenance, I-495
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
Section 6F.68 Type 1, 2, or 3 Barricades

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
Section 6F.68 Type 1, 2, or 3 Barricades

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:

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

Continuous barrier is detectable

Town of Clayton Sidewalk Improvements
Section 6F.77 Pavement Markings

Standard:
03 Existing pavement markings shall be maintained in all long-term stationary (see Section 6G.02) TTC zones in accordance with Chapters 3A and 3B, except as otherwise provided for temporary pavement markings in Section 6F.78. Pavement markings shall match the alignment of the markings in place at both ends of the TTC zone. Pavement markings shall be placed along the entire length of any paved detour or temporary roadway prior to the detour or roadway being opened to road users.
04 (DE Revision) For long-term stationary operations, pavement markings, including raised pavement markers, in the temporary traveled way that are no longer applicable shall be removed or obliterated as soon as practical. Pavement marking obliteration shall remove the non-applicable pavement marking material, and the obliteration method shall minimize pavement scarring. Painting over existing pavement markings with black paint or spraying with asphalt shall not be accepted as a substitute for removal or obliteration.

Option:
05 Removable, non-reflective, preformed tape that is approximately the same color as the pavement surface may be used where markings need to be covered temporarily.
06 (DE Revision) If a permanent raised pavement marker needs to be obscured in a TTC zone, the retroreflective lens of the raised pavement marker may be removed rather than removing the entire housing.

- Maintained in long-term stationary zones
- Installed prior to opening detour or diversion road
- DE Standard: **Conflicting markings, including RPMs, shall be removed or obliterated**
- “Blackout” tape used to cover conflicting markings only if tape is approximately same color as pavement
- DE Option: Remove RPM lens rather than entire housing
Existing RPM lenses conflict with temporary lane lines

Section 6F.77 Pavement Markings

US 13 / DE 404 Intersection Realignment and Bridgeville Service Road
RPM lenses were removed to avoid conflict with temporary lane lines.

Conflicting lane lines were obliterated.

Existing neutral area channelizing lines and hatching were obliterated because Exit 5 is open to traffic.

Interstate Bridge Maintenance, I-495
“Blackout” tape shall not be used on concrete because it does not match the pavement color.

SR 141, Kirkwood Hwy to Faulkland Rd
Section 6F.78 Temporary Pavement Markings

**DE Guidance:**
- Should not remain in place longer than 30 days
- Installed based on DelDOT’s Temporary Pavement Markings Policy
  - Shall comply with Part 3
  - Width of longitudinal lines: 4 in MIN.

MEMORANDUM

To: All Users of the Delaware Manual on Uniform Traffic Control Devices

From: Adam S. Weiser, P.E., PTOE Safety Programs Manager

Date: January 7, 2011

Subject: Temporary Pavement Markings Policy

Section 6F.72 of the Delaware Manual on Uniform Traffic Control Devices (DE MUTCD) suggests that the State develop a policy regarding the use of temporary pavement markings for highway work zones. As such, this memorandum defines the policy for the use of temporary pavement markings within highway work zones on roadways within the jurisdiction of the Delaware Department of Transportation (DelDOT). This policy covers the widths of longitudinal pavement markings, the required markings for long-term stationary operations and the required markings between lifts of pavement during paving operations.

A. Temporary Pavement Marking Dimensions

The widths of all temporary pavement markings, including centerlines, edge lines and other longitudinal pavement markings shall comply with Section 3A.05 of the DE MUTCD. This Section requires that the minimum width of a normal line be 4-inches. As such, longitudinal temporary pavement markings on all roadways shall be no less than 4-inches wide. The layout of temporary pavement markings shall match the layout of existing pavement markings, i.e., provide a 6-inch wide gap between centerlines, no single solid yellow centerlines, etc. The width of transverse pavement markings shall be as described in the applicable sections of Part 3 of the DE MUTCD. Typical dimensions for common transverse markings are as follows:

- Stop lines = 16 inches wide
- Crosswalk markings:
  - Piano key markings = 24 inches wide
  - Parallel transverse markings = 12 inches wide with a minimum 6 feet separation between lines (allowable for temporary crosswalk markings only)
Excerpt

As defined in the DE MUTCD, long-term stationary work is work that occupies a location more than three (3) days. As such, this Policy requires that temporary pavement markings be installed in locations where work occupies a location more than three (3) days and the work requires continuous lane closures, lane shifts and/or other traffic pattern changes. In these situations, the temporary pavement markings shall be installed along with the other temporary traffic control, prior to work beginning. For these types of operations, all temporary pavement markings shall comply with Part 3 of the DE MUTCD regarding the design and use of longitudinal and transverse pavement markings. At a minimum, the following markings, if applicable for the specified location, shall be used:

- Centerline
- Edge line
- Broken Lane lines, if applicable
- Turn arrows and lane drop arrows
- Turn lane and lane drop dotted lines
- Turning tracks within intersections, if delineation of turning paths is needed
- Stop lines
- Crosswalks that are to remain in use during construction (two 12-inch wide parallel markings separated by a distance of 6 feet placed perpendicular to approaching traffic is allowable for temporary crosswalks)
- Railroad crossing pavement markings
- Bike symbols, if applicable
- Raised/recessed pavement markers when required by the DE MUTCD or as directed by the Traffic Section.
Section 6F.78 Temporary Pavement Markings

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.

Single solid yellow center line prohibited on a two-way road per Part 3

S. Governors Ave, Webbs Ln to Water St
Section 6F.78 Temporary Pavement Markings

Minimum width of temporary longitudinal markings is 4 inches per DelDOT’s Temporary Pavement Markings Policy

State St, Millsboro
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

S. Governors Ave, Webbs Ln to Water St
03 Except in emergency situations, flagger stations shall be illuminated at night.

04 Floodlighting shall not produce a disabling glare condition for approaching road users, flaggers, or workers.

Guidance:

05 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:

06 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*
Section 6F.85 Temporary Traffic Barriers

Guidance:

04 Because the protective requirements of a TTC situation have priority in determining the need for temporary traffic barriers, their use should be based on an engineering study.

- Use of temporary traffic barrier based on engineering study

Movable barrier provides positive protection for nighttime double lane closure

Movable barrier provides shoulder closure during non-working hours

I-95 Median Barrier Replacement
DelDOT DGM 1-21 provides guidance for use of positive protection in work zones

- Work area with no escape route
- Long-term stationary projects
- Vertical differences (Table 6G-1)
- Storage of equipment (Table 6G-2)
Section 6F.85 Temporary Traffic Barriers

Standard:

05 Temporary traffic barriers shall be supplemented with standard delineation, pavement markings, or channelizing devices for improved daytime and nighttime visibility if they are used to channelize vehicular traffic. The delineation color shall match the applicable pavement marking color.

Standard:

05D (DE Revision) For enhanced conspicuity, non-directional retroreflective panels (see Figure 6F-8) shall be 6-inch wide and 12-inch high with rounded corners. The non-directional retroreflective panel shall have fluorescent orange, prismatic retroreflective sheeting on both sides.

05E (DE Revision) When used, non-directional retroreflective panels shall be placed at 50-foot intervals. The first panel shall be mounted within 10 feet of the leading edge of barrier.

• DE Standard:
  
  Enhanced conspicuity, non-directional retroreflective panels used to delineate barrier

  50-ft panel spacing; first panel within 10 ft of leading edge
Section 6F.85 Temporary Traffic Barriers

- Barrier and corresponding end treatment shall be crashworthy

- End treatments per AASHTO “Roadside Design Guide”
  - Flare end outside clear zone
  - Install crashworthy cushion

Drums are not compliant barrier end treatments

Milton Rail to Trail Conversion
Section 6F.85 Temporary Traffic Barriers

Leading edge of barrier should be offset full width of shoulder

SR 1, North Frederica Grade Separated Intersection
New typical applications depicting barrier applications

Figure 6H-5. Shoulder Closure on an Interstate, Freeway, or Expressway with a Temporary Traffic Barrier (TA-5)

(Delaware Revision)

Figure 6H-34. Lane Closure on a Multi-Lane, Divided Highway with a Temporary Traffic Barrier (TA-34)

(Delaware Revision)

Notes: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.

The distance between the advance warning signs and the sign legends should be based on the interstate/expressway/freeway criteria in Table 6H-3 unless site specific constraints require a reduced sign spacing.
Section 6F.86 Crash Cushions

• **DE Guidance:** Sand crash cushions generally reserved for short-duration maintenance

• **DE Guidance:** Sand crash cushions should not be installed where reverse strikes are possible
Impact attenuators should be installed per manufacturer’s instructions (to avoid “snagging” motorists)
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
Guidance:

17A (DE Revision) If the work operation requires a flagger to assist work vehicles entering or exiting the work area or to periodically control traffic, flagger signs (see Section 6F.31) should be used in addition to the typical advance warning signs for each application. If used, the flagger signs should be located at the downstream end of the advance warning area, which typically corresponds with the beginning of a transition taper.

• DE Guidance: Supplemental Flagger signs when flagger assists work vehicles entering and exiting the work area

Supplemental FLAGGER AHEAD sign should be installed upstream of flagger station

SR 141, Kirkwood Hwy to Faulkland Rd
Sections 6G.05 – 6G.19

• 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.

Option:
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.
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 divestures 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

- **DE Standard:** **Vertical difference treatments** based on Table 6G-1 criteria

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### Table 6G-1. Vertical Difference (Delaware Revision)

<table>
<thead>
<tr>
<th>Type of Vertical Difference</th>
<th>Criteria</th>
<th>Height (H) of Vertical Difference</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 in &lt; H ≤ 2 in</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>No channeling devices required</td>
<td>- For differences along or between traveled ways, the UNABLE LANE (WS-11) sign shall be used</td>
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</tr>
<tr>
<td>Standard</td>
<td></td>
<td>- For differences between the traveled way and shoulder or at the edge of pavement, the LOW SHOULDER (WB-9) sign shall be used</td>
<td></td>
</tr>
<tr>
<td>Guidance</td>
<td></td>
<td>- Shoulders ≥ 6 ft wide: Drums shall be used to delineate the vertical difference for up to 3 calendar days. If the vertical difference is not eliminated by the end of the 3rd calendar day, a 4 to 1 foot of wedge material shall be placed or temporary traffic barrier shall be installed.</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td></td>
<td>- Shoulder &lt; 6 ft wide: The Shoulder Drop Off (WS-17) sign shall be used until the vertical difference is eliminated</td>
<td></td>
</tr>
<tr>
<td>Guidance</td>
<td></td>
<td>- Throughout the duration of the vertical difference condition, drums should be placed between the traveled way and shoulder or along the edge of pavement</td>
<td></td>
</tr>
<tr>
<td>Option</td>
<td>No channeling devices required</td>
<td>TCC devices and correction may be omitted for new pavement surfaces with the Same Edge</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td></td>
<td>- Throughout the duration of the vertical difference condition, drums shall be placed between the traveled way and shoulder or along the edge of pavement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- If the vertical difference is within the traveled way or shoulder, the Shoulder Drop Off (WB-17) sign shall be used until the vertical difference is eliminated</td>
<td></td>
</tr>
<tr>
<td>Guidance</td>
<td></td>
<td>- Temporary traffic barrier should be considered</td>
<td></td>
</tr>
<tr>
<td>Transverse</td>
<td>No channeling devices required</td>
<td>- Exception for roadway obstacles such as manholes and utility valves, BUMP (WB-1) or DIP (WB-2) signs shall be installed</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td></td>
<td>- A ramp of a temporary roadway material shall be installed at a slope of 20 to 1 across the limits of the vertical difference, including the part of the pavement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Exception for roadway obstacles such as manholes and utility valves, BUMP (WB-1) or DIP (WB-2) signs shall be installed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- A ramp of a temporary roadway material shall be installed at a slope of 20 to 1 across the limits of the vertical difference, including the parts of an obstacle</td>
<td></td>
</tr>
</tbody>
</table>

---

1. *Per Section 14.14, the traveled way is defined as the portion of the roadway for the movement of vehicles, exclusive of the shoulders, berms, sidewalks, and parking lanes.*

2. *Channeling devices are not required if the vertical difference is located behind barriers, barriers, or vertical curbs.*

---

Sussex Road 213
## Section 6G.20 Vertical Difference

<table>
<thead>
<tr>
<th>Type of Vertical Difference</th>
<th>Criteria</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H ≤ 1 in</td>
<td>- For differences along or between traveled ways, the UNEVEN LANES (W8-11) sign shall be used.</td>
</tr>
<tr>
<td></td>
<td>1 in &lt; H ≤ 2 in</td>
<td>- For differences between the traveled way and shoulder or at the edge of pavement, the LOW SHOULDER (W8-9) sign shall be used.</td>
</tr>
</tbody>
</table>

### Notes:
- Longitudinal ≤ 10 ft from edge of traveled way.

**Example:** US 113 south of Milford
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></td>
<td>H ≤ 1 in</td>
</tr>
</tbody>
</table>
| Transverse                 | Standard | - Except for roadway obstacles such as manholes and utility valves, BUMP (W8-1) or DIP (W8-2) signs shall be installed.
|                            |          | - 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 |

- **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.20 Vertical Difference

DE Standard: **Pavement millings (or similar) used for wedge material at edge of pavement**

DE Guidance: **Base course material used for wedge material between traveled way and pavement box**

**HSIP NCC, SR 896 and Four Seasons Pkwy Intersection Improvement**

05  (DE Revision) Where a fillet of wedge material is used at the edge of pavement in accordance with Table 6G-1, pavement millings, or a similar suitable material, shall be used for the wedge material.

Guidance:

06  (DE Revision) Where a fillet of wedge material is used between a traveled way and pavement box in accordance with Table 6G-1, base course material should be used for the wedge material and should be placed at no greater than the slope specified in Table 6G-1. The base course material should be compacted after placement.
### 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></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>More than 25 mph</td>
<td>Drums</td>
</tr>
<tr>
<td></td>
<td>L &gt; 30 ft</td>
<td>All</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></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>
<tr>
<td></td>
<td>L &gt; 30 ft</td>
<td>All</td>
<td>None</td>
</tr>
</tbody>
</table>

- DE Standard: **Treated as roadside obstacle per Table 6G-2**

Oak Orchard Rd
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

Part 6; Section 6H.01
### 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}{60} )</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</td>
</tr>
<tr>
<td>Urban (high speed)*</td>
<td>350</td>
</tr>
<tr>
<td>Rural</td>
<td>500</td>
</tr>
<tr>
<td>Interstate / Expressway / Freeway</td>
<td>1,000</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.)

- Notice these distances are not necessarily minimums
- Too long can be just as bad
• Off-roadway work
  – Mowing
• Shoulder work
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*
• 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**
**TA-4 & TA-4A Short Duration or Mobile Operation on a Shoulder**

- **Case 20-A = TA-4 & TA-4A**

- **DE Standard:** TMA required for mobile operations on roads > 40 mph

- **DE Option:** TMA can be omitted for short duration work < 15 min if vehicle displays high-intensity, flashing, oscillating, or strobe lights

- **DE Option:** TMA and arrow board omitted from work vehicles that cannot support devices

- **Arrow board(s) in caution mode**
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>Work Within the Traveled Way of a Two-Lane Highway (see Section 6G.10) – also applicable to other roadway types, as noted</td>
<td></td>
</tr>
<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
Optional single flagger application reserved for short work zones along low-volume roads

Utility work along Old Lancaster Pk
• Alternate applications for TA-10 (flagger control) reserved for low-volume roads
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
• 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
Typical Applications

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.
Notes for Figure 6H-35—Typical Application 35
Short Duration and Mobile Operations on a Multi-Lane, Divided Highway
with a Single Lane Closure
(Delaware Revision)

Standard:
1. Arrow boards on the shadow vehicles shall, at a minimum, be Type B, with a size of 60 x 30 inches.
2. If used, vehicle-mounted signs shall be mounted in a manner such that they are not obscured by
   equipment or supplies. Sign legends on vehicle-mounted signs shall be covered or turned from view when
   work is not in progress.
3. Shadow and work vehicles shall display high-intensity rotating, flashing, oscillating, or strobe lights.
4. An arrow board shall be used when a lane is closed. When more than one lane is closed, a separate
   arrow board shall be used for each closed lane.
5. When a side road or entrance ramp intersects the highway within the TTC zone, additional TTC
   devices shall be placed as needed.

Guidance:
6. Vehicles used for these operations should be made highly visible with appropriate equipment, such as signs
   or arrow boards.
7. Work should normally be accomplished during off-peak hours to the extent practical.
8. Whenever adequate stopping sight distance exists to the rear, the shadow vehicles should maintain the
   minimum distance from the preceding vehicle and proceed at the same speed. The shadow vehicles should slow
   down in advance of vertical or horizontal curves that restrict sight distance.

Option:
9. The minimum distance between the shadow vehicles may vary according to terrain and other factors, such as the
   manufacturer’s recommendations for the truck-mounted attenuator.
10. Shadow Vehicle 4 may be used where adequate shoulder width is available to display a portable changeable
    message sign.

Guidance:
11. If used, Shadow Vehicle 4 should be located upstream of queued traffic to advise motorists of the potential for
    stopped vehicles.

Standard:
12. Except as provided in Notes 14 and 15 or as denoted as optional in Figure 6H-35, the work and shadow
    vehicles shall be equipped with truck-mounted attenuators for operations on roadways with a posted speed
    limit or 85th-percentile speed greater than 40 mph.

Option:
13. Arrow boards may be omitted from work vehicles that cannot support the installation of an arrow board.
14. Truck-mounted attenuators may be omitted from specialized work vehicles, such as sweeper, vacuum, and
    pothole patching trucks, and other work vehicles that cannot support the installation of a truck-mounted
    attenuator.
15. For short duration operations of 15 minutes or less along roadways with a posted speed limit or 85th-
    percentile speed greater than 40 mph, truck-mounted attenuators may be omitted if a vehicle with activated high-intensity
    rotating, flashing, oscillating, or strobe lights is used or if the shoulder width is less than the width of a truck-
    mounted attenuator.
16. 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.

Part 6; Section 6H.01
What if the work is in the center lanes?

A very well thought out TTC plan should be developed, that’s what
• 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
• Work within traveled way of urban street
  – Lane closure on subdivision street
  – Detour

<table>
<thead>
<tr>
<th>Typical Application Description</th>
<th>Typical Application Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane Closure on a Minor Street</td>
<td>TA-18</td>
</tr>
<tr>
<td>Detour for One Travel Direction</td>
<td>TA-20</td>
</tr>
<tr>
<td>Detour for a Closed Street</td>
<td>TA-20</td>
</tr>
<tr>
<td>Detour</td>
<td>TA-20</td>
</tr>
<tr>
<td>Work Within the Traveled Way of an Urban Street</td>
<td>TA-18, TA-20</td>
</tr>
<tr>
<td>(see Section 6C.11) – also applicable to other</td>
<td>-</td>
</tr>
<tr>
<td>roadway types, as noted</td>
<td>-</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
• 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>Typical Application Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Two-Lane Conventional Road</td>
</tr>
<tr>
<td>Work Within the Traveled Way at an Intersection and on Sidewalks (see Section 6G.13)</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>
</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>
</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>
</tr>
<tr>
<td>Half Road Closure on the Far Side of an Intersection</td>
<td>Not applicable in Delaware</td>
</tr>
<tr>
<td>Multiple Lane Closures at an Intersection</td>
<td>TA-23 (≤ 40 MPH) or TA-33 (&gt; 40 MPH)</td>
</tr>
<tr>
<td>Closure in the Center of an Intersection</td>
<td>Not applicable in Delaware</td>
</tr>
<tr>
<td>Closure at the Side or Center of an Intersection</td>
<td>TA-27</td>
</tr>
<tr>
<td>Sidewalk Detour or Diversion</td>
<td>TA-28</td>
</tr>
<tr>
<td>Crosswalk Closures and Pedestrian Detours</td>
<td>TA-29</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

**Don’t over-ride the signal**

Title 21, Chapter 41
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>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>Two-Lane Conventional Road</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>Temporary Reversible Lane Using Moveable Barriers</td>
<td>-</td>
</tr>
<tr>
<td>Work in the Vicinity of a Grade Crossing (see Section 6G.18)</td>
<td>TA-46</td>
</tr>
<tr>
<td>Work in the Vicinity of a Grade Crossing</td>
<td>-</td>
</tr>
</tbody>
</table>
TA-46. Work in the Vicinity of a Grade Crossing

- 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

- BE PREPARED TO STOP (W3-4)
- CENTER LANE CLOSED AHEAD (W9-3)
- EXIT CLOSED (E5-2a)
- END DETOUR (M4-8a)
- DETOUR (M4-9)
- DETOUR (M4-10)
Section 6I.02 Major Traffic Incidents

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
Section 6I.03 Intermediate Traffic Incidents

Support:
01 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.

02 Guidance:
03 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 6I.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

SR 1, SR 24 to north of US 9 (Third Lane)
Where Are We?

Just a couple announcements and we’re out of here...
What is/are in the Other Modules?

- Introduction and Part 1 (General)
  - 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
What is/are in the Other Modules?

- Part 2 ( Signs ) – ground based only
  - 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
What is/are in the Other Modules?

- Part 3 (Markings)
  - General (colors, dimensions, materials, retroreflectivity)
  - Pavement and curb markings
  - Delineators
  - Colored pavements
  - Channelizing devices
  - Islands
  - Rumble strip markings
Where Can I Find This Stuff?


- Delaware MUTCD: [www.mutcd.deldot.gov](http://www.mutcd.deldot.gov)

- Delaware T² Center: [http://www.ce.udel.edu/dct/T2.html](http://www.ce.udel.edu/dct/T2.html)

- These slides: [http://www.ce.udel.edu/dct/T2TechBriefs.html](http://www.ce.udel.edu/dct/T2TechBriefs.html)
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