MOT Common Problems and Best Practices to Improve Safety in Work Zones

February 17, 2009

Richard Toulson
DelDOT Traffic
Causes of Work Zone Crashes/Incidents

- Unexpected or confusing situations
- Obstructions
- Diverted attention
- Exposed workers
- Improper Temporary Traffic Control Setup
Hazard Identification

Restricted Sight Distance
Hazard Identification

Restricted Sight Distance at Construction Access
Accessibility For All Users

All road users shall be accommodated:

- Motorists
- Bicyclists
- Pedestrians, including persons with disabilities in accordance with ADA
Temporary Traffic Control Devices

- Signs
- Barricades
- Channelizing Devices
  - Cones
  - Drums
- Concrete Barriers
- Pavement Markings
- Arrow Panels

- Portable Changeable Message Signs
- Warning Lights
- Traffic Signals
- Truck Mounted Attenuators
Common Problems - Signing

- Inapplicable signs not being completely covered, removed or turned away from traffic
- Improper sign mounting
- Improper spacing
- Improper height
- Sign obstructions (foliage, other signs) or poor sign placement affecting sight distance
Poor Sign Spacing
Common Problems - Sign Supports

Improper Breakaway Sign Support
Unacceptable Portable Sign Mounting
Unacceptable Pedestrian Signing
Detour Signing

Acceptable

Unacceptable
Sign Placement/Coordination
Sign Placement/Coordination
Unacceptable Method of Covering Signs
Acceptable Method of Covering Signs
Sign Respect
Sign Respect
Unacceptable Signing on Barricades
Common Problems - Barricades

Missing Type B Warning Lights
Common Problems - Channelizing Devices

- Improper drums (not meeting material specification and/or reflective striping specification)
- Lack of reflective collars on cones at night
- Improper spacing, both laterally and longitudinally
- Inadequate shoulder, taper, and/or buffer lengths
Common Problems - Taper/Buffer Lengths

- Posted speeds are not being used to establish the safest temporary traffic control setup
Common Problems - Taper/Buffer Lengths
Common Problems - Taper/Buffer Lengths
Common Problems - Taper/Buffer Lengths
Cones

- Minimum height of 28 inches for all operations
- Cones not to be used for nighttime operations (unless for a single nighttime emergency operation)
- If Cones are used at night, they should be retroreflectorized for maximum visibility
Unacceptable Cones
Drums

- Effective 12/31/09, the horizontal markings on drums shall be fluorescent orange and white prismatic retroreflective sheeting
- 1 Amber Type B flashing light shall be installed on each of the first 2 drums in series used for channelization
- 1 Amber Type B flashing light shall be installed on the drum at the end of the work space
- If all drums meet the new sheeting requirements, lights are not required.
Unacceptable Drums
Common Problems - Temporary Concrete Barrier

- Improperly flared barrier end sections
- Improper advance channelization
- Improper delineation
- Reflectors improperly mounted on flared barrier end sections (reflectors are prohibited on flared barrier end sections)
- Missing/unseated joints
- Defective/cracked barriers
Common Problems - Defective/Cracked Barrier
Common Problems - Missing/Unseated Joints
Temporary Traffic Barriers - End Treatments

- For posted speeds greater than 30 MPH, an impact attenuator or crash cushion shall be installed at the end of barrier if less than 30 ft from the travelway.

- For posted speeds of 30 MPH or less, a tapered end shall be installed (unless otherwise directed by the Chief Traffic Engineer).
Common Problems - End Treatments

- Improper Installation
- Improper Sign Storage
Common Problems - End Treatments

Unacceptable within Clear Zone

Unacceptable over 30 mph

Unacceptable
Truck-Mounted Attenuators (TMAs)

- TMAs required by 16 of 25 cases in DelDOT MUTCD - Part 6
- TMAs are required on all limited access highways and highways with 4 or more lanes with posted speeds of 45 mph or greater for the following:
  - Pavement marking
  - Roadside spraying
  - Patching
  - Rotomilling
  - Sweeping
  - Temporary traffic barrier placement
  - Others as directed by the Chief Traffic Engineer
- All vehicles with TMAs shall have arrow panels
Common Problems - Pavement Markings

- Unnecessary pavement markings not being completely removed
- Improper application of temporary pavement markings
Unacceptable Pavement Marking Removal
Unacceptable Pavement Marking Removal
Unacceptable Pavement Marking Removal
Unacceptable Temporary Marking Installation
Common Problems - Arrow Panels

- Not properly aimed to provide maximum visibility
- Maintenance, especially bulb replacement
- Not dimmed during nighttime
Acceptable Arrow Panel Placement
Arrow Panels

Caution Mode

Aiming
Unacceptable Arrow Panel Placement
Unacceptable Arrow Panel Use
Flagger Operations

Qualifications

- All flaggers (except emergency personnel and law enforcement officers), shall be certified by a DelDOT-recognized flagger certification program.

Apparel

- Class 3 vests
- Orange head gear
Common Problems - Flagging

- Improper flagging techniques
- Incorrectly using STOP/SLOW paddles
- Using inadequate two-way radios
Flagging During Nighttime

- Flagger stations shall be illuminated at night (except in emergency situations)
Vertical Difference Guidelines

- Vertical Difference is created whenever a difference in grade of more than 1” exists.

- Vertical Difference treatments shall meet the requirements indicated in Table 6G-1.
# Vertical Difference Guidelines

**DelDOT MUTCD - Table 6G-1**

<table>
<thead>
<tr>
<th>Type of Vertical Difference</th>
<th>Type of Direction</th>
<th>Height of Vertical Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal, c ≤ 3.7 m (12 ft) from edge of Traversable</td>
<td>Standard</td>
<td>≤ 25 mm (1 in) to &lt; 50 mm (2 in)</td>
</tr>
<tr>
<td></td>
<td>No channelizing devices required</td>
<td>For differences along or between traveys, the UNEVEN LANES (W8-11) sign shall be used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For differences between the travey and a shoulder, or at the edge of pavement less than 3 m (10 ft) from the travey, the LOW SHOULDER (W8-9) sign shall be used</td>
</tr>
<tr>
<td></td>
<td>Guidance</td>
<td>Wedge not required, however, vertical difference should be eliminated no later than the following day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drums should be used throughout vertical difference condition</td>
</tr>
<tr>
<td></td>
<td>Standard</td>
<td>No channelizing devices required</td>
</tr>
<tr>
<td>Transverse Standard</td>
<td>No channelizing devices required</td>
<td>BUMP (W8-1) or DIP (W8-2) sign shall be used</td>
</tr>
</tbody>
</table>

(1) Unless otherwise directed by the Chief Traffic Engineer or designee.

(2) No channelizing devices are required if the vertical difference is:
- out of right of way
- behind guardrail, barrier, or curb

(3) No channelizing devices are required if the vertical difference is further than 3.7 m (12 ft) from the edge of the roadway.

The edge of the travey shall be defined as the white stripe. If there is no white line, the curb or the edge of pavement shall be the edge of the travey.

Where:  < = “Less than”  ≤ = “Less than or equal to”  ≥ = “Greater than or equal to”  > = “Greater than”
Unacceptable Vertical Differences
Storage of Equipment

- Storage areas shall be treated as a road side obstacle
Table 6G-2. Storage of Equipment
(DeLDOT MUTCD Only)

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance from Travelway*, L (feet)</th>
<th>Speed, V (mph)</th>
<th>Required Channelizing Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammable Materials (fuel, propane, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All roadways</td>
<td>$L &lt; 30$</td>
<td>All</td>
<td>Temporary Traffic Barrier</td>
</tr>
<tr>
<td></td>
<td>$L &gt; 30$</td>
<td>All</td>
<td>Drums (Expressway)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>None (Other Roadways)</td>
</tr>
<tr>
<td>Equipment and All Other Materials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expressway / Freeway</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$L \leq 30$</td>
<td>All</td>
<td>Temporary Traffic Barrier</td>
</tr>
<tr>
<td></td>
<td>$L &gt; 30$</td>
<td>All</td>
<td>Drums</td>
</tr>
<tr>
<td>All other roadways</td>
<td>$0 \leq L \leq 12$</td>
<td>$V \leq 25$</td>
<td>Drums</td>
</tr>
<tr>
<td></td>
<td>$V &gt; 25$</td>
<td></td>
<td>Temporary Traffic Barrier</td>
</tr>
<tr>
<td></td>
<td>$12 &lt; L \leq 30$</td>
<td>$V \leq 25$</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>$V &gt; 25$</td>
<td>$L &gt; 30$</td>
<td>Drums</td>
</tr>
</tbody>
</table>

< “Less than”
≤ “Less than or equal to”
> “Greater than”

* The edge of the travelway shall be defined as the white stripe (see diagram below). If there is no white line, the curb or the edge of pavement shall be the edge of the travelway.
Questions