

FHWA Roadway Departure Technology Transfer  
**Roadside Safety Systems Installer Training**

**Session 5:**  
**Temporary Traffic Control**  
**Through the Work Area**

# Course Topics

- Session 4 – Pre-Installation Considerations
- **Session 5 – Temporary Traffic Control Through the Work Area**

# Session 5 Objectives

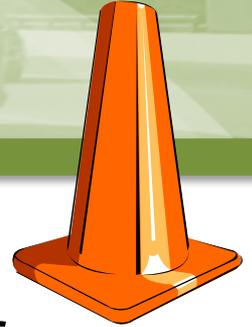
- Understand the importance of safely routing traffic through or around work areas.
- Use the Delaware MUTCD, Part 6 to design and implement effective temporary traffic control plans.

# Session 5 Outline

- Introduction
- Temporary Traffic Control Standards
- Temporary Traffic Control Plan
- Temporary Traffic Control Zone
- Temporary Traffic Control Devices
- Typical Applications
- Coordination of Work and Temporary Traffic Control
- Protection of Unfinished Work



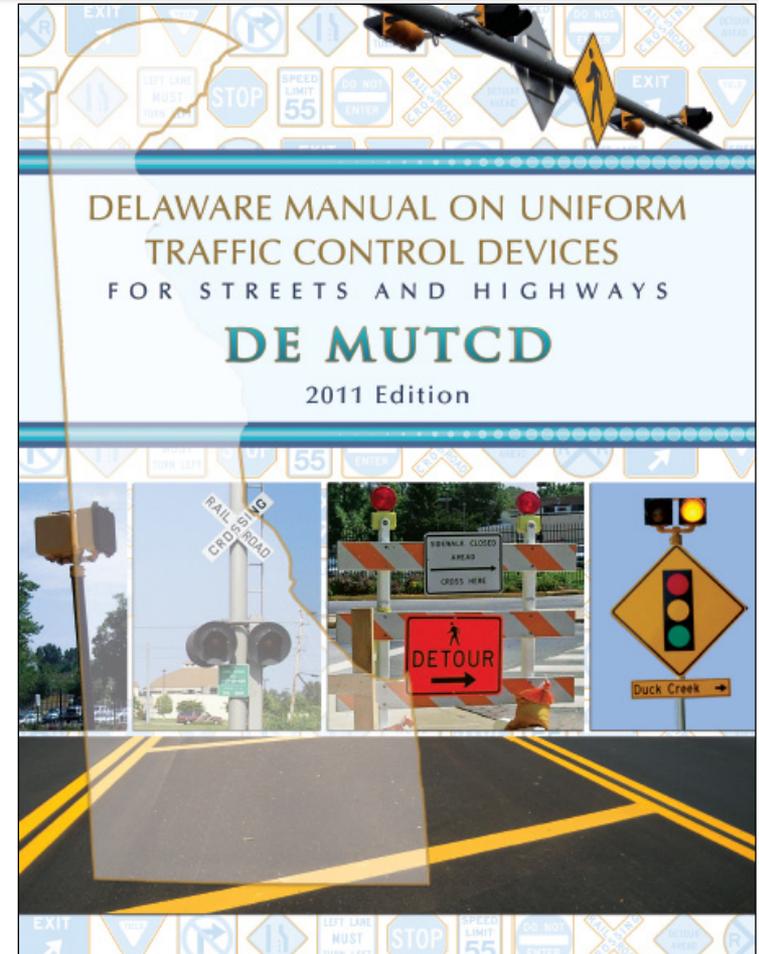
# Introduction



- Functions of temporary traffic control:
- Provide for the safe and efficient movement of vehicles, bicyclists, and pedestrians through or around temporary traffic control zones.
  - Protect workers, equipment and unfinished work.
  - Provide for the efficient completion of whatever activity interrupted the normal use of the roadway.
  - Traffic control selected for each situation depends on type of highway, road user conditions, duration of operation, physical constraints, and the proximity of the work space to road users.

# The MUTCD

- Governs the design and usage of temporary traffic control devices in Delaware.
- Applies to ALL streets and highways open to the public.



# Temporary Traffic Control Plan

- Temporary Traffic Control Plan (TTCP): a graphic representation of a work site showing the temporary traffic control designed for a project.
- Essential elements shown on the plan:
  - The existing geometrics of a roadway and it's associated features (i.e. curb/shoulder lines, pavement markings, adjacent land use)
  - The limits of the work space
  - The traveled way
  - All temporary traffic control devices to be used

# Temporary Traffic Control Plan

- TTCP is supplemented with notes and possibly additional drawings of particular items. Written text supplies specific information to supplement the graphics where necessary.
- The plan may be very simple or very complex, depending on the activity involved.



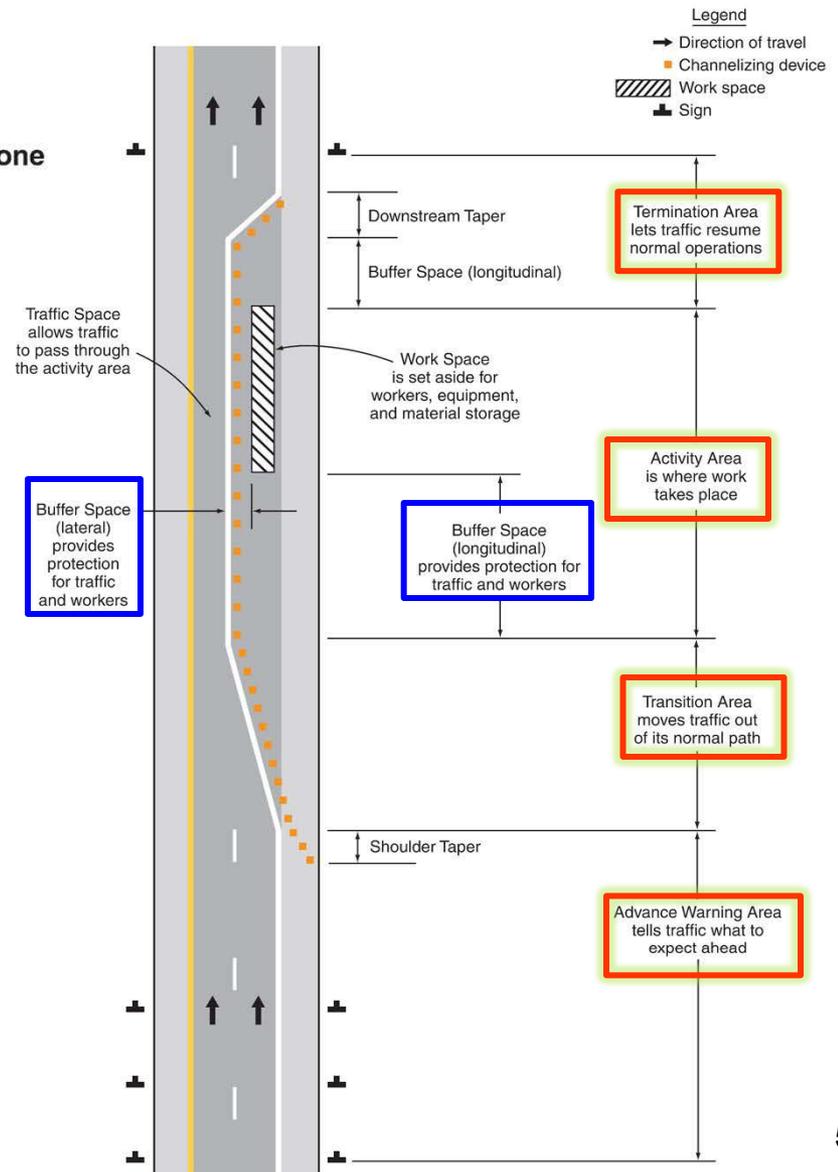
# Temporary Traffic Control Zone (TTCZ) Definition

- The entire section of roadway between
  - The first advance warning sign (or device)
  - Through the last temporary traffic control device, where traffic returns to its normal path



# Parts of a TTCZ

Figure 6C-1. Component Parts of a Temporary Traffic Control Zone

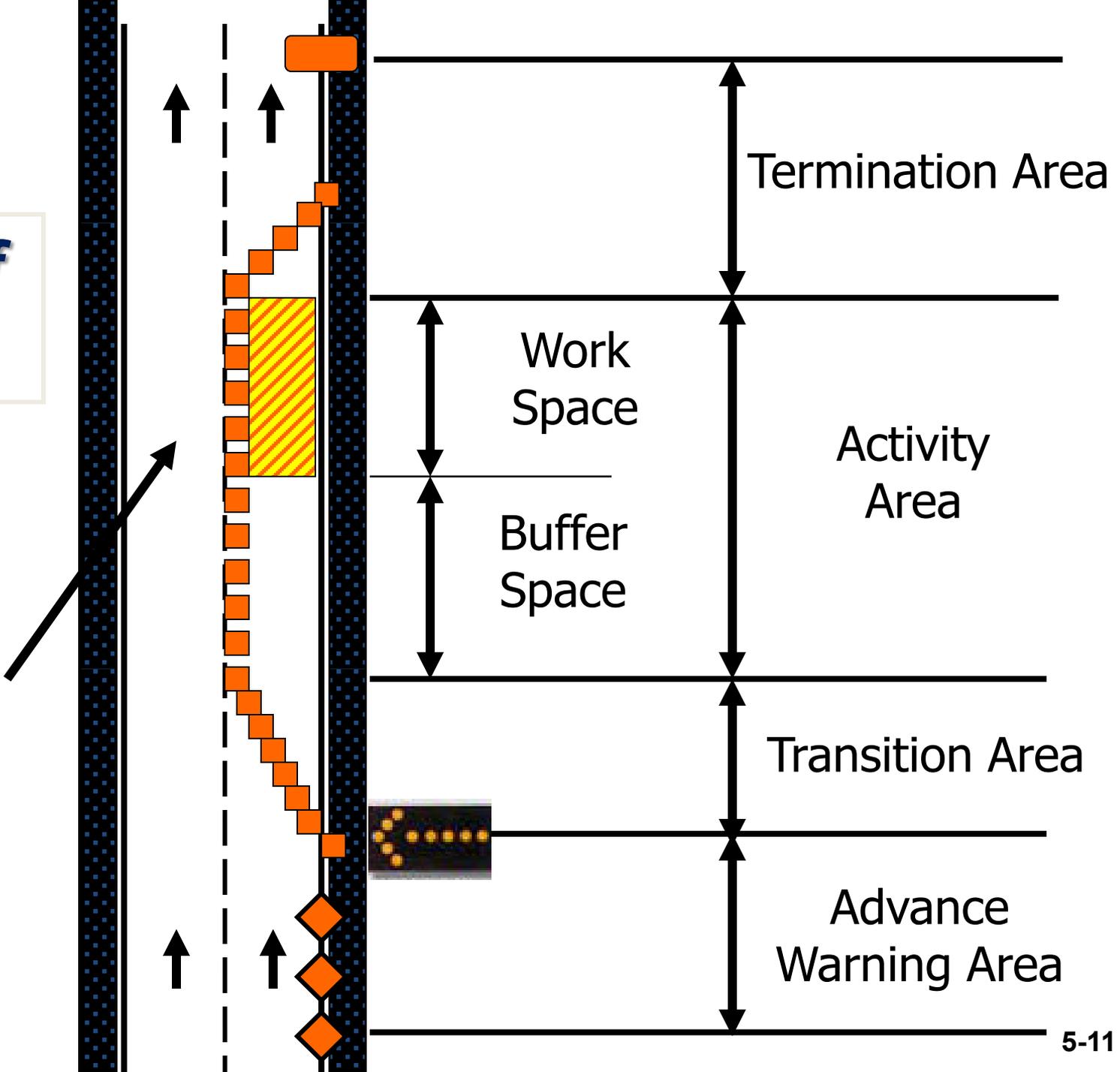


Ref: DELDOT MUTCD, Figure 6C-1, Pg. 6C-3

June 2011

**Parts of  
a TTCZ**

Traffic  
Space



# Advance Warning Area

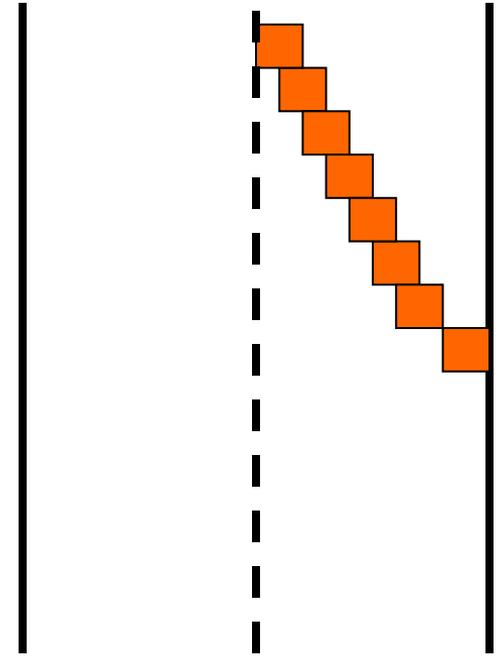
## ➤ Provides

- Warning
- Information
- Actions to take  
**IN ADVANCE!!!**



# Transition Area

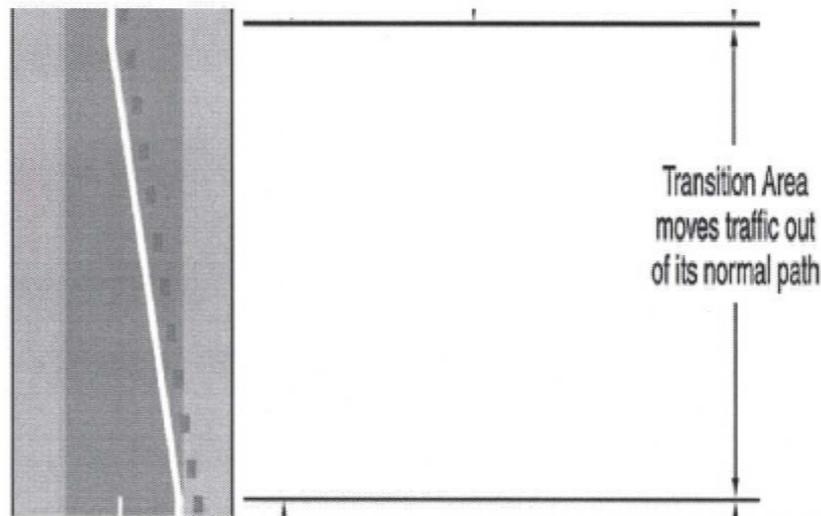
- Traffic is moved from the normal travel lanes.
- May contain various types of “**tapers**” to close lanes or move traffic.
- Required for lane closures.



# Components of Highway Work Zones

## ➤ Transition Area

- Section of highway where road users are directed out of their normal path.
- Tapers are generally used:
  - Merging taper
  - Shoulder taper
  - Lane shift taper



# Components of Highway Work Zones

- Tapers

$$L = \frac{WS^2}{60}$$

$$S \leq 40 \text{ MPH}$$

$$L = WS$$

$$S > 40 \text{ MPH}$$

L = taper length in feet

W = width of offset in feet

S = posted speed limit or off-peak 85<sup>th</sup> percentile speed prior to work starting



# Components of Highway Work Zones

Type of Taper	Taper Length
Merging Taper	at least L
Shifting Taper	0.5L to L*
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	50 feet minimum, 100 feet maximum
Downstream Taper	50 feet minimum, 100 feet maximum

# Activity Area

## 3 Sub-areas

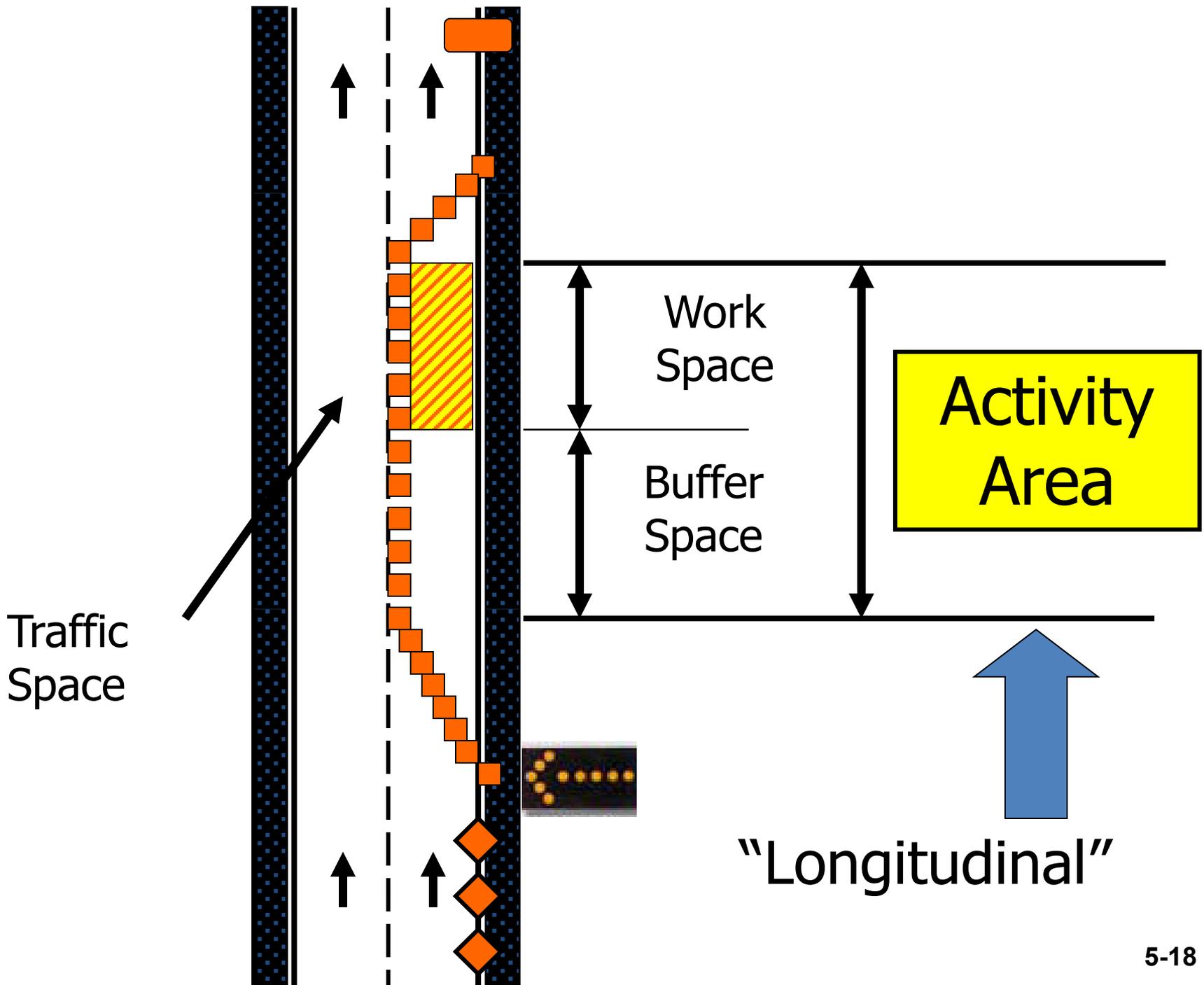
### ➤ **Buffer Spaces**

- Longitudinal
- Lateral

### ➤ **Work Space**

### ➤ **Traffic Space**





# Longitudinal Buffer Space

- Optional recovery area for errant vehicles
- Protects **BOTH** workers & motorists
- **COMPLETELY** empty
  - No vehicles, equipment or materials
- Provide a buffer space unless you have a documented reason not to based on engineering judgment

**Based on stopping sight distances**

# Stopping-Sight Distance as a Function of Speed

**Table 6C-2. Stopping Sight Distance as a Function of Speed**

Speed*	Distance
20 mph	115 feet
25 mph	155 feet
30 mph	200 feet
35 mph	250 feet
40 mph	305 feet
45 mph	360 feet
50 mph	425 feet
55 mph	495 feet
60 mph	570 feet
65 mph	645 feet
70 mph	730 feet
75 mph	820 feet

Ref: DELDOT MUTCD,  
Table 6C-2, Pg. 6C-5  
June 2011

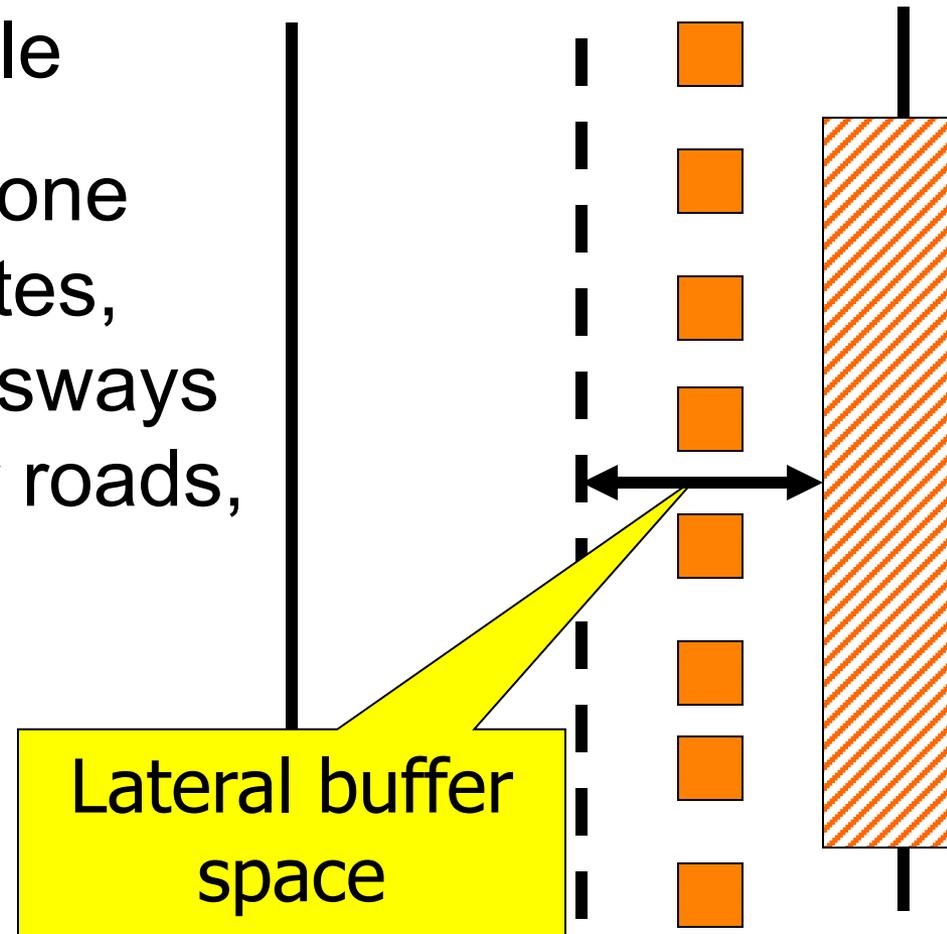
\* Posted speed, off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed

# Longitudinal Buffer Space



# Lateral Buffer Space

- No set distance or table
- Recommend width of one travel lane on Interstates, Freeways and Expressways in Delaware. All other roads, lateral buffer space is optional.
- Based on engineering judgment



# Work Space



- Where the actual work takes place
  - Workers
  - Equipment and materials
  - Work vehicles
    - Truck-mounted attenuator

# Traffic Space

- The space open for motorists to pass safely.

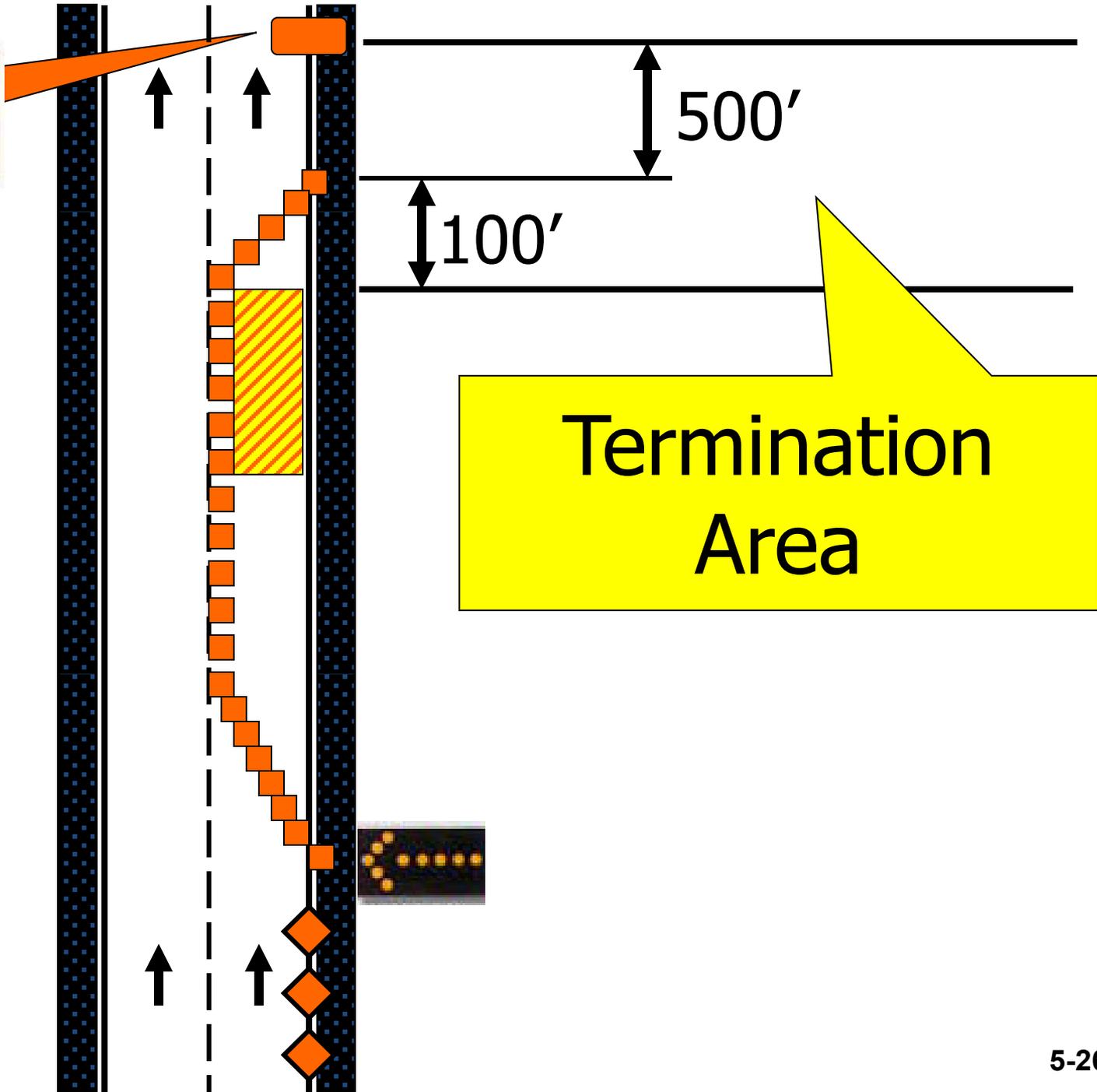


# Termination Area

- End of TTCZ
- Resume normal driving
- May contain (optional):
  - **END ROAD WORK**
  - Downstream taper
    - Min. 100 ft. per lane reopened



END  
ROAD WORK



# Temporary Traffic Control Devices

- The Temporary Traffic Control Plan is implemented utilizing Temporary Traffic Control Devices (TTCD's) that provide motorists with regulations, information and guidance.
- Devices commonly used in guardrail activities:
  - Signs
  - Channelizing Devices: Cones, Drums
  - Arrow Panels
  - Flaggers
  - Truck Mounted Attenuators (TMA's)
  - Portable Changeable Message Signs
  - Beacons/Strobe Lights on all vehicles, including construction equipment (Required)

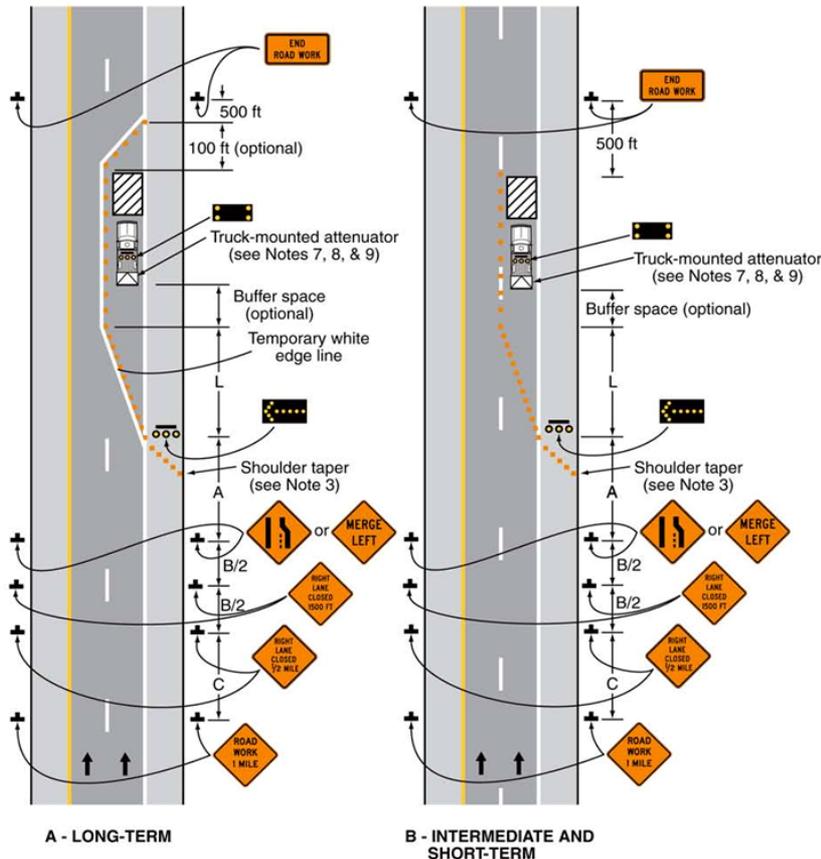


# Typical Applications

- Chapter 6H of the 2011 DE MUTCD presents typical applications for a variety of situations commonly encountered.
  - While not every situation is addressed, the information illustrated can generally be adapted to a broad range of conditions.
  - In many instances, an appropriate temporary traffic control plan is achieved by combining features from various typical applications.
  - Applying these guidelines to actual situations and adjusting to field conditions requires judgment. In general, the procedures illustrated represent minimum solutions for the situations depicted.
  - Be sure to read the notes and options that appear in the 2011 DE MUTCD tables.

# Typical Applications

**Figure 6H-33. Stationary Lane Closure on a Multi-Lane, Divided Highway (TA-33)  
(Delaware Revision)**



**Typical Application 33**

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.

**Notes for Figure 6H-33—Typical Application 33  
Stationary Lane Closure on a Multi-Lane, Divided Highway  
(Delaware Revision)**

**Standard:**

1. This TTC zone application also shall be used when work is being performed in the lane adjacent to the median on a multi-lane, divided highway. In this case, the LEFT LANE CLOSED signs and the corresponding Lane Ends (or MERGE RIGHT) signs shall be substituted.
2. When a side road or entrance ramp intersects the highway within the TTC zone, additional TTC devices shall be placed as needed.

**Guidance:**

3. When paved shoulders having a width of 8 feet or more are closed, channelizing devices should be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.
4. On multi-lane, undivided roads and multi-lane, divided highways with narrow medians, the advance warning signs on the left-hand side of the directional roadway should be eliminated.

**Support:**

5. Where conditions permit, restricting all vehicles, equipment, workers, and their activities to one side of the roadway might be advantageous.

**Standard:**

6. 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.
7. For long-term, intermediate-term, and short-term operations, a truck-mounted attenuator shall be used on roadways with a posted speed limit or 85<sup>th</sup>-percentile speed greater than 40 mph.

**Option:**

8. For short duration operations of 15 minutes or less along roadways with a posted speed limit or 85<sup>th</sup>-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.
9. Truck-mounted attenuators may be used for all operations along roadways with a posted speed limit or 85<sup>th</sup>-percentile speed less than or equal to 40 mph.

**Guidance:**

10. When a grade crossing exists within or upstream of the transition area and it is anticipated that queues resulting from the lane closure might extend through the grade crossing, the TTC zone should be extended so that the transition area precedes the grade crossing (see Figure 6H-46).
11. Early coordination with the railroad company or light rail transit agency should occur before work starts (see Figure 6H-46).

**Option:**

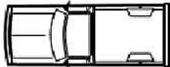
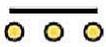
12. A flagger or a uniformed law enforcement officer may be used at the upstream side of the grade crossing to minimize the probability that vehicles are stopped within 50 feet of the grade crossing, measured from both sides of the outside rails (see Figure 6H-46).

**Guidance:**

13. When a grade crossing equipped with active warning devices exists within the activity area, provisions should be made for keeping flaggers informed as to the activation status of these warning devices (see Figure 6H-46).

# DelDOT Symbols on Typical Applications

**Table 6H-2. Meaning of Symbols on Typical Application Diagrams  
(Delaware Revision)**

	Arrow board		Shadow vehicle
	Arrow board support or trailer (shown facing down)		Sign (shown facing left)
	Changeable message sign or support trailer		Surveyor
	Channelizing device		Temporary barrier
	Crash cushion		Temporary barrier with retroreflective enhanced conspicuity panel
	Direction of temporary traffic detour		Traffic or pedestrian signal
	Direction of traffic		Truck-mounted attenuator
	Flagger		Type 3 barricade
	High-level warning device (Flag tree)		Warning light
	Longitudinal channelizing device		Work space
	Luminaire		Work vehicle
	Pavement markings that should be removed for a long-term project		

# Typical Applications

**Table 6H-1. Index to Typical Applications (Sheet 1 of 2)  
(Delaware Revision)**

Typical Application Description	Typical Application Number		
	Two-Lane Conventional Road	Multi-Lane Conventional Road	Interstate, Freeway, or Expressway
<b>Work Outside of the Shoulder (see Section 6G.06)</b>			
Work Beyond the Shoulder > 10 Feet from the Edge of the Traveled Way	TA-1	TA-3A	TA-5 or TA-5A
Work Beyond the Shoulder ≤ 10 Feet from the Edge of the Traveled Way	TA-3	TA-3A	TA-5 or TA-5B
Off-Roadway Mowing Operations	TA-1A	TA-1B	TA-1B
Blasting Zone	TA-2	TA-2	TA-2
<b>Work on the Shoulder (see Sections 6G.07 and 6G.08)</b>			
Work on the Shoulders	TA-3	TA-3A	TA-5 or TA-5B
Short Duration or Mobile Operation on a Shoulder	TA-4	TA-4A	TA-4A
Shoulder Work with Minor Encroachment	TA-6 (≤ 40 MPH) or TA-10 (> 40 MPH)	TA-33	TA-33
<b>Work Within the Traveled Way of a Two-Lane Highway (see Section 6G.10) – also applicable to other roadway types, as noted</b>			
Road Closed with a Diversion	TA-7	TA-7	TA-7
Roads Closed with an Off-Site Detour	TA-20	TA-20	TA-20
Overlapping Routes with a Detour	TA-20	TA-20	TA-20
Lane Closure on a Two-Lane Road Using Flaggers	TA-10	-	-
Lane Closure on a Two-Lane Road with Low Traffic Volumes	TA-11 or TA-11A	-	-
Lane Diversion on a Two-Lane Road with Low Traffic Volumes	TA-11B	-	-
Lane Closure on a Two-Lane Road Using Traffic Control Signals	TA-12	-	-
Temporary Road Closure	TA-13	-	-
Haul Road Crossing	TA-14	TA-14	-
Work in the Center of a Road with Low Traffic Volumes	TA-15	-	-
Surveying Along a Two-Lane Road	TA-16	TA-35	TA-35
Mobile Operations on a Two-Lane Road	TA-17	-	-
Mobile Striping Operations on a Two-Lane Road	TA-17A or TA-17B	-	-
<b>Work Within the Traveled Way of an Urban Street (see Section 6G.11) – also applicable to other roadway types, as noted</b>			
Lane Closure on a Minor Street	TA-18	-	-
Detour for One Travel Direction	TA-20	TA-20	TA-20
Detour for a Closed Street	TA-20	TA-20	TA-20

# Typical Applications

- Most commonly used TA's for Guardrail Installation/repair
  - TA-3 – Work on Shoulder of a two-lane road
  - TA-3A – Work on Shoulder of a multi-lane, divided highway
  - TA-5B – Stationary lane closure for Shoulder work  $\leq$  10 ft. from the edge of the traveled way on an interstate, freeway or expressway.
  - TA-10 – Lane closure on a two-lane road using flaggers
  - TA-33 – Stationary lane closure on a multi-lane, divided highway.

Typically apply to Standard Installations and Guardrail maintenance activities.

# Coordination of Work and Temporary Traffic Control

- When conflicts arise between two or more activities being performed by different work forces, the people in charge of temporary traffic control for each project must coordinate so that temporary traffic control devices present a logical picture to the motorist.
- Avoid overlap with the TTC devices and confusion to traveling public.

# Coordination of Work and Temporary Traffic Control

- Follow whatever provisions exist to coordinate overlapping project activities. When there are no established provisions:
  - Recognize the problem.
  - Take steps to correct any serious misguidance to the motorist.
  - Identify the person in charge of the project causing the conflict.
  - Discuss potential corrective action needed and who should perform the action. Obtain agreement.
  - Get approval of the adjustments to the plan by the District Safety Officer
  - Follow up to ensure that the corrections were implemented.

# Protection of Unfinished Work

- The normal treatment of a site at the end of the work day is to reopen the closed lane.
  - Move upstream of the project, leaving the **END ROAD WORK** sign, if used, in view.
  - Pick up devices along the tangent and taper or move them to the edge of the shoulder.
  - Any signs that conflict with the situation should be completely removed or covered.

# Protection of Unfinished Work

- All equipment and any non-crashworthy devices should be removed from within the “clear space” or shielded with impact attenuators.
- Inspect the site before leaving, and inform the Transportation Management Center that work is suspended and the temporary traffic control removed.
- If the unfinished work leaves “gaps” in a guardrail system, or leaves a system such that it would not perform as it was designed in the event of an impact, it must be shielded from traffic.

# Protection of Unfinished Work

- If work was intended to be completed in one shift, but due to some circumstance it had to be stopped, the same level of safety must be maintained as when work was going on.
  - The unfinished work itself should not become a potential hazard. The best protection is the use of attenuators.
  - More devices, more retroreflectivity, and more signs may be needed. Remember, the non-work period may occur during hours of darkness.
  - Make a final inspection of the temporary traffic control system before leaving the site.
  - Informing the Transportation Management Center in this case is even more critical than in normal circumstances.

# Protection of Unfinished Work

- Guardrail Blunt Ends
  - Place temporary sand drum array
- Gaps in guardrail or unprotected roadside Features
  - Shield w/temporary PCC safety barrier and proper end treatments
  - Barrier installation in accordance w/DE MUTCD and manufacture's instructions
- Questions related to protection of unfinished work should be discussed with traffic safety PRIOR to starting any work.
- Traffic safety working on guidelines for the protection of unfinished guardrail work.

# Session 5 Outcomes

- Understand the importance of warning the traveling public of any disruption to the traffic flow resulting from barrier installation.
- Know how to use the 2011 DE MUTCD to design and maintain an effective temporary traffic control plan for the duration of the work.