# UVA Transportation Training Academy

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Construction Management and Training

**Work Zone Safety Device Check List – Truck Mounted Attenuator**

Virginia Work Area Protection Manual (Section 6F-95)(Page 6F-77)

When used:

A. When closing a lane on four or more lane roadway with posted speed of 45 mph or greater

B. On shoulders of multilane roadways with a posted speed of 45 mph or greater for operations with a duration greater than 60 minutes.

C. On shoulders, ramps and loops or interstate and Limited Access highways

D. When a mobile operation occupies all or part of the travel lane on a multi-lane roadway with a posted speed of 45 mph or greater

E. For planned operations involving snooper trucks or bucket trucks regardless of the posted speed limit

F. Other locations where the Regional Traffic Engineer feels such protection is warranted

_____ Certification that the unit conforms to NCHRP 350 test level 3

_____ In good condition, i.e. no holes, major dents, etc.

_____ Rear Panel shall have alternate 6-inch-wide orange and black chevron sloped downward at a 45-degree angle starting at the middle.

_____ Manufacturer's instructions available upon request (suggest they stay in the truck)

_____ The required weight of the support vehicle noted in the manufacturer's instructions

_____ A weigh ticket for the support truck (with specific identification to the truck.)

_____ The truck shall be parked in second gear or in park if automatic

_____The parking brake shall be applied

_____The wheels shall be aligned straight ahead

_____ THE WHEELS SHALL NOT BE CHOCKED (the manufacturer should tell you)

DATE INSPECTED: _____

SIGNATURE OF INSPECTOR: _____

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**Work Zone Safety Device Check List – Portable Changeable Message Sign**

Virginia Work Area Protection Manual (Section 6F-68) (Page 6F 43)

When Used:

- ✓ Ahead of the work area to advise of adverse conditions
- ✓ Ahead of the work area to advise of impending work/event
- ✓ Where speed is expected to drop substantially or suddenly
- ✓ Where queuing and delays are expected
- ✓ Where there are changes in the surface conditions
- ✓ Incident management
- ✓ Where there is a new road/travel pattern

What to look for:

A. _____ Minimum of 7 feet above the roadway in urban areas
B. _____ Minimum of 5 feet above the roadway in rural areas
C. _____ Red and White conspicuity strip along the front
D. _____ Tow vehicle completely removed from the unit and away from the taper
E. _____ Outriggers/support legs deployed and leveled
F. _____ When two or more are used, they must be 1000 feet apart and on the same side of the road
G. _____ Message in accordance with Appendix D of the Virginia Work Area Protection Manual

**Remember:**

When placed on the roadway or within the clear zone; there are always **4 Type II Channelizing Devices (Drums)** placed in front of the arrow board beginning at the front wheel and proceeding forward. No channelizing devices go at the rear wheel unless it is in addition to the other 4. See page 6F-48 in the Virginia Work Area Protection Manual.

When placed in the median where it is in both clear zones (each direction) drums are placed in advance of **BOTH** directions.

Straight Path Consulting

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**Work Zone Safety Device Check List – Arrow Board**

Virginia Work Area Protection Manual (Section 6F-69) (Page 6F-47)

When Used:

- ✓ On the shoulder at the beginning of each taper
- ✓ On vehicles in a mobile operation
- ✓ in the 4-corner mode when blocking the shoulder
- ✓ If there is no room on the shoulder move up into the taper until it fits

What to look for:

A. _____ Minimum of 7 feet above the roadway
B. _____ Red and White conspicuity strip along the front
C. _____ Tow vehicle completely removed from the unit and away from the taper
D. _____ Outriggers/support legs deployed and leveled
E. _____ No lights out in the head for more than 30 minutes
F. _____ One light out in the stem for the shift
G. _____ Center light in head always out
H. _____Support vehicle (if used) shall have a rotating amber high-intensity light

Remember:

There are always **4 channelizing devices** placed in front of the arrow board beginning at the front wheel and proceeding forward. (towards oncoming traffic) No channelizing devices go at the rear wheel unless it is in addition to the other 4. See page 6F-48 in the Virginia Work Area Protection Manual.

***The channelizing devices are the same as are in the taper. i.e. cones if the taper is made up of cones and drums if the taper is made up of drums.***

# COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, VIRGINIA 23219 2000

**Charles A. Kilpatrick, P.E.**
Commissioner

**April 3, 2015**

**TO:** **Work Zone Traffic Control Training Instructors**

**FROM:** **David B. Rush, WZS Training Committee Chairman**

**Re:** **Failure to Perform Satisfactory Work Zone Traffic Control Techniques by Trained Personnel**

**It has been brought to our attention that on occasion, Work Zone Traffic Control (WZTC) trained personnel have failed to apply the proper techniques to meet the requirements when installing, reviewing, or managing the installation and removal of work zone traffic control. The purpose of these training courses is to provide train personnel. In turn, trained individuals must apply this knowledge to provide safe work zones for workers, motorist, pedestrians, bicyclist and other road users. Failure to apply proper WZTC techniques affects not only safety but could have legal consequences if it contributes to a crash in a work zone.**

**Procedures are being develop to address suspension of a WZTC training verification card and the steps needed to release the suspension. Suspension of a training verification card will remove the responsibilities associated with the possession of a WZTC training card – meeting the requirements to install, review, make adjustments to and the removal of work zone traffic control or supervise those who perform these functions.**

**Until the procedures are finalized and released, current language in Section 105 of the VDOT Road and Bridge Specifications may be applied by VDOT Project personnel to those who fail to adequately apply the training they have received through the WZTC training courses.**

***105.05—Character of Workers, Work Methods, and Equipment***

***(a) Workers***

*Workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special or skilled work shall have sufficient experience in such work and in the operation of equipment required to perform it properly and satisfactorily.*

*Any person employed by the Contractor or any subcontractor who, in the opinion of the Engineer, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, when directed in writing by the Engineer, be removed by the Contractor or subcontractor employing the person and shall not be employed again on any portion of the work without the written approval of the Engineer. If*

*the Contractor fails to remove the person or furnish suitable and sufficient personnel for proper prosecution of the work, the Engineer may withhold all monies that are or may become due the Contractor and may suspend the work until the Contractor has complied with the Engineer's directive.*

*Please provide a copy of this information to attendees of your training classes and impress upon them the seriousness of applying what you have taught them once they have adequately passed the examination and begun their duties as Basic, Intermediate, or Advance Work Zone Traffic Control trained personnel.*

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# Intermediate Work Zone Traffic Control Training

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Module 1 - IWZTCT

2

## Welcome

- Instructor:
  - *Billy Green*
  - *The University of Virginia Transportation Training Academy*
  - billyandjulia@vabb.com

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Course Goal
•Upon completion of this course, you will be able to determine and correctly apply the traffic control devices needed to safely and effectively protect workers, motorists and pedestrians in a work zone application USING STANDARD REFERENCES
GOAL
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Module 1 - IWZTCT

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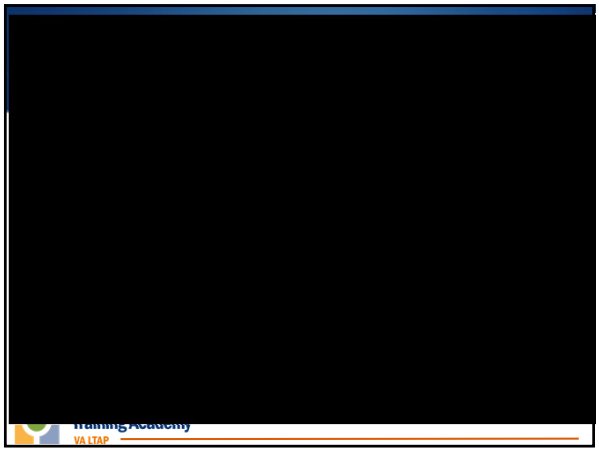
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## Topics We'll Cover

- Liability and Risks
- Human Factors
- Manuals and References
- Temporary Traffic Control Devices
- Building WZ Skills and Mobile Operations
- Making Adjustments to Temporary Traffic Control
- Law Enforcement in Work Zones, New TTC Figures, & Documentation
- Final Exercise, Closing Remarks, Exam

Work Zone Types, Duration, & Component Parts

Worker, Flagger and Pedestrian Safety

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Module 1 - IWZTCT

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## Office of the Attorney General

- **Localities have the option to adopt the 2011 VA Supplement to the MUTCD and the VA WAPM but if they receive State Funds they must follow the Supplement & the WAPM otherwise they must follow the 2009 MUTCD.**

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## Work Zone Definition

- "A work zone is an area on or above a highway, roadway, pedestrian facility or shared-use path with construction, maintenance, permit or utility work activities."

- We also have to be aware of any effects work under the roadway has.
  - Tunneling
  - Direct boring

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Section 6A.03, 77

Module 1 - IWZTCT

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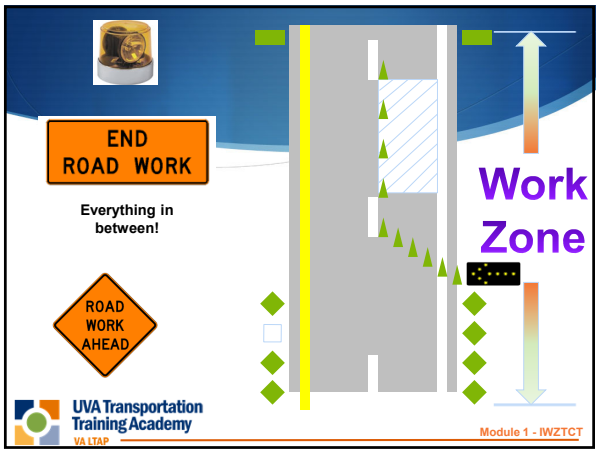


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## PLANNING

For success !!!!
Limit surprises
Work Zone planning is as important as any other activity

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## PLAN

PLANNING is no good unless we follow the plan within reason

OR

MAKE CHANGES THAT ARE LOGICAL AND SAFE

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## PARTNERING !

Joint Activity

Owner & Contractor

Forman & Crew

Know expectations going in

Watch out for each other!!

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## DOCUMENTATION

Get use to hearing this word

- ✓ Complete
- ✓ Comprehensive
- ✓ Clear
- ✓ Concise
- ✓ Correct

If not documented; it was never done

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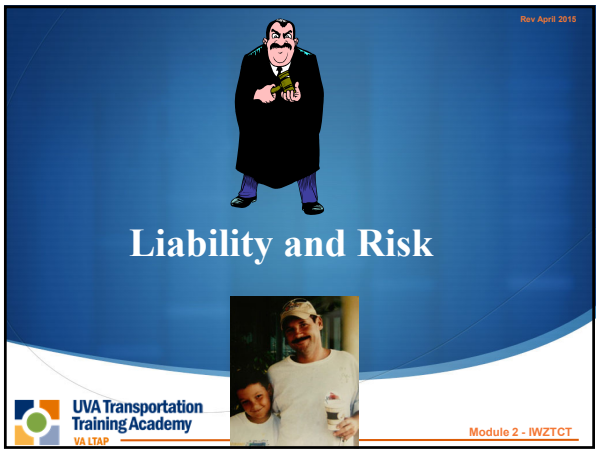
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Liability and Risk
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Module 2 - IWZTCT

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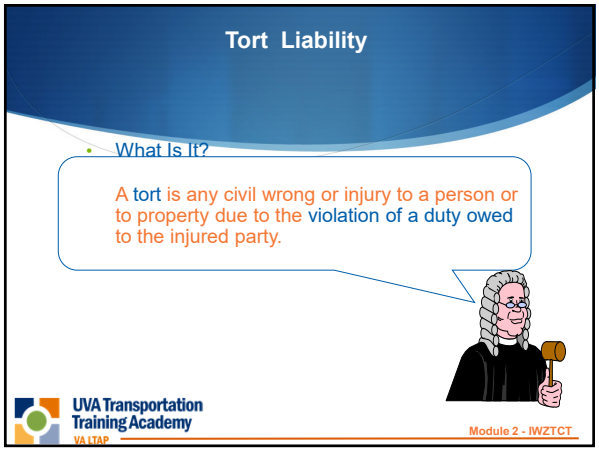
Tort Liability
What Is It?
A tort is any civil wrong or injury to a person or to property due to the violation of a duty owed to the injured party.
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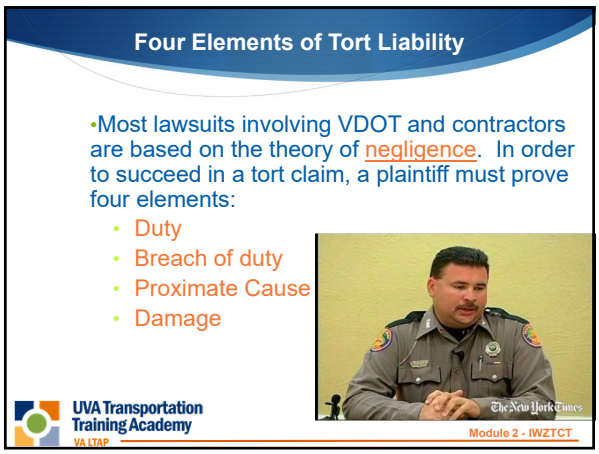
Four Elements of Tort Liability
•Most lawsuits involving VDOT and contractors are based on the theory of negligence. In order to succeed in a tort claim, a plaintiff must prove four elements:
Duty
Breach of duty
Proximate Cause
Damage
The New York Times
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## Four Elements of Tort Liability

- Duty
  - An obligation to exercise the standard of care necessary to reasonably protect the safety of persons and property.

PG 39

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## Four Elements of Tort Liability

- Breach of Duty
  - Through his/her actions, or failure to act, he/she failed to meet the standard of care required under the circumstances (what's prudent and reasonable). Also known as negligence.

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## Four Elements of Tort Liability

- Proximate Cause -
- An act or an omission that produces an event and without that, the event would not have occurred. Also could be more than (1) proximate cause of an injury. All a plaintiff must prove is that the negligence was one of the contributing causes of the plaintiff's injury.

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## Four Elements of Tort Liability

- Damage
  - Resulting from the negligence causing death, personal injury, consequential damages (lost wages), or property damage.

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## Gross Negligence

- Gross negligence – utterly disregarding and completely neglecting the safety of another
- Through your actions
- Through failure to act when warranted

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## Tort Liability Awards

- VDOT can be sued for up to ~~$100,000.~~
- A VDOT employee has *no cap limitations – unlimited.*
- VDOT has paid the judgment in the past, unless the employee was found grossly negligent.
- *DO NOT LET THIS LULL YOU INTO A FALSE SENSE OF SECURITY!!!!!!!!*

1982 sovereign immunity

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## Tort Liability Awards

- A contractor has no cap limitations.
- A contractor's employee has no cap limitations.
- As in most tort cases, the prosecutor is looking for the party with the deepest pockets.

*Plaintiff* *Defendant*

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## How Can I Protect Myself?

**PAGE 7 IN YOUR POCKET GUIDE**

***Remember This!!!***

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## How To Minimize Your Liability Exposure

***Law Suits***

1. Have an approved Traffic Control Plan.
2. Personnel with appropriate WZTCT shall be present during installation, maintenance & removal of TTC devices.
3. Train all personnel in proper work zone safety techniques.
4. Follow the Virginia Work Area Protection Manual and its latest revisions.

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## How To Minimize Your Liability Exposure

- Eleven Daily Steps
- To Minimize Your Liability Exposure:

5. Minimize traffic disruptions.
6. Inspect WZ sites daily for conformance.
   - Immediately after set-up
   - Periodically throughout the day

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PG 78
Module 2 - IWZTCT

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## How To Minimize Your Liability Exposure

- Eleven Daily Steps
- To Minimize Your Liability Exposure:

7. Promptly repair or replace damaged devices
8. Promptly remove unneeded devices.
9. Properly install and remove temporary traffic control devices from the roadway.
10. View the work zone from the road user's perspective.

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## How To Reduce Your Liability Exposure

- Eleven Daily Steps
- To Minimize Your Liability Exposure:

11. Keep comprehensive documentation
    - Written checklist form
    - Daily diary
    - Photographs
    - Video recordings

*Super Important!!!*

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Module 2 - IWZTCT

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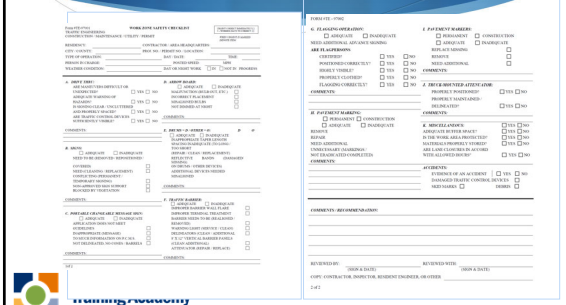
# Work Zone Safety Checklist

August 2011 Page B-3 Page B-4 August 2011



Appendix A

VA LTAP Module 2 - IWZTCT

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## Knowledge Check

- Name the 4 elements necessary for a lawsuit to be successful.
- 1._____
- 2. _____
- 3. _____
- 4._____

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## Knowledge Check

Name some of the ways to help reduce your work zone liability

1._____

2. _____

3. _____

4. _____

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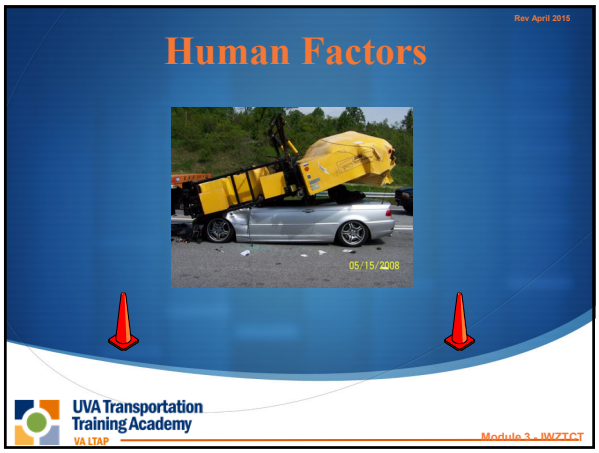
Rev April 2015
Human Factors
05/15/2008
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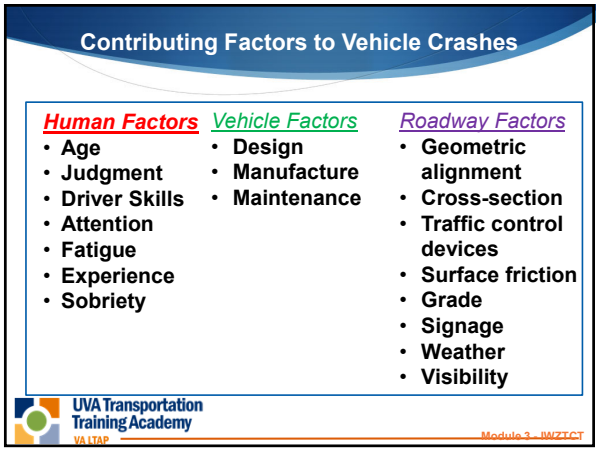
Contributing Factors to Vehicle Crashes
Human Factors
• Age
• Judgment
• Driver Skills
• Attention
• Fatigue
• Experience
• Sobriety
Vehicle Factors
• Design
• Manufacture
• Maintenance
Roadway Factors
• Geometric alignment
• Cross-section
• Traffic control devices
• Surface friction
• Grade
• Signage
• Weather
• Visibility
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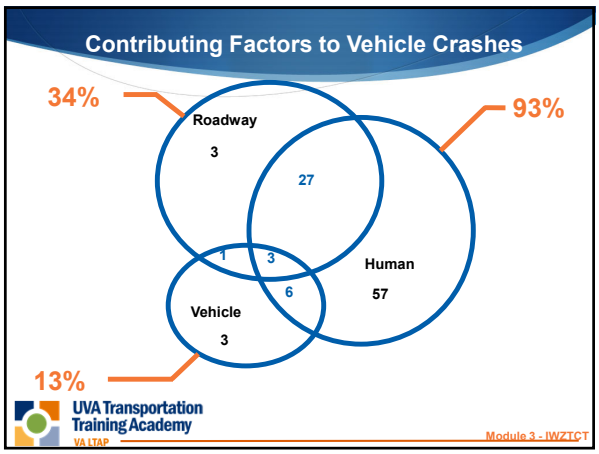
Contributing Factors to Vehicle Crashes
34%
93%
13%
Roadway
3
27
1
3
6
Human
57
Vehicle
3
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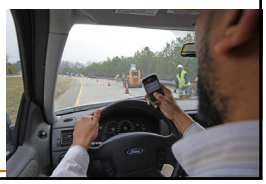
# Our Biggest Challenge

# Motorist!



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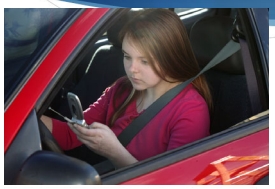
## Each Motorist Is Different



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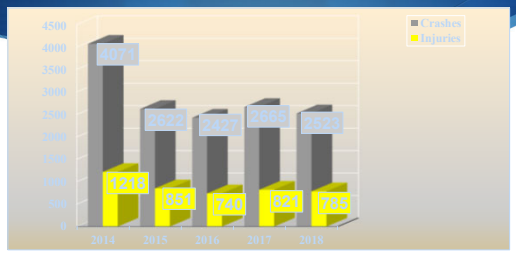
## Work zone crashes and injuries in Virginia, 2014-2018




Average 8.0 crashes a day over a 5 year period
Average 2.5 injuries a day over a 5 year period

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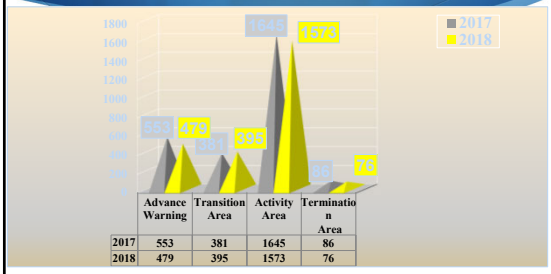
## 2017 – 2018 Work Zone Crashes Per Component Part of A Work Zone




| | Advance Warning | Transition Area | Activity Area | Termination Area |
|---|---|---|---|---|
| 2017 | 553 | 381 | 1645 | 86 |
| 2018 | 479 | 395 | 1573 | 76 |

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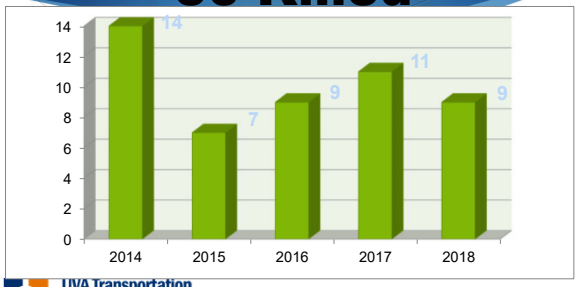
## Work Zone Fatalities on ALL Virginia State Roadways from 2014-2018

**50 Killed**

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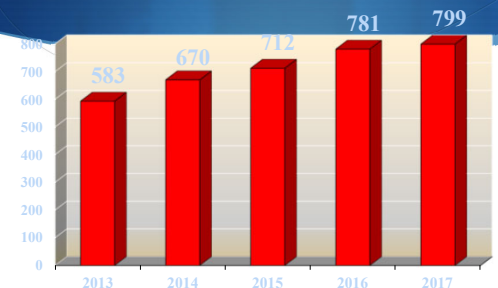
## Work zone fatalities nationwide 2013-2017




**3,545 deaths!**

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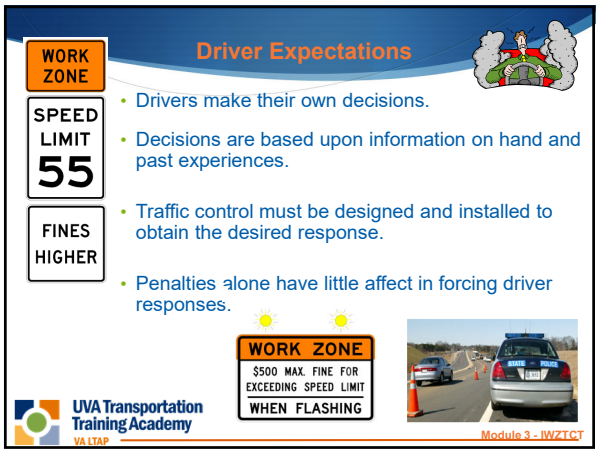
Driver Expectations
WORK ZONE
SPEED LIMIT 55
FINES HIGHER
• Drivers make their own decisions.
• Decisions are based upon information on hand and past experiences.
• Traffic control must be designed and installed to obtain the desired response.
• Penalties alone have little affect in forcing driver responses.
WORK ZONE
$500 MAX. FINE FOR EXCEEDING SPEED LIMIT
WHEN FLASHING
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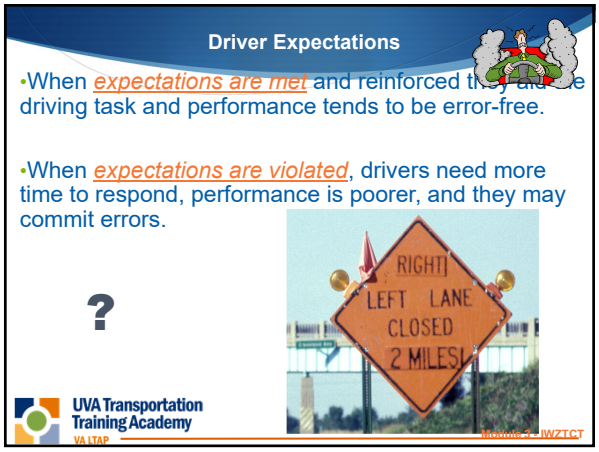
Driver Expectations
•When expectations are met and reinforced they allow driving task and performance tends to be error-free.
•When expectations are violated, drivers need more time to respond, performance is poorer, and they may commit errors.
?
RIGHT LEFT LANE CLOSED 2 MILES
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Are Expectations Violated Here?
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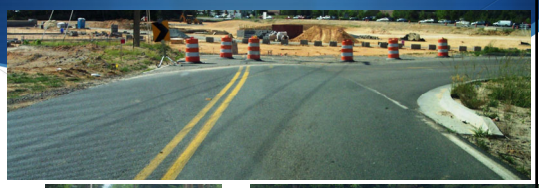
## Are Expectations Violated Here?



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## Driver Behavior

The following steps must be performed for a motorist to avoid a hazard:

1. Hazard becomes visible
2. Hazard is detected
3. Hazard is recognized

Detection and Recognition

4. Driver decides on action
5. Driver begins response
6. Maneuver is completed

Decision and Response

5 to 7 Seconds

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## Driver Behavior

The following steps must be performed for a motorist to avoid a hazard:

1. Hazard becomes visible.
2. Hazard is detected.
3. Hazard is recognized.
4. Driver decides on action.
5. Driver begins response.
6. Maneuver is completed.

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## Manuals & References

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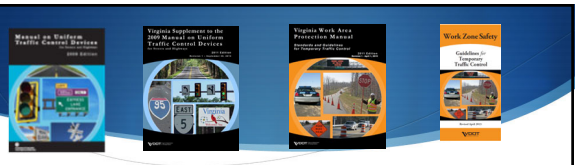

- Changes/Additions
- All of these MANUALS apply to all roads open to the public, including private roads

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## National Standards

**Manual on Uniform Traffic Control Devices (MUTCD, the "bible" of traffic control)**

- **Provides national standards and guidelines applicable to all streets and highways open to public travel.**
- **It establishes Federal minimum requirements for traffic control.**
- **Latest edition issued in December, 2009.**

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## Standards are Important

- MUTCD
- Uniformity and consistency were developed.
- MUTCD ensured basic traffic engineering principles were followed.
- Driver expectations and their reactions improved.

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## Why We Need Standards
## Sign Fabrication Standards

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## Sign Fabrication Standards

**Regulatory and Warning signs should be fabricated using one of these three manuals otherwise, new signs shall be submitted to the State Traffic Engineer for approval.**

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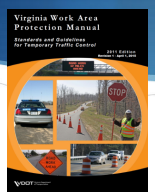
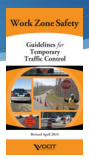
## Work Area Protection Manual & Pocket Guide




**Standard** — **Supplement**

- Standard for WZs in Virginia
- References used to develop this training
- Details ***MINIMUM*** **typical application** ***diagrams***
- Requirement for WZTC for designers and field personnel; inspectors, maintenance, utilities

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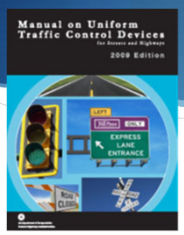
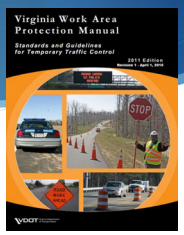
## WZ Traffic Control Requirements




**"Shall"** → STANDARD

**"Should"** → GUIDANCE

**"May"** → OPTION

**Additional Information** → SUPPORT

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## Standard:

Page I-2

- - A statement of required, mandatory, or specifically prohibitive practice regarding traffic control device(s).
- - Standards are labeled, and the text appears in bold large type.
- - The verb "shall" is typically used.
- - Standards are sometimes modified by Options.
- - Engineering study should be the basis for a decision to deviate from a Standard statement

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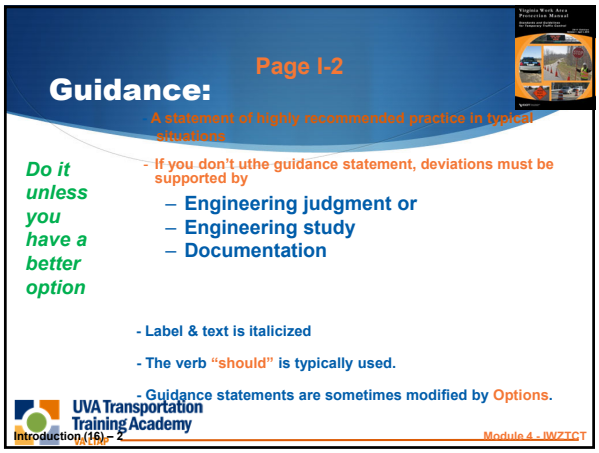
Guidance:
Page I-2
- A statement of highly recommended practice in typical situations
- If you don't uthe guidance statement, deviations must be supported by
– Engineering judgment or
– Engineering study
– Documentation
Do it unless you have a better option
- Label & text is italicized
- The verb "should" is typically used.
- Guidance statements are sometimes modified by Options.
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Introduction (16) – 2
Module 4 - IWZTCT

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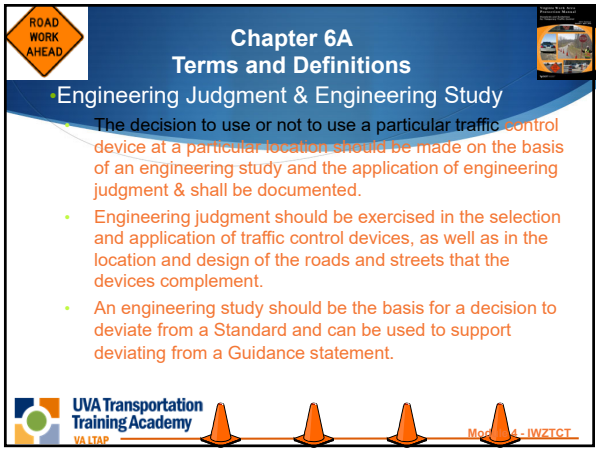
ROAD WORK AHEAD
Chapter 6A
Terms and Definitions
Engineering Judgment & Engineering Study
The decision to use or not to use a particular traffic control device at a particular location should be made on the basis of an engineering study and the application of engineering judgment & shall be documented.
Engineering judgment should be exercised in the selection and application of traffic control devices, as well as in the location and design of the roads and streets that the devices complement.
An engineering study should be the basis for a decision to deviate from a Standard and can be used to support deviating from a Guidance statement.
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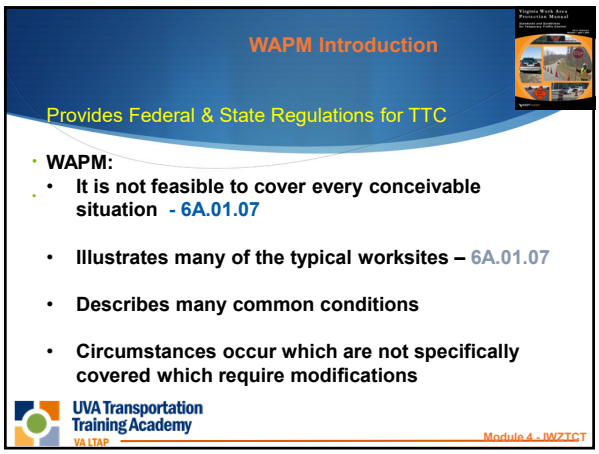
WAPM Introduction
Provides Federal & State Regulations for TTC
WAPM:
It is not feasible to cover every conceivable situation - 6A.01.07
Illustrates many of the typical worksites – 6A.01.07
Describes many common conditions
Circumstances occur which are not specifically covered which require modifications
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## DEFINITIONS

Pages 6A-2 through 6A-7

Clear Zone

Crashworthy

Public Road Open to Public Travel - **Interesting**

Public Road

Traveled Way

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## FUNDAMENTAL PRINCIPAL #1

Page 6B-1

General plans or guidelines should be developed to provide SAFETY for motorists.

SAFETY

Each decision we make must include the question:

Is this safe?

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## FUNDAMENTAL PRINCIPAL #2

- Page 6B-2
- **Road user movement should be inhibited as little as practical.**
- Do not set up lane closures until we need them.

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## FUNDAMENTAL PRINCIPAL #3

- Page 6B-4
- **Motorist, bicyclists, and pedestrians should be guided in a "*Clear and Positive*" manner.**
- Clear and Positive are the key words
- Are you satisfied with minimums?

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## FUNDAMENTAL PRINCIPAL #4

- Page 6B-2
- Provide acceptable levels of operations, routine day and night inspections of TTC elements should be performed.

INSPECTIONS

How often depends on the operation

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## FUNDAMENTAL PRINCIPAL #4
INSPECTIONS

- 6B.01.08 – Daily & weekly using Appendix B Checklist
- 6B.01.09 – Night time
- 6B.01.10 – Change of Traffic Patterns
- 6B.01.11 – made by someone trained in Fundamental Principals

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## FUNDAMENTAL PRINCIPAL #5

- Page 6B-3
- Attention should be given to the maintenance of roadside safety

### CLEAR ZONE

Where are you going to park your equipment at the end of the day?

See page A-4 near the end of the manual

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## FUNDAMENTAL PRINCIPAL #6

- Page 6B-3
- Only those individuals who are trained in Work Zone Traffic Control Practices and have a basic understanding of the principals…..
- **THIS IS THE ONLY STANDARD STATMENET AMOUNG THE 7 FUNDIMENTAL PRINCIPALS**
- Training is constant; not every 4 years

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## FUNDAMENTAL PRINCIPAL #7

- Good public relations should be maintained!!!

### PUBLIC RELATIONS

- Essential to a successful project
  - Honest
  - Forthright
  - Timely

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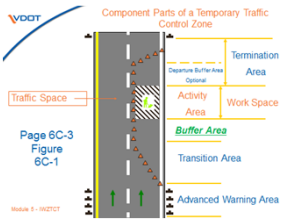
## TEMPORARY TRAFFIC CONTROL ELEMENTS

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## PEDESTRIAN AND WORKER SAFETY

Look at the 3 items in the Table of Contents on Page TC-1

- Pedestrian Considerations
- Accessibility Considerations
- Worker Safety Considerations

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## PEDESTRIAN AND WORKER SAFETY

- Section 6D.03.05, 06 & 06
  - Class 3 vest
  - Type E trousers
- *6D.03.12*
  - 360 degree visibility

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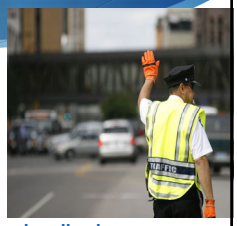
## Flaggers



- Section 6E.07.06
- Stand on shoulder
- Section 6E.07.08
- Stands Alone!!!!
- Section 6E.07.11
- **Only uniformed police officer directs signalized intersection**

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## TEMPORARY TRAFFIC CONTROL DEVICES

- Page TC-1
- Types of Devices Section 6F
- General Characteristics of Signs
- Page TC-2 – starts information and detail of the various signs we have in standard inventory

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## TEMPORARY TRAFFIC CONTROL DEVICES

- Page TC-3
- ½ way down the page starts a list of traffic control devices other than signs

- ***We need to be able to refer to these sections in order to understand the detail necessary in their placement and use!!***

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## Portable Changeable Message Signs

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## TEMPORARY TRAFFIC CONTROL DEVICES

- Portable Changeable Message Signs
  - Page 6F-48
- 6F.68.11 – visible from ½ mile day and night
- 6F.68.26 – power source and batter backup
- 6F.68.29 – 1000 feet apart
- 6F.68.33 – trailer mounted not crashworthy

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## Does PCMS Use Meet Guidelines?

- No message shall be:
  - Animated
  - Rapid flashing
  - Dissolving
  - Exploding
  - Scrolling
  - Traveling horizontally or vertically across the face
  - Dynamic elements

4 drums, Group II Channelizing, forming a taper shall be placed in advance of the PCMS for delineation.

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## TEMPORARY TRAFFIC CONTROL DEVICES

VDOT

Delineation for PCMS, Arrow Board & Other Trailer Mounted Devices

**Figure 6F-6, Channelizing Devices for PCMS, Arrow Board and other Trailer Mounted Devices1**

1: Revision 1 – 4/1/2015

FOUR (4) DRUMS FORM A TAPER
IN ADVANCE OF THE PCMS OR OTHER
UNMANNED TRAILER MOUNTED DEVICES
0- 35 MPH SPACING AT 20'
36 MPH & ABOVE SPACING AT 40'

Conspicuity material (white, red) is required for trailer mounted devices where the trailer's signal and brake lights are located.

Section 6F.68 (36); Figure 6F-6

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## TEMPORARY TRAFFIC CONTROL DEVICES

VDOT

Arrow Board

Module 6 - IWZTCT

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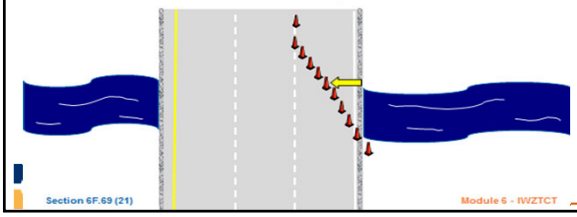
## TEMPORARY TRAFFIC CONTROL DEVICES

VDOT

Arrow Board Proper Placement

For narrow shoulders, place inside the taper as close to the beginning of the taper as possible but within the channelizing devices.



Section 6F.69 (21)

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•Our most effective traffic control device when used correctly!

•It SHALL be removed from the tow vehicle immediately

*Again with the NEAT PRIDE*

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## TEMPORARY TRAFFIC CONTROL DEVICES

### arrow boards

VDOT Arrow Board Maintenance

- The bulb between the stem and arrow head shall be out to make the arrow more legible.
- No bulbs are allowed to be out in the arrow head.
  - Correct within 30 minutes of notification
- *Only* 1 additional bulb can be out in the stem.
  - Correct prior to next work shift

Section 6F.69 (29), Figure 6F-7

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## CONTROL DEVICES CONES

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## TEMPORARY TRAFFIC CONTROL DEVICES

VDOT

Channelizing Devices Serve To:

- Delineate work areas
- Safely guide & direct road users
- Provide smooth & gradual traffic movement from one lane to another
- Reduce width of travel way

Section 6F.71 (02), (03)

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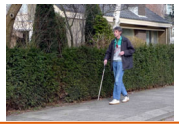
## TETEMPORARY TRAFFIC CONTROL DEVICES

- 6F.71.04
- Detectable to users of long canes and visible to persons having low vision
- 6F.71.05
- Continuous detectible bottom (>2”) and top (> 32”)



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## TEMPORARY TRAFFIC CONTROL DEVICES
### cones

- Page 6F-52
- 6F-72.04 – when workers are present to maintain
- 6F.72.06 – when workers are not present – Group II devices shall be used

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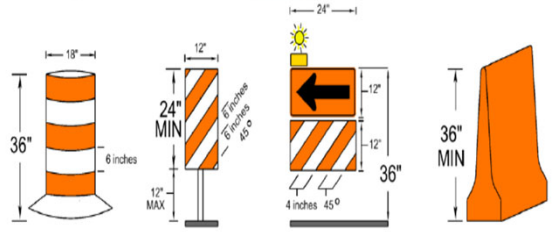
## TEMPORARY TRAFFIC CONTROL DEVICES
### Type II Devices

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## TEMPORARY TRAFFIC CONTROL DEVICES
Drums/Barrels

VDOT

New or Changed Work Zone Items

Channelizing Device Group 2 Drums

- Advertisement as of Jul2012 Retroreflectivity - Type 3 reboundable material
- All drum regardless of advertisement date shall comply July 1, 2016.
- 6" alternating stripes orange & white

Used in:

- all tapers on Limited Access hwy at night
- unmanned work zones

Section 6F.75 (01), (02) (09); Road & Bridge Specification 247

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# Drums

- *4 times when we have to use them*
  1. In front of trailer mounted devices
  2. In unmanned work zones
  3. In tapers/transitions on limited access highways at night
  4. In front of hazards

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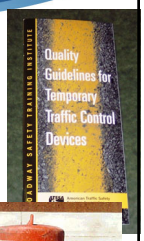
# ATSSA Quality Guidelines for TTC Devices

- Use ATSSA Guide for reference to replace TTC Devices:
  - Acceptable
  - Marginal
  - Unacceptable



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# TEMPORARY RAISED PAVEMENT MARKERS

## Construction Pavement Markers

Page 6F-63

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- TEMPORARY RAISED PAVEMENT MARKERS
  - Construction Pavement Markers
    - Section 6F.87.03
    - Installed when temporary markings longer than 3 days
    - 20 foot centers in tapers and transitions
    - 40 foot centers in tangent

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- Truck Mounted Attenuator – TMA
  - Crash Cushion
    - Page 6F-76

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## TEMPORARY TRAFFIC CONTROL DEVICES

- Truck Mounted Attenuator – TMA
  - Crash Cushion
    - Section 6F.98.06
      - 24 hours

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## Truck Mounted Attenuator – TMA Crash Cushion

6F.98.17 – on hot asphalt
6F.98.18 – must use on additional operations
6F.95.19 – explains previous section
6F.95.20 – nothing, **NOTHING is placed on the Shadow Vehicle with a TMA**
6F.95.21 – Must be inspected each day before use

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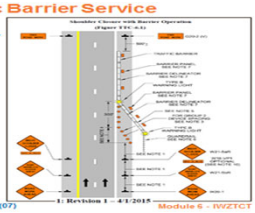
## TEMPORARY TRAFFIC CONTROL DEVICES

- Barrier Panels and Type B Lights
- Look in under Temporary Traffic Barriers

VDOT

Traffic Barrier Service

- Barrier panel new name for barrier vertical panel
- Type B warning light used at the beginning of the barrier run & at the breakpoint
- Barrier panel spacing
  - 40 feet taper
  - 80 feet tangent (parallel to the travelway)
- Barrier delineator spacing same as barrier panel but spaced in between the barrier panel



Section 6F.94 (07) — Module 6 - IWZTCT

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## Types of Temporary Traffic Control Zone Activities Section 6G

- Page TC-4
- Use Table of Contents to look for details of activities by where they are within the right of way
- Gives description of activity, reasons for a specific type of design and offers reasons and potential options

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## Types of Temporary Traffic Control Zone Activities Section 6G

- Sections 6G.10,11,12 & 13
- Short durations are not a reason to discard safety.
- Sometimes less is more
- Augment using other devices such as flashing lights.

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## Types of Temporary Traffic Control Zone Activities Section 6G

- Section 6G.19 – **Working in a Median**
  - Watch clear zones from both sides
- TTC-42 –working on the inside lane of an undivided multi-lane highway
- Section 6G.11.04 – placing signs on an urban street

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## Types of Temporary Traffic Control Zone Activities Section 6G

- Section 6G.12.19
- When working over a roadway open to traffic the lane shall be closed unless it is physically impossible for materials, equipment or personnel could fall into the open lane or shoulder.

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## Types of Temporary Traffic Control Zone Activities Section 6G

- Section 6G.12.20
- Not a good idea if you are in a bucket truck
- Do not just stop reading when you find what you are looking for.
- What is the rest of the story?

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## Types of Temporary Traffic Control Zone Activities Section 6G

- Section 6H.12.22 – when the center lane of a multi-lane roadway must be closed; an adjoining lane shall be closed such that traffic will not split around the work area.
- TTC-18

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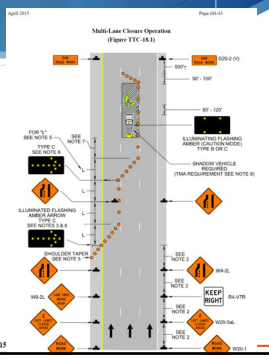
## Working in Center Lane of Multi-Lane Road

The center lane & an adjoining lane shall be closed such that through traffic is not split around the work area.

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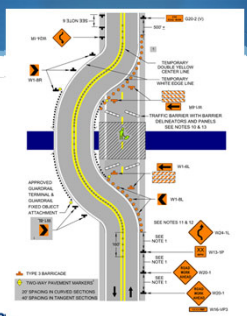
- Section 6G.13 – Diversions & Detours



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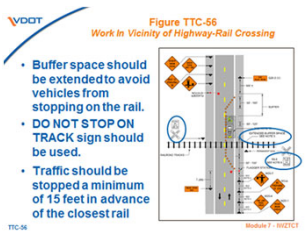
## Types of Temporary Traffic Control Zone Activities
## Section 6G
## Section 6G.23 – Work in the Vicinity of a Railroad Crossing

Contractor shall coordinate all Operations over or on railroad Right of way




- Buffer space should be extended to avoid vehicles from stopping on the rail.
- DO NOT STOP ON TRACK sign should be used.
- Traffic should be stopped a minimum of 15 feet in advance of the closest rail

TTC-56

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## Types of Temporary Traffic Control Zone Activities Section 6G

- Section 6G.25
- Installing and Removing Temporary Traffic Control

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## Office of the Attorney General

- **Localities have the option to adopt the 2011 VA Supplement to the MUTCD and the VA WAPM but if they receive State Funds they must follow the Supplement & the WAPM otherwise they must follow the 2009 MUTCD.**

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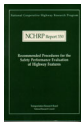
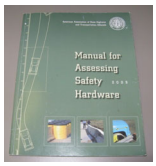
## Work Zone Guidelines Crashworthy TTC Devices

- Federal Reports
  - NCHRP 350
- Manual of Accessing Safety Hardware (MASH)
- AASHTO Roadside Design Guide
- OSHA Requirements
  - Adopted the MUTCD 2009.
  - Can now cite work zone deficiencies under the General Duty clause.






New testing requirement for safety hardware

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## Knowledge Check

- Why is uniformity of sign presentation important?
- Name the sign that goes on the back of delivery vehicles
- True or False: A Standard statement is opional.

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## Knowledge Check

- True of False: A Guidance statement is highly recommended but not a requirement.
- When are we required to perform fundamental principal Number 4?

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## Knowledge Check

- Name the 4 types of Arrow Boards.
- 1.
- 2.
- 3.
- 4.

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## Knowledge Check

- What categories are normally used in the Commonwealth?
- When no one is present on the project; what are the requirements for TTC?

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## Knowledge Check

- Name the 4 times when your have to use a Type II TTC device.
- 1.
- 2.
- 3.
- 4.

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## Knowledge Check

- Which sections deals with Temporary Raised Pavement Markers?
- What is the minimum spacing in
- tangent:
- Taper:

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## Knowledge Check

- Where do we put Type B “flashing” lights?
- When can we work over an active travel lane with no TTC?

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## Knowledge Check

- What are the precautions we should take when working in the vicinity of a rail road crossing?
- or

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## Knowledge Check

- **What guide do we have to determine the quality of our TTC devices?**
- **What is the process for getting a new or adjusted sign approved?**

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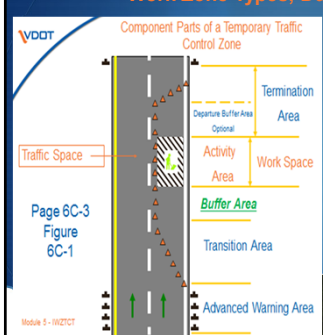
Rev April 2015

## Work Zone Types, Duration & Component Parts



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Module 5 - IWZTCT

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## Work Zone Types are determined by:

- Work location
- Type of work operation & equipment needs
- Work duration/timeframe
- Highway type

Section 6C.01 Intro

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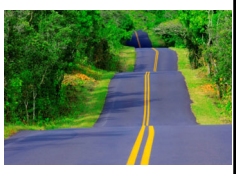
## Work Zone Types are determined by:

- Work Location – in relation to traffic:
  - Outside the shoulder
  - On the shoulder w/ no encroachment
  - On the shoulder with encroachment
  - Within the median, and
  - Within the traveled way.





124

## Work Zone Types are determined by:

- Work Operation:
  - Equipment needs
  - Type of materials needed
  - Quick fix or long term repair
  - Compact work area or
  - Extended work area
  - Work in an intersection
  - Work in a roundabout
  - Temporary Traffic Control Devices

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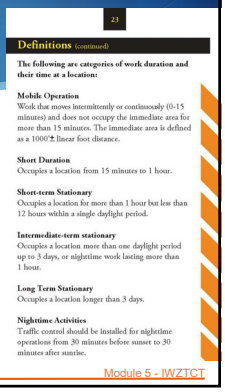
## Work Zone Types are determined by:

- Work Duration timeframes:
  - **Mobile Operation**
  - **Short Duration**
  - ***Short-term Stationary***
  - **Intermediate-term Stationary**
  - **Long-term Stationary**

Defines Nighttime Activities



23

**Definitions** (continued)

**The following are categories of work duration and their time at a location:**

**Mobile Operation**
Work that moves intermittently or continuously (0-15 minutes) and does not occupy the immediate area for more than 15 minutes. The immediate area is defined as a 1000 ± linear foot distance.

**Short Duration**
Occupies a location from 15 minutes to 1 hour.

**Short-term Stationary**
Occupies a location for more than 1 hour but less than 12 hours within a single daylight period.

**Intermediate-term stationary**
Occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.

**Long Term Stationary**
Occupies a location longer than 3 days.

**Nighttime Activities**
Traffic control should be installed for nighttime operations from 30 minutes before sunset to 30 minutes after sunrise.



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## Work Zone Types are determined by:

- Highway Type Factors:
  - Two-Lane Roadway
  - Multi-Lane Roadway
  - Limited Access highway
  - Ramps
  - Intersections
  - Roundabouts
  - Road Closure
  - Detours

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## Other Highway Factors:

- Other Highway Factors:
  - Road user volumes
  - Road vehicle mix
    - Buses (School, Commercial)
    - Trucks
    - Cars
    - Motorcycles
    - Pedestrians – sidewalk or visual evidence



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- Geometrics:
  - Vertical and horizontal alignment
  - Intersections
  - Interchanges

**Other Influences on the Installation of TTC Devices:**

  - Signals
  - Driveways
  - Business entrances
  - Schools
  - Emergency Services
  - Evidence of Pedestrians



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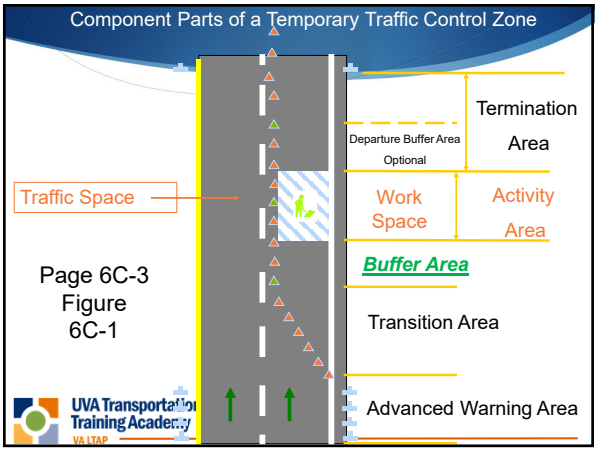
## VWAPM Use- Posted Speed Limit

- The posted speed limit has an influence on the installation of TTC devices:
  - Recommended Sign Spacing of Advance Warning Signs Page 6
  - Taper Length Criteria for TTC Page 18
  - Taper Length Chart Page 185
  - Channelizing Devices Spacing Page 10
  - Length of Longitudinal Buffer Space Page 17
  - Shadow Truck with TMA Section 6F.98 (11) A - E
  - Clear Zone values & Barrier Flare rate Appendix A page A-4



130

## Component Parts of a Temporary Traffic Control Zone






131

## Component Parts of a Temporary Traffic Control Zone

- Advance Warning tells traffic what to expect ahead.
- Transition Area moves traffic out of its normal path.
- Buffer Area provides protection for traffic and workers. (Clear space, no workers, no equipment or no materials)
- Activity Area:
  - Work space is where the work takes place. The work space is set aside for workers, shadow/TMA vehicle, equipment, and material storage.
  - Traffic Space allows traffic to pass through the work space.
- Termination Area lets traffic resume normal driving and may include an optional departure buffer area.



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## WAPM References

- Recommended Spacing for Advance Warning Signs?
- *Page 6 in pocket guide*

**Table 6H-5, Recommended Spacing of Advance Warning Signs[1]**

| Road Type | Spacing (Feet) |
|---|---|
| Urban street with 25 mph or less posted speed | 100 – 200 |
| Urban street with 30 to 40 mph posted speed | 250 – 350 |
| * All Other Roadways with 45 mph or less posted speed | 350 – 500 |
| All Other Roadways with greater than 45 mph posted speed | 500 – 800 |
| Limited Access highways | 1300 – 1500 |

* Urban streets with greater than 40 mph posted speed limits fall into this category.

**Note:** For urban conditions, it is generally better to place all advanced warning signs within a one block area versus spreading out the signs over several blocks, however, motorist must have time to recognize and react to each warning sign see Section 6G.11.



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## WAPM References

- Channelizing Device Spacing?
- *Page 10 in pocket guide*

**Table 6H-4, Channelizing Device Spacing**

| Location | Posted Speed Limit (mph) | |
|---|---|---|
| | 0 - 35 | 36 + |
| Transition Spacing | 20' | 40' |
| Travelway Spacing | 40' | 80' |
| Spot Construction Access * | 80' | 120' |

* For easier access by construction vehicles into the work area, spacing of devices may be increased to this distance, but shall not exceed one access per 0.25 mile unless approved by the engineer and documented.



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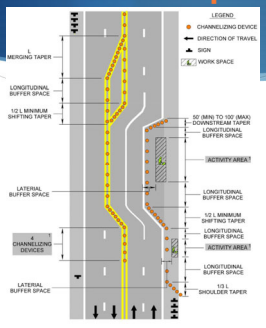
## Example of Types of Tapers & Buffer Spaces




- Merging taper takes away a lane
- Shoulder tapers are required in advance of a WZ or shoulder closure
- Shifting taper moves traffic laterally right or left
- Downstream taper moves traffic back to its normal path



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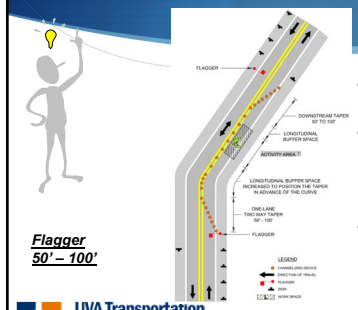
## Example of a One-Lane, Two-Way Taper




***Flagger 50' – 100'***

- One-lane, two-way Taper 50' to 100'
- One-lane, two-way taper controls traffic movement alternately around the work space
- Downstream taper moves traffic back to its normal path

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## WAPM References

- Taper Length Criteria for
- TTC Zone (formulas) Page 6C-7 or Page 6H-2

**Table 6C-3, Taper Length Criteria for Temporary Traffic Control Zones**

| Type of Taper | Taper Length (L) |
|---|---|
| Merging | L= Minimum |
| Shifting | See table below[2] |
| Shoulder | ⅓ L Minimum |
| Two-Way Traffic | 50 Feet Minimum,100 Feet Maximum |
| Downstream | 50 Feet Minimum,100 Feet Maximum |
| L= Taper Length, W= Width of Offset, S= Posted Speed Limit | |

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## Taper Length (L)

- Taper lengths?

Page 6C-7 or Page 6H-5

**Table 6C-4, Taper Length Chart**

| Posted Speed Limit (mph) | Taper Length (L) Width of Offset (Feet) 9 | 10 | 11 | 12 | Remarks |
|---|---|---|---|---|---|
| ≤ 25 | 95 | 105 | 115 | 125 | L= S²W/60 |
| 30 | 135 | 150 | 165 | 180 | " |
| 35 | 185 | 205 | 225 | 245 | " |
| 40 | 240 | 270[1] | 295[1] | 320 | " |
| 45 | 405 | 450 | 495 | 540 | L=SW |
| 50 | 450 | 500 | 550 | 600 | " |
| 55 | 495 | 550 | 605 | 660 | " |
| 60 | 540 | 600 | 660 | 720 | " |
| 65 | 585 | 650 | 715 | 780 | " |
| 70 | 630 | 700 | 770 | 840 | " |

[1] Limited Access highways shall use a 1000' merging taper regardless of the posted speed.

**Shifting Tapers - full lane width shifts on Limited Access Highways shall use a 750' shifting taper for posted speeds less than 65 mph and a 1000' shifting taper for posted speeds equal to or greater than 65 mph. For all other roadways ⅔ L should be used.[2]**

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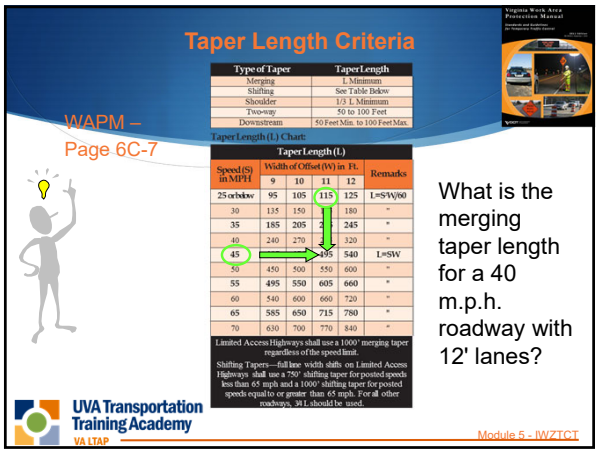
Taper Length Criteria
WAPM – Page 6C-7
Type of Taper
Taper Length
Merging
L Minimum
Shifting
See Table Below
Shoulder
1/3 L Minimum
Two-way
50 to 100 Feet
Downstream
50 Feet Min. to 100 Feet Max.
Taper Length (L) Chart:
Taper Length (L)
Speed (S) in MPH
Width of Offset (W) in Ft.
9
10
11
12
Remarks
25 or below
95
105
115
125
L=SW/60
30
135
150
180
"
35
185
205
245
"
40
240
270
320
"
45
405
495
540
L=SW
50
450
500
550
600
"
55
495
550
605
660
"
60
540
600
660
720
"
65
585
650
715
780
"
70
630
700
770
840
"
Limited Access Highways shall use a 1000' merging taper regardless of the speed limit.
Shifting Tapers—full lane width shifts on Limited Access Highways shall use a 750' shifting taper for posted speeds less than 65 mph and a 1000' shifting taper for posted speeds equal to or greater than 65 mph. For all other roadways, 3/4 L should be used.
What is the merging taper length for a 40 m.p.h. roadway with 12' lanes?
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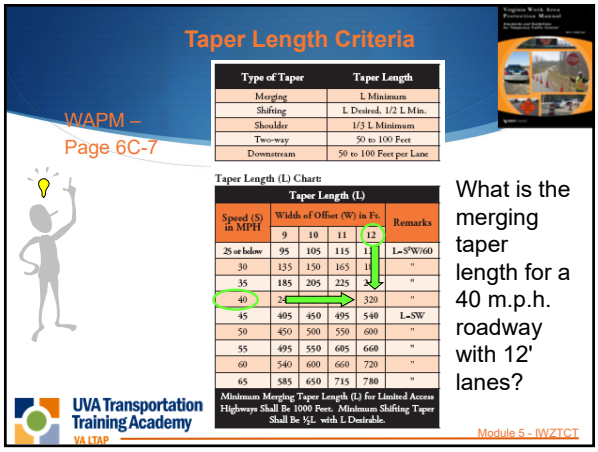
Taper Length Criteria
WAPM – Page 6C-7
Type of Taper
Taper Length
Merging
L Minimum
Shifting
L Desired, 1/2 L Min.
Shoulder
1/3 L Minimum
Two-way
50 to 100 Feet
Downstream
50 to 100 Feet per Lane
Taper Length (L) Chart:
Taper Length (L)
Speed (S) in MPH
Width of Offset (W) in Ft.
9
10
11
12
Remarks
25 or below
95
105
115
L=S²W/60
30
135
150
165
"
35
185
205
225
"
40
320
"
45
405
450
495
540
L=SW
50
450
500
550
600
"
55
495
550
605
660
"
60
540
600
660
720
"
65
585
650
715
780
"
Minimum Merging Taper Length (L) for Limited Access Highways Shall Be 1000 Feet. Minimum Shifting Taper Shall Be ½L with L Desirable.
What is the merging taper length for a 40 m.p.h. roadway with 12' lanes?
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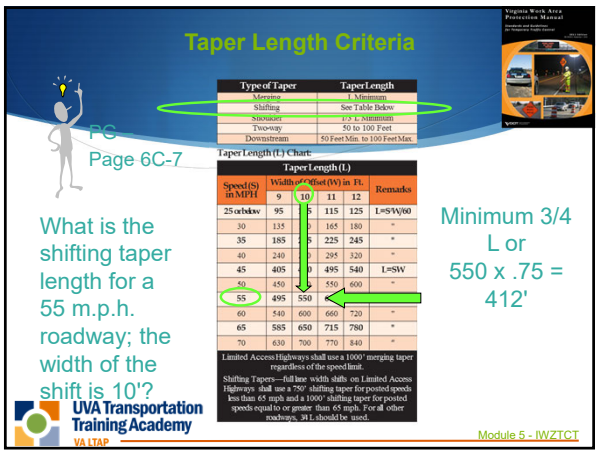
Taper Length Criteria
PG Page 6C-7
Type of Taper
Taper Length
Merging
L Minimum
Shifting
See Table Below
Shoulder
1/3 L Minimum
Two-way
50 to 100 Feet
Downstream
50 Feet Min. to 100 Feet Max.
Taper Length (L) Chart:
Taper Length (L)
Speed (S) in MPH
Width of Offset (W) in Ft.
9
10
11
12
Remarks
25 or below
95
115
125
L=S²W/60
30
135
165
180
"
35
185
225
245
"
40
240
295
320
"
45
405
495
540
L=SW
50
450
550
600
"
55
495
550
"
60
540
600
660
720
"
65
585
650
715
780
"
70
630
700
770
840
"
Limited Access Highways shall use a 1000' merging taper regardless of the speed limit.
Shifting Tapers—full lane width shifts on Limited Access Highways shall use a 750' shifting taper for posted speeds less than 65 mph and a 1000' shifting taper for posted speeds equal to or greater than 65 mph. For all other roadways, 3/4 L should be used.
What is the shifting taper length for a 55 m.p.h. roadway; the width of the shift is 10'?
Minimum 3/4 L or 550 x .75 = 412'
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## Taper Length Chart

| Type of Taper | Taper Length |
|---|---|
| Merging | L Minimum |
| Shifting | See Table Below |
| Shoulder | 1/3 L Minimum |
| Two-way | 50 to 100 Feet |
| Downstream | 50 Feet Min. to 100 Feet Max. |

Taper Length (L) Chart:

| Speed (S) in MPH | Width of Offset (W) in Ft. 9 | 10 | 11 | 12 | Remarks |
|---|---|---|---|---|---|
| 25 or below | 95 | 105 | 115 | 125 | L=S*W/60 |
| 30 | 135 | 150 | 165 | 180 | " |
| 35 | 185 | 205 | 225 | 245 | " |
| 40 | 240 | 270 | 295 | 320 | " |
| 45 | 405 | 450 | 495 | 540 | L=SW |
| 50 | 450 | 500 | 550 | 600 | " |
| 55 | 495 | 550 | 605 | 660 | " |
| 60 | 540 | 600 | 660 | 720 | " |
| 65 | 585 | 650 | 715 | 780 | " |
| 70 | 630 | 700 | 770 | 840 | " |

Limited Access Highways shall use a 1000' merging taper regardless of the speed limit.

Shifting Tapers—full lane width shifts on Limited Access Highways shall use a 750' shifting taper for posted speeds less than 65 mph and a 1000' shifting taper for posted speeds equal to or greater than 65 mph. For all other roadways, 30 L should be used.

WAPM – Page 6C-7

What is the merging taper length for a 70 m.p.h. limited access highway with 12' lanes?

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## Why use a buffer space?

"Buffer" dictionary definition:

- To protect something against impact or reduce the shock of an impact
- Intervening shield reducing interaction of two parts
- A thing that shields or protects against harm

WAPM – A longitudinal buffer space should be placed in advance of a work zone. A clear space, no workers, equipment or materials

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## Length of the Longitudinal Space

VWAPM –

Page 6C-5 and Page 6H-5

Table 6C-2. Length of the Longitudinal Buffer Space

| Posted Speed (MPH) | Distance (Feet) |
|---|---|
| 20 | 15 - 120 |
| 25 | 155 - 165 |
| 30 | 200 - 210 |
| 35 | 250 - 260 |
| 40 | 305 - 325 |
| 45 | 360 - 380 |
| 50 | 425 - 445 |
| 55 | 500 - 530 |
| 60 | 570 - 600 |
| 65 | 645 - 675 |
| 70 | 730 - 760 |
| 75 | 820 - 850 |

What is the buffer space length for 70 m.p.h.?

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## Activity Area

- Consists of the Work Space & Traffic Space
- Where the work takes place
  - Workers
  - Equipment
  - Materials
  - Shadow/TMA vehicle
- Work may be stationary or may move as work progresses
- Maximum length of the work space should not exceed 2 miles unless approved by RTE

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## Activity Area

- Consists of the Work Space & Traffic Space
- Where the work takes place
  - Workers
  - Equipment
  - Materials
  - Shadow/TMA vehicle
- Work may be stationary or may move as work progresses
- Maximum length of the work space should not exceed 2 miles unless approved by RTE

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## Skip Marks and Gaps

Total Distance – Gap plus skip line
40 Feet Long

Table 6H.4



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## DURATIONS AND COMPONENT PARTS KNOWLEDGE CHECK

What is the purpose of the Buffer Zone?

Name 3 elements that help determine the make up of our work zones:

1.__

2. _

3.__

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## DURATIONS AND COMPONENT PARTS KNOWLEDGE CHECK

A Work Zone is on a 4 lane road, 12 foot lane, 55 mph. The area needed to perform the work is 500 feet long and 10 feet wide. Determine the distances for each of the Component Parts

1.____

2. ___

3.____

4. ____

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## DURATIONS AND COMPONENT PARTS KNOWLEDGE CHECK

A Work Zone is on a 4 lane road, 14 foot lane, 55 mph. The area needed to perform the work is 600 feet long and 10 feet wide. Determine the distances for each of the Component Parts

1.__

2. _

3.__

4. __

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## DURATIONS AND COMPONENT PARTS KNOWLEDGE CHECK

A Work Zone is on a 4 lane limited access, 14 foot lane, 55 mph. The area needed to perform the work is 600 feet long and 10 feet wide. Determine the distances for each of the Component Parts

1.__

2. _

3.__

4. __

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## DURATIONS AND COMPONENT PARTS KNOWLEDGE CHECK

In what manual and on what page are the "Durations" found?

1. __

2. __

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## DURATIONS AND COMPONENT PARTS KNOWLEDGE CHECK

A Work Zone is on a 2-lane road, 10 foot lane, 45 mph. It has alternating skip lines and double yellow lines. You will be there 4 hours. The area needed to perform the work is 250 feet long and 10 feet wide. Determine the distances for each of the Component Parts

1.___

2. __

3.__

4. __

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*What changes if the speed limit is 35 mph?*
*~~What changes if the speed limit is 30 mph?~~*

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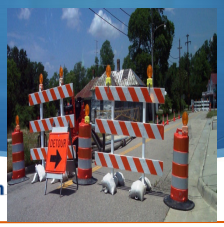
Rev April 2015

# Temporary Traffic Control Devices



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Module 6 - IWZTCT

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## Traffic Control Devices

To be effective, all traffic control devices should meet the following 5 Basic Requirements:

1. Fulfill a need
2. Command attention
3. Convey a clear, simple meaning
4. Command respect
5. Give adequate time for response

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Module 6 - IWZTCT

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- THE POWER OF WORDS
- SIGNS HAVE WORDS
- PCMS's HAVE WORDS
- TTC's ARE VISUAL REPRESENTATINS OF WORDS
- WE NEED TO BE CAREFUL HOW WE PRESENT THEM TO THE PUBLIC

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## Traffic Control Devices

Purpose of Traffic Control Devices (TCDs):

Ensure highway safety by providing for the ***orderly*** and ***predictable*** movement of traffic and provide the ***guidance*** and ***warning*** necessary for road users to get through the work zone safely.

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## Traffic Control Device Signs

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## Regulatory Signs

- Traffic Laws and regulations
- Must be authorized by proper authority (Regional Traffic Engineer or the jurisdiction's responsible charge) supported by Engineering Study
- Design Colors: Black & White, Red & White

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Warning Signs Are Used To:
WARN
ADVISE
DIRECT
ROAD WORK AHEAD
ONE LANE ROAD AHEAD
BE PREPARED TO STOP
LANE ENDS MERGE RIGHT
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Module 6 - IWZTCT

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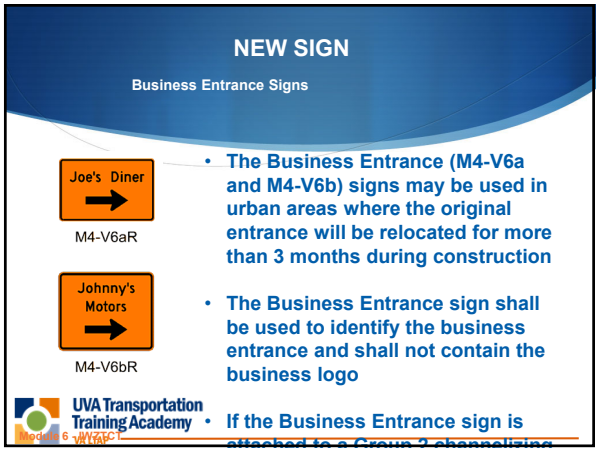
NEW SIGN
Business Entrance Signs
Joe's Diner
M4-V6aR
Johnny's Motors
M4-V6bR
• The Business Entrance (M4-V6a and M4-V6b) signs may be used in urban areas where the original entrance will be relocated for more than 3 months during construction
• The Business Entrance sign shall be used to identify the business entrance and shall not contain the business logo
• If the Business Entrance sign is
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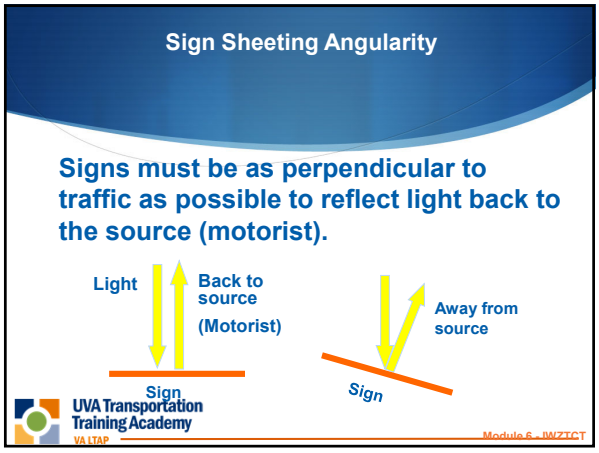
Sign Sheeting Angularity
Signs must be as perpendicular to traffic as possible to reflect light back to the source (motorist).
Light
Back to source
(Motorist)
Sign
Away from source
Sign
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VA LTAP
Module 6 - IWZTCT

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## Requirements for Rigid Signs

- Sign substrates for signs mounted on drums, Type 3 Barricades, and portable sign stands:
  - Rollup sign material
  - 0.4 inch thick corrugated polypropylene or polyethylene plastic
  - 0.079 inch thick aluminum/plastic laminate

**Substrate sign must be crashworthy meeting NCHRP 350 or MASH requirements.**



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## Minimum Sign Dimensions

- Unless restricted by right-of-way or pedestrians, the normal dimension for warning signs is *48″ x 48″*.

Standard

Greater emphasis larger signs should be used

**Right-of-way constraints 36″ x 36″ may be used**



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## Sign Placement

- Signs are generally placed on the right-hand side of the roadway.
  - Divided roadways with a median wider than 8' then left and right sign assemblies are required unless otherwise specified.

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## Sign Placement
## Narrow Medians

- Smaller signs may be used in the median when the median width is between 6.5 & 8' to provide left side assemblies on a multi-lane highway

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## Sign Height Requirements

- The bottom of a sign mounted on a portable sign support, shall be at least 1 foot above the traveled way.

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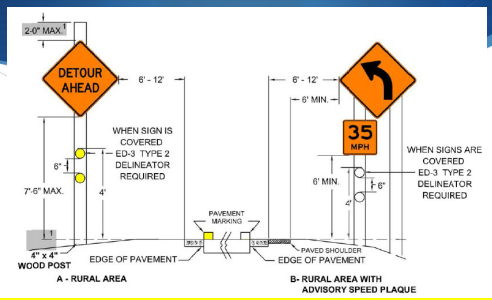
## Typical Post Mounted Installations




NOTE: FOR POST SIZE & INSTALLATION PROCEDURES SEE EITHER THE PLAN INSERTABLE SHEET OR VIRGINIA ROAD AND BRIDGE STANDARDS STP-1, WSP-1 & ED-3.

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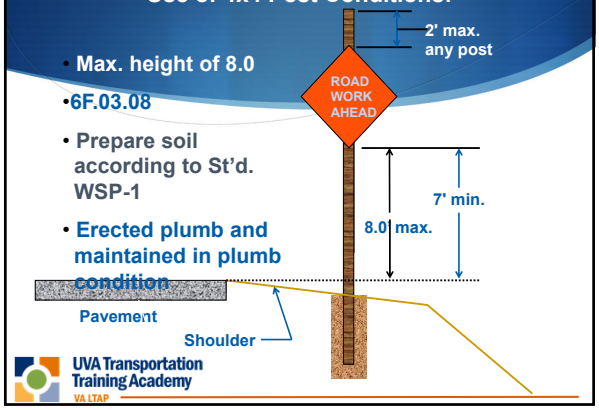
## Use of 4x4 Post Conditions:

- Max. height of 8.0
- 6F.03.08
- Prepare soil according to St'd. WSP-1
- Erected plumb and maintained in plumb condition

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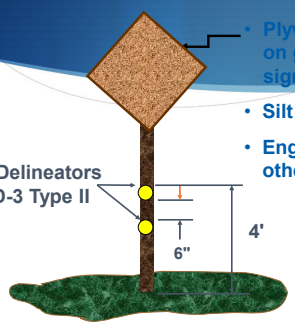
## Covering of Construction Signs

- Plywood allowed only on ground mounted signs
- Silt fence allowed
- Engineer approves other materials

2 Delineators
ED-3 Type II




A sign shall not be visible day or night

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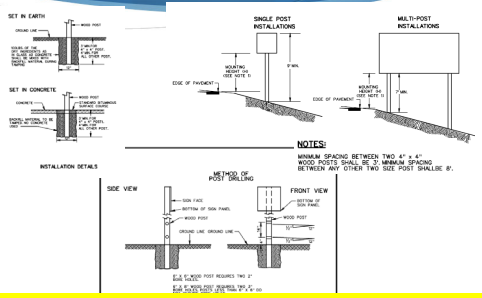
## Posts Requirements




NOTE: FOR POST SIZE & INSTALLATION PROCEDURES SEE EITHER THE PLAN INSERTABLE SHEET OR VIRGINIA ROAD AND BRIDGE STANDARDS STP-1, WSP-1 & ED-3.

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## Portable Sign Supports

- **Tripod sign stands:**
  - **shall not be used, regardless of their crashworthiness**
  - **reduces sign's retroreflectivity**
  - **reduces sign visibility**

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## Portable Sign Supports

**Section 6F.03, Sign Placement**

**Portable sign supports:**
**(20) Legs fully extended for stability or add weight**
**(21) Portable support weight:**

- **25 pound sand bag per leg or**
- **2 drum collars center of sign stand**

- **Sign & TTC notes for portable support weigh supersede & shall be followed!**

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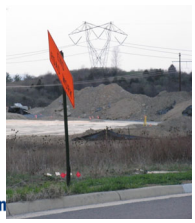
## Sign Maintenance

- Review work zone signs after setup and throughout the day, daily on long term projects and replace when needed (when signs lack respect).



174

## Arrow Board Proper Placement

- It SHALL be removed from the tow vehicle.
- LED type needs to be “AIMED” toward motorists.
- Nighttime the arrow must dim correctly *(50%).*

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## Channelizing Devices

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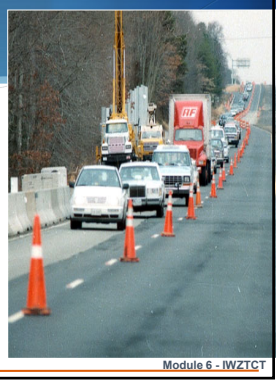
## Channelizing Devices Serve To:

- Delineate work areas
- Safely guide & direct road users
- Provide smooth & gradual traffic movement from one lane to another
- Reduce width of travel way



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## Proper Ballast

**Channelizing devices need to be reviewed and maintained throughout the work day.**

Would you believe this story?

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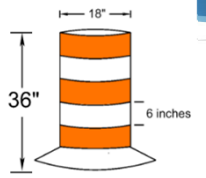
## New or Changed Work Zone Items

**Channelizing Device Group 2 Drums**



- Advertisement as of Jul2012 Retroreflectivity - Type 3 reboundable material
  - All drum regardless of advertisement date shall comply July 1, 2016.
- 6" alternating stripes orange & white

**Used in:**

- all tapers on Limited Access hwy at night
- unmanned work zones

Section 6F.75 (01), (02) (09);
~~Road & Bridge Specification 247~~



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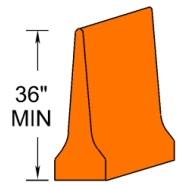
## New or Changed Work Zone Items

**Channelizing Devices: Group 2**
**Longitudinal Channelizing Device**




- Not a traffic barrier and has not met barrier crashworthy requirements
- May be used instead of cones, drums or barricades
- May be hollow or filled with water as ballast

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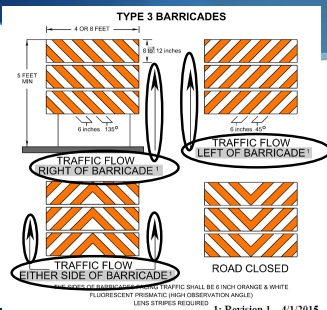
## Section 6F.76, Type 3 Barricades & Figure 6F-8




- Alternating stripes fluorescent orange and fluorescent white
- 45° - 6" stripe
- 4 or 8 feet wide
- Rail height 8"- 12"
- Crashworthy NCHRP 350 or MASH tested

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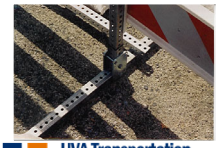
## Crashworthy Design



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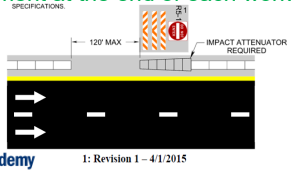
## Type 3 Barricades

- Used to close or partially close a road.
- Shall be used to close work access opening or construction entrance
- Assigned a person to ensure proper placement at the end of each work day.

*document*

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## Section 6F.64 Work Vehicle Frequent Turns sign

(01) Mounted on rear of a vehicle hauling/delivering material

(02) May be displayed at all times or covered or removed when not in use

(05) Not required when the tailgate has been removed or lowered for work operations

(05) Not required on vehicles which can enter or exit the work zone at higher speeds

(03) Work Vehicle Do Not Follow is not required on 1-way, 2-lane operation

G20-V1a [1]

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## Work Vehicle Frequent Turns

- Measured vertically from the bottom of the sign to the pavement a minimum of 4 feet and can be modified to fit indentions of the truck tailgate
  - Letters cannot be modified
  - Allows for sign to be cut in two
  - Eliminates border if necessary

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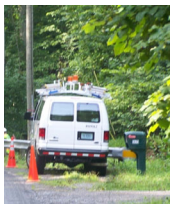
## Shadow Vehicles *EACH* and EVERY Work Zone has a Shadow Vehicle



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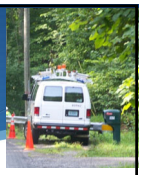
## Shadow Vehicle



- A vehicle used to protect workers or work equipment from an errant vehicle
- 360°amber vehicle warning light (high-intensity rotating, oscillating or flashing light)
  - If blocked by flashing arrow or CMS shall be visible for 180°
- (Parked 80 – 120 feet in advance of the first work area

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## Shadow Vehicle with a TMA

TMA attached to a shadow trailer or truck shall be:

- Crashworthy meeting NCHRP Report 350 (Test Level 3) or MASH testing.
- Weight of the support truck shall be in accordance to manufacturer's specifications

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Section 6F.95 (13), (08)

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## Shadow Vehicle with a TMA

***Remember or see check list***

Contractor must self-certify support truck:

- Manufacturer's support truck weight recommendation.
- Weight may be added to support truck.
- Copy of the weight ticket for truck.
- Weight ticket shall provide adequate information to associate the ticket with the applicable truck.

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## Shadow Vehicle with a TMA

- Question???
- What if I want to put a TMA on my Work Operations vehicle. Do I have to use another TMA as well?
- ANSWER:
- See Section 6G25.09

Section 6F.95 (13), (06)

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## Vehicle Warning Lights

- Amber warning lights shall be mounted as to be viewed 360 degrees on vehicles without arrow boards, and 180 degrees on vehicles with arrow boards
  - High intensity amber rotating
    - 75 to 135 flashers per minute
  - Oscillating amber light
  - High intensity amber flashing light
- Visible day or night conditions
  - ½ mile on Limited Access Highways
  - 1500 feet all other roadway

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## Vehicle Warning Lights

Amber Vehicle Warning lights:

- shall be used on all vehicles performing mobile operations
- should be used, DAY and NIGHT, on work vehicles entering and exiting the work area
- should be turned off unless perceived as a hazard on parked work operation vehicles or equipment in a stationary lane closure

White vehicle warning lights are reserved for emergency vehicles and shall not be used on construction/maintenance vehicles

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## Eliminate Floodlight Glare

**Anti-glare shields or Air-filled lights**

- **Should be considered if light glare cannot be eliminated**
- **Conversion units may be available for light towers**

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## Traffic Barriers

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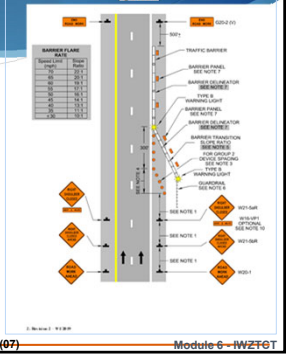
## Traffic Barrier Service

- **Barrier panel new name for barrier vertical panel**
- **Type B warning light used at the beginning of the barrier run & at the breakpoint**
- **Barrier panel spacing**
  - **40 feet taper**
  - **80 feet tangent (parallel to the travel way)**
- **Barrier delineator spacing**
  - **20 feet taper**
  - **80 feet tangent (in between panels)**



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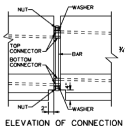
## Types of Barriers

Barrier Design

- Requires a positive connection
- Req'd. on ALL projects starting with Jan. 2000 adv. date
- VDOT's approved version shall be in 20' sections
- Other types are on the approved list

T-LOK




ELEVATION OF CONNECTION

PIN & LOOP

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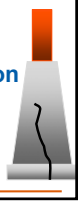
## Barrier Condition

- Contractor shall visually inspect all barriers
- Barriers shall be structurally sound
- No concrete missing
  - Top or bottom sides
  - End section of the barrier
- No through cracks
- Contractor shall furnish a self- certification
- NCHRP-350 or MASH Approved



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Road & Bridge Specifications Section 512

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## Barrier Deflection Table & Anchorage

- Appendix A;
- Pages A-13 & 14

•Anchorage - length of barrier needed upstream, downstream of the WZ to ensure maximum deflection is not exceeded

•No materials or equipment should be stored in deflection zone

**Table 2, Traffic Barrier Service Concrete Deflection Table**
Barrier types most likely to be used on VDOT projects are shown in **bold** and highlighted.

| FHWA Code | Manufacturer | Device Description | Test Level | Dynamic Deflection | Anchorage (a) |
|---|---|---|---|---|---|
| **B-79** | **Pennsylvania DOT** | **12.5' Long F-Shape temporary barrier w/plate connection.** | **TL-3** | **8'- 7"** | **80'** |
| **B-63** | **Barrier Systems, Inc.** | **Quickchange Moveable Barrier (QMB)** | **TL-3** | **4'- 6"** | **10'- 4"** |
| **B-54** | **Virginia DOT** | **20' Long F-Shape barrier w/pin & loop connection.** | **TL-3** | **6'** | **60'** |
| **B-42** | **Rockingham Precast** | **12' Long F-Shape w/T-Bar connection.** | **TL-3** | **3'- 10"** | **60'** |
| **B-40** | **Barrier Systems, Inc.** | **Narrow Quickchange Moveable Barrier.** | **TL-3** | **2'- 11"** | **(b)** |

**Table 3, Acceptable Longitudinal Steel Barriers**

| FHWA Code | Manufacturer | Device Description | Test Level | Dynamic Deflection | Anchorage |
|---|---|---|---|---|---|
| B134 | Energy Absorption Systems, Inc. | Vulcan Barrier | TL-3 | 13'- 2" | 302' Lg. (a) |
| B134 | Energy Absorption Systems, Inc. | Vulcan Barrier with Anchoring System VAS | TL-3 | 6'- 11" | (b) |
| B-131 | Highway Care, Inc. | Barrier Guard 800 | TL-3 | 4'- 11" | (c) |
| B-158 | Highway Care, Inc. | Barrier Guard 800 MDS | TL-3 | 0'- 3" | (d) |
| B-176A | Hill & Smith, Inc. | Zone Guard Standard | TL-3 | 6'- 4" | (e) |
| B-176A | Hill & Smith, Inc. | Zone Guard Minimum Deflection | TL-3 | 1'- 4" | (f) |

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## Improper Storage

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## Barrier Installation

- The storing of materials, equipment, or other hazards within the barrier deflection zone should be avoided.

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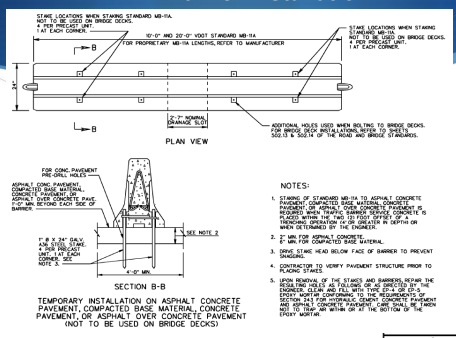
## Barrier Installation



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## Barrier Installation

### Appendix A, Page A-16

**BARRIER TRANSITION FLARE RATE**

| | | |
|---|---|---|
| 70 MPH | = | 22:1 |
| 65 MPH | = | 20:1 |
| 60 MPH | = | 19:1 |
| 55 MPH | = | 17:1 |
| 50 MPH | = | 16:1 |
| 45 MPH | = | 14:1 |
| 40 MPH | = | 13:1 |
| 35 MPH | = | 11.1 |
| 30 MPH & BELOW | = | 10:1 |

WHEN THE BARRIER TRANSITION SLOPE IS ON HORIZONTAL ALIGNMENT THE TOTAL OFFSET SHALL BE PRORATED AROUND THE CURVE IN LIEU OF A STRAIGHT LINE SLOPE.



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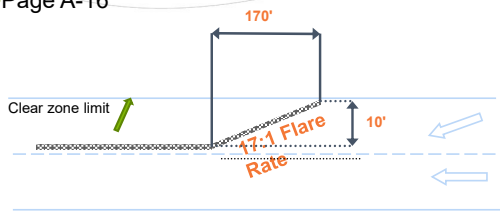
## Barrier Installation

- Barrier Transitions Flare Rate; Appendix A
- Page A-16



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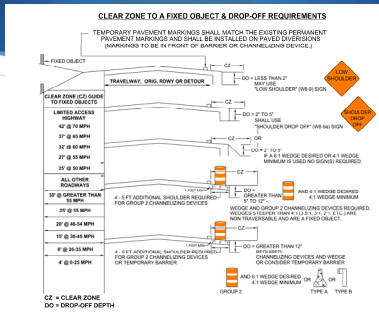
## Drop-off Condition



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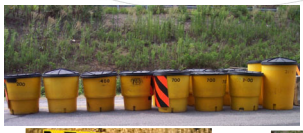
## Blunt End Protection

Approved end treatments



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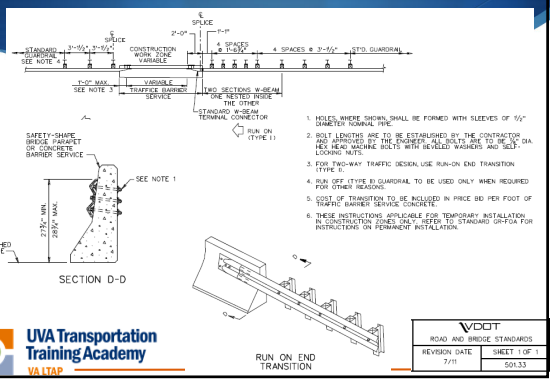
## FOA attachment for Construction Zones

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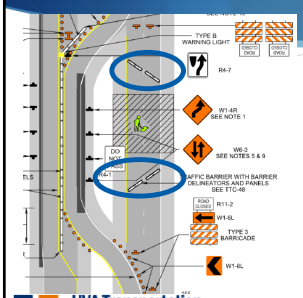
## Barrier for Road Closure




**Barrier required on long term road closures:**

- **when a grade differential of one foot or greater**
- **Barrier placed at 45° angle to the travel way**
- **Placed behind Type 3 Barricade but before the work space**
- **Placed to allow equipment access to WZ .**

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TTC-44

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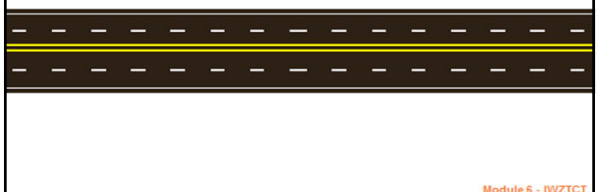
# Eradication and Temporary Pavement Markings & Markers



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## Pavement Marking & Eradication

- ***Pavement markings and markers are the primary source of delineation for motorist at night.***
- *Lack of markings, or improper eradication of existing markings, are one of the areas most cited in work zone litigation.*
- The following questions should be asked for every construction project . . .

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## Pavement Marking Eradication

- Are all conflicting pavement markings removed?

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## Pavement Marking Eradication

- Tapers and lane shifts are most important
- 100% removal required.

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## Pavement Marking Eradication

- Are conflicting pavement markings removed correctly?
- Black paint or spraying with asphalt shall not be a substitution for removal or obliteration of existing pavement markings
- Eradication by water/sand blasting, grinding or combination thereof

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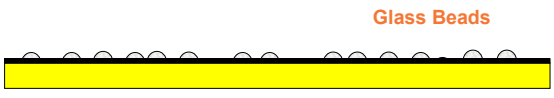
## Pavement Marking Eradication

- Painting over existing markings with black paint or asphalt is not allowed.

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## Pavement Marking & Eradication

- TTC-55

- Eradication of Pavement Markings in a Work Zone
  - In lane shift situations, all pavement markings and markers not behind temporary traffic barriers and within 6' of the new edge line shall be removed.
  - Remove reflective element from markers conflicting with new markings.

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## Pavement Marking Eradication

- Type E – Non-reflective removable black construction pavement marking
  - shall be applied in accordance with the manufacturer's recommendations
  - suggested to be used no longer than 120 days

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## Temporary Traffic Control Devices Knowledge Check

List the 5 needs for Temporary Traffic Control Devices

1. __
2. __
3. __
4. __
5. __

When on a highway with median barrier and the shoulder is between 6.5 & 8' is it ok to use a sign that is a different shape and size?

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## Temporary Traffic Control Devices Knowledge Check

Name the 2 devices that can be used to stabilized portable sign stands

1. _____
2. _____

True of False – Every work zone shall have a Shadow Vehicle

True or False - When inspecting Temporary Barrier Service; the most critical part is the connection.

Right lane width: 10" – speed limit 45 mph – What is the barrier distance away from the break that the barrier has to start?

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## Temporary Traffic Control Devices Knowledge Check

You are closing the right lane of a multi-lane highway with Temporary Barrier Service. What is the distance from the beginning of the hazard to the beginning of the Temporary Barrier Service?

Right lane width: 12" – speed limit 45 mph

***Which end of the barrier to we start to place first?***

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Rev May 2017, April 2015

VDOT
Virginia Department of Transportation

# Worker, Flagger & Pedestrian Safety

Module 7 - IWZTCT

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## Worker Safety

**Worker Safety Considerations:**

**All workers:**

- **should receive training appropriate to the job decisions they are required to make**
- **should be trained on how to work next to motor vehicle traffic to minimize their vulnerability.**
- **having specific TTC responsibilities should be trained on**
  - **TTC techniques**
  - **TTC device usage**
  - **TTC device placement**

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## Worker Safety

**Worker Safety Considerations – Contractor Responsibilities:**

- **Activity Area**
  - **Minimize backing-up maneuvers of construction vehicles**
  - **Minimize risk exposure**
- **Worker Safety Planning (Contractor)**
  - **Engineering**
  - **Administrative**
  - **Personal protection measures**
  - **OSHA**
  - ***ANOTHER STORY***

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Section 6D.03 (03) D, E

Module 7 - IWZTCT

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## Workers and Flaggers Personal Protection

Workers & flaggers are required to wear ANSI/ISEA 107-2010 Class 3 High Visibility Safety Apparel

- Wear safety apparel when exposed to traffic & construction equipment.
- All apparel shall be securely fastened to maximum the visibility of the workers.
- VDOT headwear shall have 360° of retroreflective material
- ANSI 107/ISEA 107-2010 headwear may be worn.

Sections 6D.03 (03), (07), (12), 6E.02 (03-05), (09)

Rev May2017
Module 7 - IWZTCT

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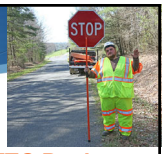
## High Visibility Apparel




Workers Installing and Removing TTC Devices and Flaggers:

- Type E Trousers (full length waistband trousers or overalls) shall be worn during day and night time flagging operations.
- Shorts shall not be worn

Sections 6D.03 (05), 6E.02 (04 – 05)

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Module 5 - BWZTC

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## High Visibility Apparel

- Leg Gaiters or Chaps are not allowed in lieu of Type E Trousers for workers installing, maintaining, or removing TTC devices
- Workers not installing TTC may wear leg gaiters as an option
- Allows utility flaggers to wear fire-retardant leg gaiters or chaps
- Lights internal to the high visibility apparel shall be steady burn yellow, white, or yellow-green

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## Flagger Requirements

Flaggers

- Shall communicate in English when flagging
  - Ability to receive and give instructions
- Courteous to drivers
- Must be minimum 18 years old

Section 6E.01 (04 - 06)

Rev May2017
Module 7 - IWZTCT

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## Nighttime Flagger Station Illumination

- Flagger stations shall be illuminated at night
  - 5-foot candles or 50 lux

Intensity of the light source in foot candles shall be available in written documentation

- 1 foot-candle equal 10.8 lux
- 5 foot-candle produce 54 lux (5 x 10.8 = 54)

Sections 6E.08 (03 - 06)

Rev May2017
Module 7 - IWZTCT

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## Nighttime Flagger Station Illumination

Types of Flagger Station Illumination:

- Floodlights
- Non-glare air-filled lights
- Floodlights with anti-glare shields

Street or highway lights as well as vehicle headlights do not satisfy illumination requirement for flagger stations.

Sections 6F.90 (04), (06); 6E.08 (06)

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VDOT
Flagging Operations
Flaggers are a crucial element of TTC because they are the first line of defense between public safety and worker safety and they make the greatest number of contacts with the public.
STOP
Rev May2017
Module 7 - IWZTCT
Section 6E.01 (06)
UVA Transportation Training Academy
VA LTAP

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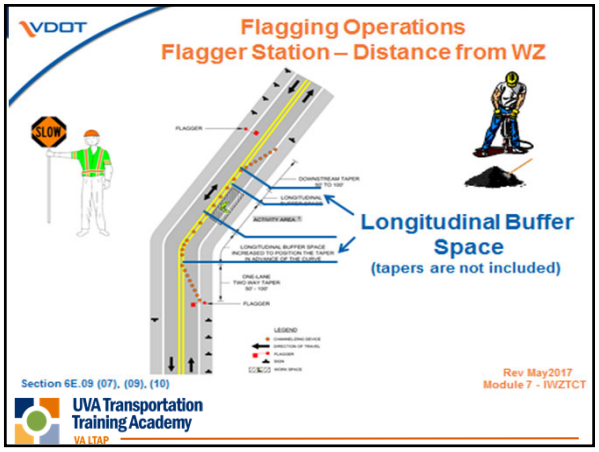
VDOT
Flagging Operations
Flagger Station – Distance from WZ
SLOW
FLAGGER
Longitudinal Buffer Space
(tapers are not included)
Rev May2017
Module 7 - IWZTCT
Section 6E.09 (07), (09), (10)
UVA Transportation Training Academy
VA LTAP

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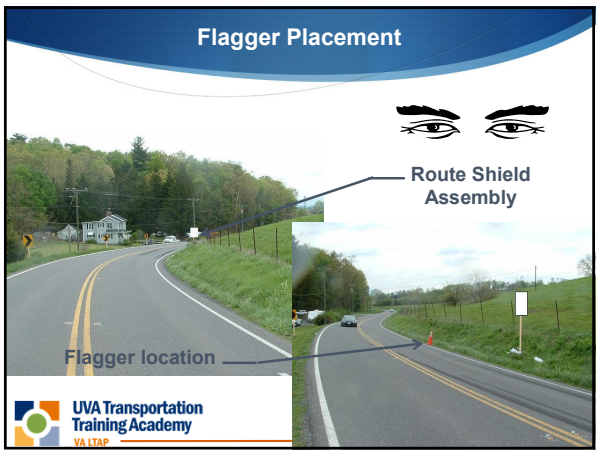
Flagger Placement
Route Shield Assembly
Flagger location
UVA Transportation Training Academy
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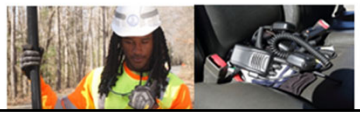
## Flagger Operations

- A lead flagger should be designated to coordinate flagging motions and traffic movement.
- When using pilot car operations the flaggers and pilot car operators shall be interconnected by radio communication.
- Flaggers should be interconnected by radio communication.



Sections 6C-12, 13 & 6E.08

Rev May2017
Module 7 - IWZTCT

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## Flagger Operations

- Cellular phones are not allowed.
- Flaggers shall control all intersecting roadways in between the mainline flaggers.
- Flagger may be added at the discretion of the Engineer for major traffic generator entrances.

Sections 6C-12, 13 & 6E.08

Rev May2017
Module 7 - IWZTCT

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## Flagger Operations

A Flagger shall not:

- stand in the travel lane if shoulders are available
- move into the travel lane; or
- stand in the center of the roadway or control traffic from the middle of an intersection.

Section 6E.07 (06)

Rev May2017
Module 7 - IWZTCT

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## Flagger Operations

A flagger
- shall stand alone
  - No workers
  - No vehicle
  - No equipment
- shall stand on the shoulder or near the shoulder as possible.
- should have an escape route
- should receive a 15 minute break every 2 hours

Sections 6E.01 (07), 6E.07 (06), (08)

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## Flagger Operations

- The flagger shall approach the vehicle from the passenger side to speak with a driver if directions or information must be given to a driver.
- Do not touch the vehicle.

Section 6E.07 (06)

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Module 7 - IWZTCT

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## FLAGGER SYMBOL SIGN

The Flagger (W20-1) symbol sign shall be removed or covered from road users when the flagger operation is suspended.

Section 6E.08 (01)

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## Typically Applications – TTC Figures

While not every situation is addressed in the WAPM, the information illustrated can generally be adapted to a broad range of conditions. In many instances, an appropriate TTC plan is achieved by combining features from various typical applications.

Section 6G.14 (18), TTC-30 1. a-c

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Module 7 - IWZTCT

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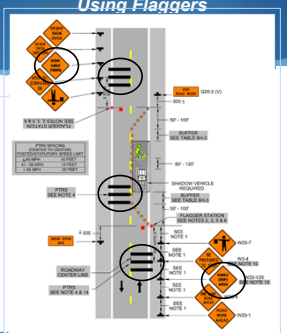
## Figures TTC-23

*Lane Closure on a Two-Lane Roadway Using Flaggers*



Two-way taper
5 - Channelizing Devices
50' taper
at 10' spacing
or
100' taper
at 20' spacing

RUMBLE STRIPS AHEAD

W20-V26

RUMBLE STRIPS and RUMBLE STRIPS AHEAD sign required

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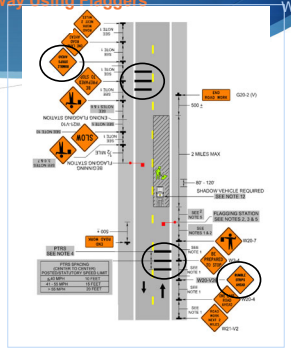
## Figures TTC-24

Non-Stationary Operation on a Two-Lane Roadway Using Flaggers

- The maximum length of WZ shall be two miles.
- PTRS and Rumble Strips Ahead sign shall be used
- Flagger symbol sign shall stay within ½ mile of the flagger.
- In lieu of a flagger walking to a new station, consider transporting a flagger when challenging terrain exist.
- A Supplemental Flagger using the Slow side of the paddle or a Slow sign may be installed in the advanced warning area to slow traffic



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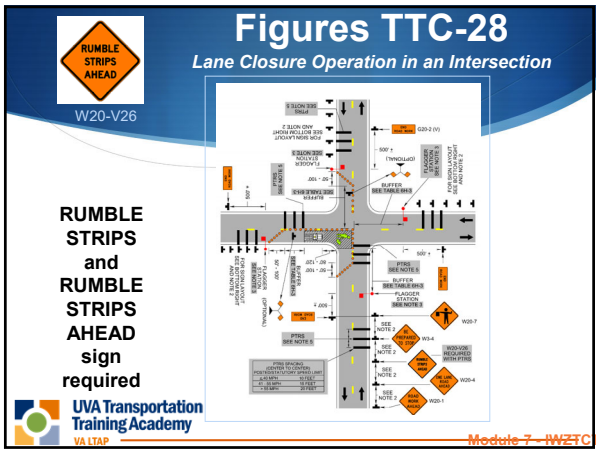
Figures TTC-28
Lane Closure Operation in an Intersection
RUMBLE STRIPS AHEAD
W20-V26
RUMBLE STRIPS and RUMBLE STRIPS AHEAD sign required
UVA Transportation Training Academy
VA LTAP
Module 7 - IWZTC

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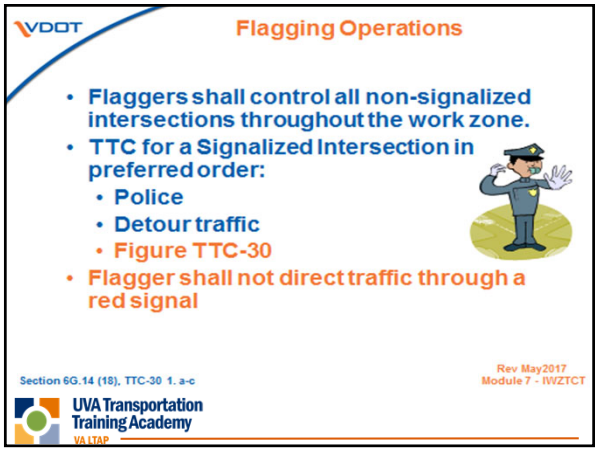
VDOT
Flagging Operations
• Flaggers shall control all non-signalized intersections throughout the work zone.
• TTC for a Signalized Intersection in preferred order:
• Police
• Detour traffic
• Figure TTC-30
• Flagger shall not direct traffic through a red signal
Section 6G.14 (18), TTC-30 1. a-c
Rev May2017
Module 7 - IWZTC
UVA Transportation Training Academy
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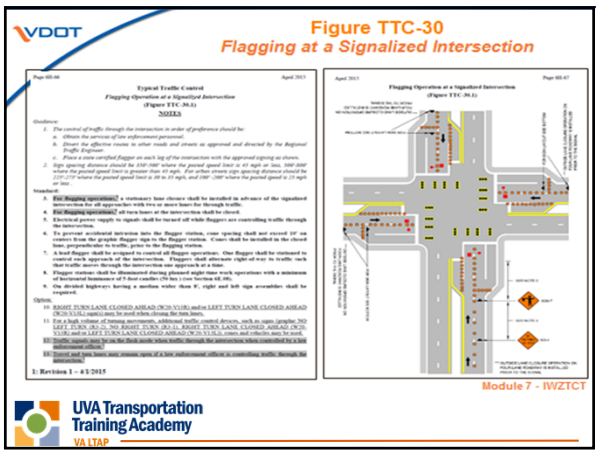
VDOT
Figure TTC-30
Flagging at a Signalized Intersection
Module 7 - IWZTC
UVA Transportation Training Academy
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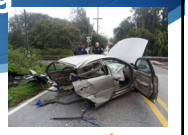
## Work In Vicinity of Highway-Rail Crossing



- When WZ causes traffic to backup or stop on an active rail tracks a LEO or flagger shall control traffic to prevent vehicles from stopping within the highway-rail grade crossing, even with automatic warning devices.
- The Contactor shall coordinate all operations on or over Rail right-of-way with the Railway Company and make all arrangements for necessary flagger and watchperson service

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VDOT

## Enhancing Flagger Operations

- We've already discussed wearing Class E Trouser both day and night
- Road Flares
- Flashing LED STOP/SLOW Paddles
- Automated Flagger Assistance Devices
- Portable Temporary Rumble Strips

Section 6F.96 (06), (07), TTC-23

Rev May2017 Module 7 - IWZTCT

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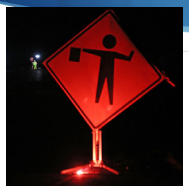
## Enhancing Flagger Operations

**Road Flares**
(weather permitting)



**Effective both day & night**

**Nighttime**
**red steady burn glow cone on flashlight, traffic baton or wand**

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## Enhancing Flagger Operations

### Flashing LED STOP/SLOW Paddles

Effective both day & night

Section 6F.96 (06), (07), TTC-23

Rev May2017 Module 7 - IWZTCT

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## Automated Flagger Assistance Devices (AFAD)

STOP / SLOW

RED & YELLOW LENS

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Rev May2017 Module 7 - IWZTCT

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VDOT

## Automatic Flagger Assistance Device

- Removes flagger from the roadway
- Controlled remotely
- Must be controlled by a certified flagger who is AFAD trained
  - A flagger may be centrally located between AFADs but must see both AFADs & approaching traffic
  - Uses a flagger at each AFAD;
- Cannot run on a timed relationship between AFAD
- Cannot be used as a traffic signal.

Section 6E.04 (01), (07)

Rev May2017 Module 7 - IWZTCT

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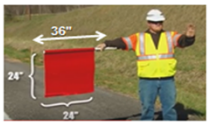
## Flag Requirements:

- Used in emergency situations
- Used by Traffic Spotters
- Temporary Traffic Control Spotters can use
- 24 x 24-inch square red or orange/red
- Shall be on a 36-inch staff
  - 1 to 1¼ inches in diameter
- Shall be retroreflective (fluorescent both sides) when used at night red or orange/red)




Section 6E.03 (10 – 12)

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Module 7 - IWZTCT

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## Flagger Procedures Using A Flag

Raise & lower slowly

Section 6E.10 (01 – 04)

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## Traffic Spotter

A Certified Flagger who can control both directions of traffic

- Used on low volume (under 500 VPD) low speed subdivision streets (30 mph or less)
- Road Work Ahead sign required
  - Additional signs may be needed depending on geometric conditions
- Must be visible to oncoming traffic
- Uses 24" flag
- Can use STOP/SLOW paddle

Section 6E.09 (01 – 05)

Rev May2017
Module 7 - IWZTCT

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## Flagger Operations

**Flaggers shall be trained and possess a valid certification card from:**

- ATSSA classroom – recertify every 4 years
- VDOT – recertify every 2 years
- Online flagging courses are not accepted

Section 6E.01 (02), (03)

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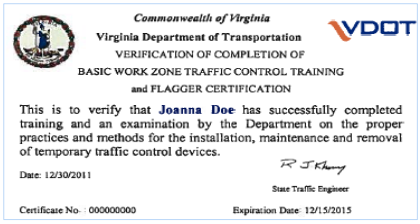
## Flagger Operations



*Commonwealth of Virginia*
**Virginia Department of Transportation**
VERIFICATION OF COMPLETION OF
BASIC WORK ZONE TRAFFIC CONTROL TRAINING
and FLAGGER CERTIFICATION

This is to verify that **Joanna Doe** has successfully completed training and an examination by the Department on the proper practices and methods for the installation, maintenance and removal of temporary traffic control devices.

Date: 12/30/2011

State Traffic Engineer

Certificate No.: 000000000 Expiration Date: 12/15/2015

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## Flagger Don'ts

- No chairs
- No headphones
- No cellular phones
- No texting
- No Stop/Slow paddle or flag installed in drums or cones

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## Inspector Responsibility

- Flaggers not performing their duties should be reported to the contractor and documented.
- If the flagger does not improve, have the contractor remove the flagger from the roadway and do not pay for the inadequate service.

Road & Bridge Specifications 105.14 (C)



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## Worker or Flagger – What Now?

It's now your job to ensure that:

- Flaggers are following the procedures we discussed
- Flaggers are highly visible from the last FLAGGER symbol sign.
- If poor visibility to the flagger station; add buffer space or add a supplemental flagger should be used.
- If shoulders are inadequate for a flagger a SLOW sign may be used in lieu of the supplemental flagger.

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## Worker or Flagger – What Now?

**VDOT Flagging Video**

**Pay careful attention. There are several test questions presented here!!!**

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VDOT

## Pedestrians Safety

**Section 6D.01**

**Standards**

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.



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## Pedestrians Safety

**Section 6D.01 (07) B**

**Pedestrians should not be led into conflicts with:**

- vehicles, equipment & operations.
- vehicles moving through or around work site.

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ONE WAY
SIDEWALK CLOSED
Landing place
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VA LTAP
Module 9 - IWZTCT

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VDOT
Pedestrians Safety
Section 6D.01 (07) C
Pedestrians should be provided with a convenient and accessible path that replicates as nearly as practical existing:
• sidewalk(s) or
• footpath(s)
Module 7 - IWZTCT
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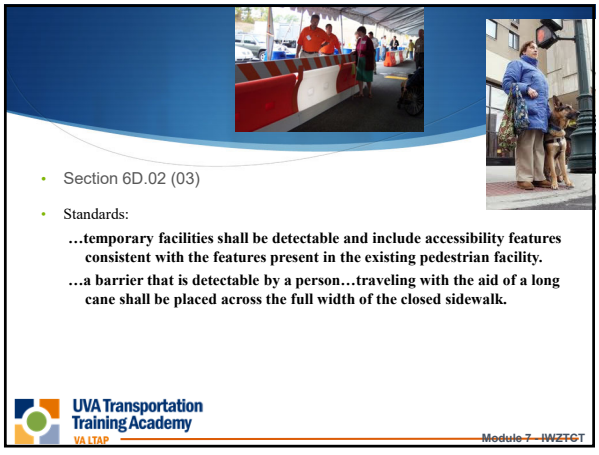
• Section 6D.02 (03)
• Standards:
…temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility.
…a barrier that is detectable by a person…traveling with the aid of a long cane shall be placed across the full width of the closed sidewalk.
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Module 7 - IWZTCT

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## Current Standards for Pedestrians in Work Zones

- Section 6D.02
- *Guidance:*
  - 05 *Because printed signs and surface delineation are not usable by pedestrians with visual disabilities…signal information should be communicated…by providing audible devices, …barriers and channelizing devices…*
  - 07 *If a pushbutton is used to provide equivalent TTC information…the pushbutton should be equipped with a locator tone to notify pedestrians with visual disabilities…and to help them locate the pushbutton.*

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- **Width of existing pedestrian facility should be provided if practical…. If not possible to maintain a minimum width of 48 inches, provide a 60" x 60" passing space every 200 feet.**
- **TTC and construction materials should not intrude into the usable width of the sidewalk, temporary pathway or other pedestrian facility.**

**Disabled Pedestrian Considerations**

Section 6D.01 (11 D)

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## Pedestrian Safety

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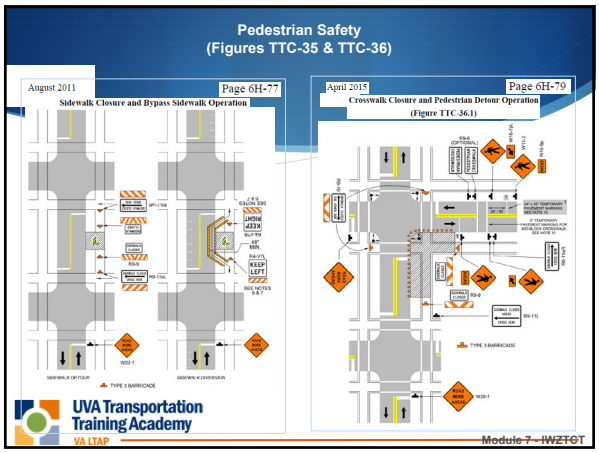
Pedestrian Safety
(Figures TTC-35 & TTC-36)
August 2011
Page 6H-77
Sidewalk Closure and Bypass Sidewalk Operation
April 2015
Page 6H-79
Crosswalk Closure and Pedestrian Detour Operation
(Figure TTC-36.1)
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Module 7 - IWZTCT

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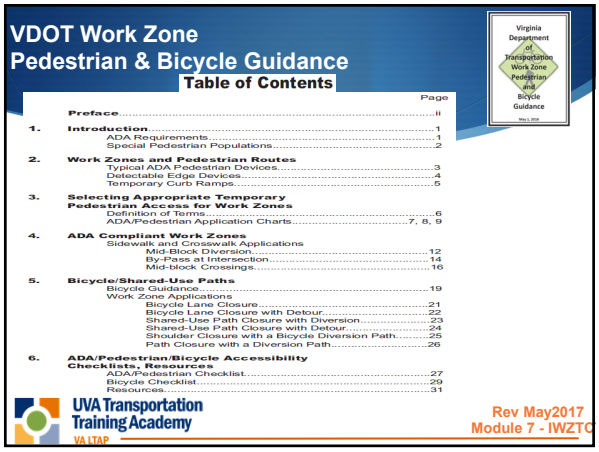
VDOT Work Zone
Pedestrian & Bicycle Guidance
Table of Contents
Virginia Department of Transportation Work Zone Pedestrian and Bicycle Guidance
Page
Preface ii
1. Introduction 1
ADA Requirements 1
Special Pedestrian Populations 2
2. Work Zones and Pedestrian Routes
Typical ADA Pedestrian Devices 3
Detectable Edge Devices 4
Temporary Curb Ramps 5
3. Selecting Appropriate Temporary Pedestrian Access for Work Zones
Definition of Terms 6
ADA/Pedestrian Application Charts 7, 8, 9
4. ADA Compliant Work Zones
Sidewalk and Crosswalk Applications
Mid-Block Diversion 12
By-Pass at Intersection 14
Mid-block Crossings 16
5. Bicycle/Shared-Use Paths
Bicycle Guidance 19
Work Zone Applications
Bicycle Lane Closure 21
Bicycle Lane Closure with Detour 22
Shared-Use Path Closure with Diversion 23
Shared-Use Path Closure with Detour 24
Shoulder Closure with a Bicycle Diversion Path 25
Path Closure with a Diversion Path 26
6. ADA/Pedestrian/Bicycle Accessibility Checklists, Resources
ADA/Pedestrian Checklist 27
Bicycle Checklist 29
Resources 31
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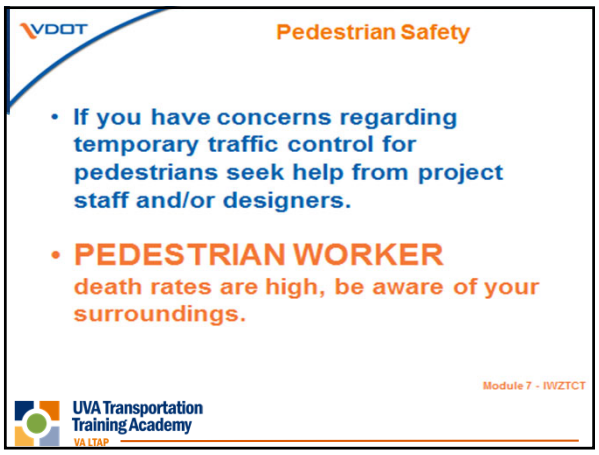
VDOT
Pedestrian Safety
• If you have concerns regarding temporary traffic control for pedestrians seek help from project staff and/or designers.
• PEDESTRIAN WORKER death rates are high, be aware of your surroundings.
Module 7 - IWZTCT
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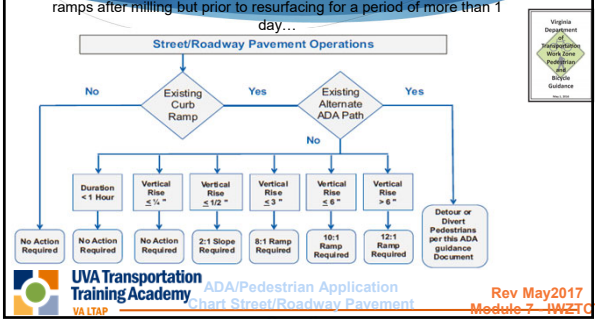
## VDOT Work Zone Pedestrian & Bicycle Guidance

**Street/Roadway Operations:** Pavement resurfacing such as Mill & Fill/Mill & Overlay work that closes or impedes pedestrian access at curb ramps after milling but prior to resurfacing for a period of more than 1 day…

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ADA/Pedestrian Application Chart Street/Roadway Pavement

Rev May2017

Module 7 – IWZTC

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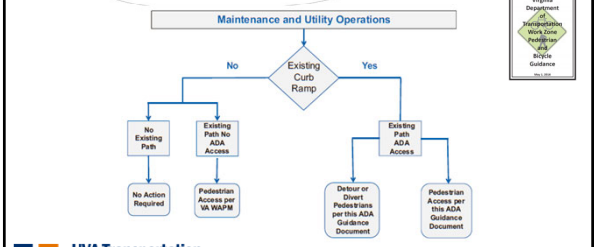
## VDOT Work Zone Pedestrian & Bicycle Guidance

**Maintenance and Utility Operations:** Daytime or nighttime work that closes or impedes pedestrian access on a pedestrian route daily over a period of 3 or fewer days…

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ADA/Pedestrian Application Chart Maintenance/Utility

Module 7 – IWZTC

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## Knowledge Check

- What is the sign that we can use when there is no safe place for a "spotter" to stand?
- What page would you find the typical set up for a flagging operation? VWAPM _____ Pocket Guide _____?
- Name all of the signs for a flagging operation in the order that a motorist would encounter them on a road with a center line $ 35 mph.
- 1.
- 2
- 3.
- 4.
- 5.

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## Flagger and Pedestrian Safety Knowledge Check

- True or False – a Flagger must be empowered to make sure all conditions for the work zone have been properly accounted for.
- Name several conditions that is not a good place for a flagger and why.
- Describe the Flagger's primary device:

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Rev April 2015

## Building WZ Skills & Mobile Operations

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## How to Lay Out a Work Zone

- Everything is based on **posted speed limit**
- Determine where the work will begin then
- working backwards determine the:
  - Amount of buffer space required
  - Types of tapers and their lengths
    - Shoulder, merging and shifting tapers
    - Is there adequate sight distance to the flagger station or arrow board?
  - Sign Spacing:
    - Start at the beginning of taper to the first advance warning sign – Road Work Ahead
    - Is there adequate sight distance?

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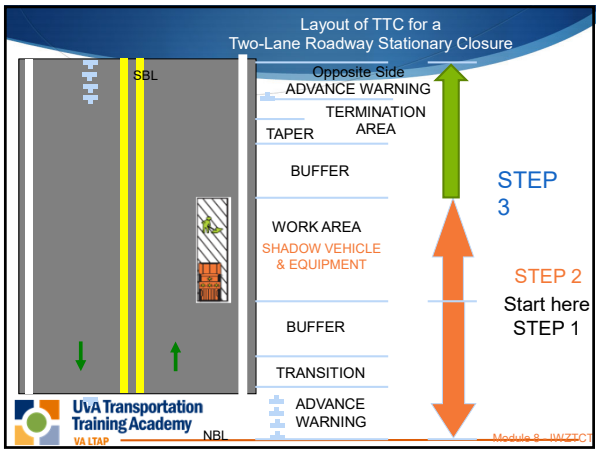
Layout of TTC for a
Two-Lane Roadway Stationary Closure
SBL
Opposite Side
ADVANCE WARNING
TERMINATION
AREA
TAPER
BUFFER
WORK AREA
SHADOW VEHICLE
& EQUIPMENT
BUFFER
TRANSITION
ADVANCE
WARNING
NBL
STEP
3
STEP 2
Start here
STEP 1
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Module 8 - IWZTCT

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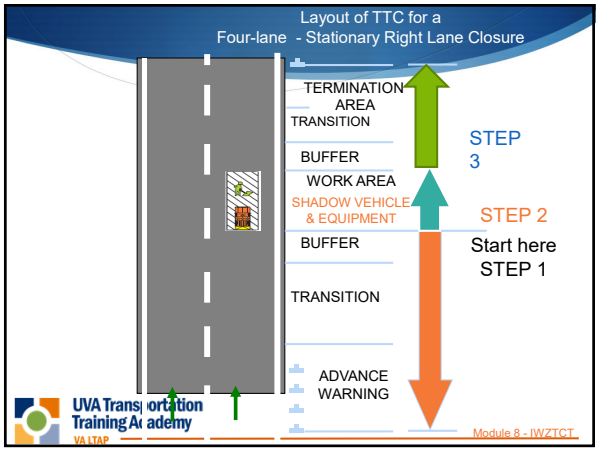
Layout of TTC for a
Four-lane - Stationary Right Lane Closure
TERMINATION
AREA
TRANSITION
BUFFER
WORK AREA
SHADOW VEHICLE
& EQUIPMENT
BUFFER
TRANSITION
ADVANCE
WARNING
STEP
3
STEP 2
Start here
STEP 1
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Module 8 - IWZTCT

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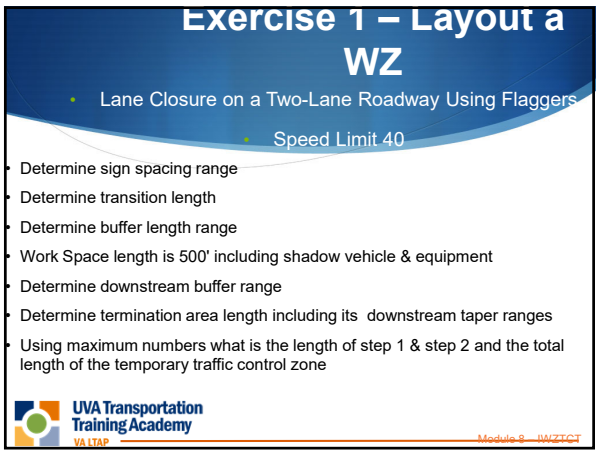
Exercise 1 – Layout a WZ
Lane Closure on a Two-Lane Roadway Using Flaggers
Speed Limit 40
Determine sign spacing range
Determine transition length
Determine buffer length range
Work Space length is 500' including shadow vehicle & equipment
Determine downstream buffer range
Determine termination area length including its downstream taper ranges
Using maximum numbers what is the length of step 1 & step 2 and the total length of the temporary traffic control zone
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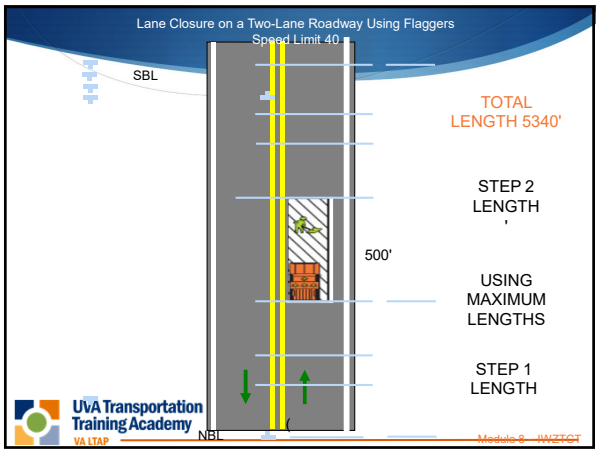


280

# Exercise 2 – Layout a WZ

Outside Lane Closure Operation on Four-Lane Roadway
Speed Limit 55

- Determine sign spacing range
- Determine transition length (lane width = 11 feet)
- Determine buffer length range
- Workspace length is 10560' including shadow vehicle & equipment
- Determine termination area length including its downstream taper ranges
- Using maximum numbers what is the length of step 1 & step 2 and the total length of the temporary traffic control zone

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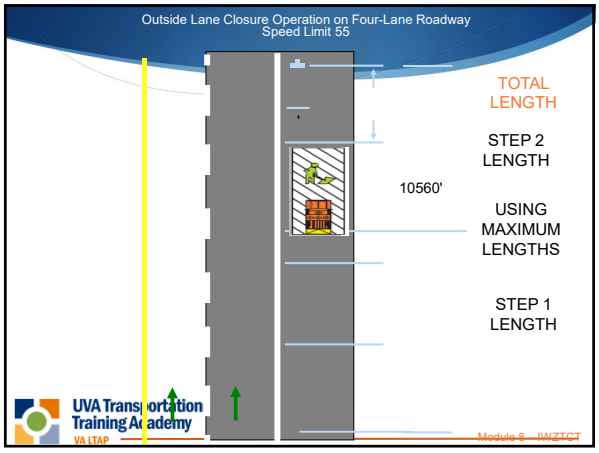


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## Install & Remove TTC

- WAPM - Section 6G.25
- Installing/Removing Temporary Traffic Control

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## Installing & Removing TTC Devices on a Two-Lane Roadway

- A modified mobile flagging operation should be used:
  - A Flagger using a Stop/Slow paddle controls traffic
  - A shadow vehicle protects workers
  - A worker operations vehicle transports TTC devices
  - Vehicles require amber warning lights
- When a shadow vehicle is not available
- A TTC Flagger using a Stop/Slow paddle controls traffic
  - An additional TTC Flagger is added
    - **Station prior to the shadow vehicle(work operations vehicle)**
    - **Warns and alert workers of approaching traffic**
    - **Controls traffic when necessary**
  - The work operations vehicle with amber warning lights acts as a shadow vehicle to protect workers

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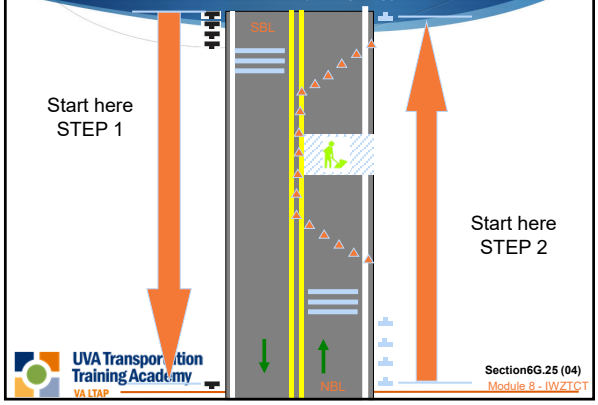
## Installing TTC Devices on a Lane Closure on a Two-Lane Roadway Using Flaggers

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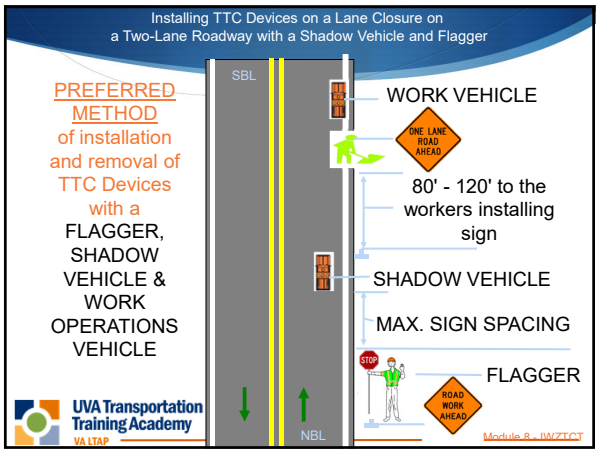
Installing TTC Devices on a Lane Closure on
a Two-Lane Roadway with a Shadow Vehicle and Flagger
PREFERRED METHOD of installation and removal of TTC Devices with a FLAGGER, SHADOW VEHICLE & WORK OPERATIONS VEHICLE
SBL
NBL
WORK VEHICLE
ONE LANE ROAD AHEAD
80' - 120' to the workers installing sign
SHADOW VEHICLE
MAX. SIGN SPACING
FLAGGER
ROAD WORK AHEAD
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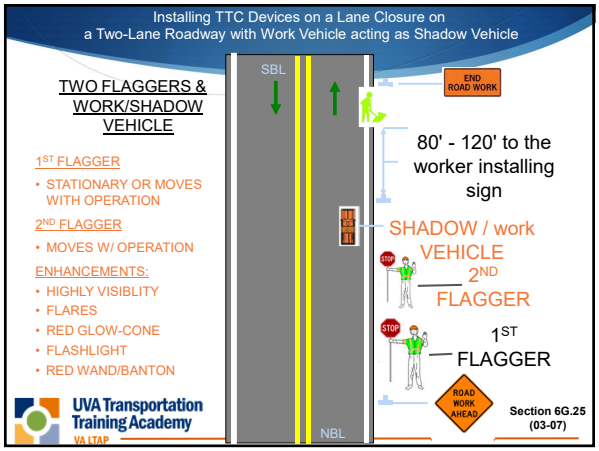
Installing TTC Devices on a Lane Closure on
a Two-Lane Roadway with Work Vehicle acting as Shadow Vehicle
TWO FLAGGERS & WORK/SHADOW VEHICLE
1ST FLAGGER
• STATIONARY OR MOVES WITH OPERATION
2ND FLAGGER
• MOVES W/ OPERATION
ENHANCEMENTS:
• HIGHLY VISIBLITY
• FLARES
• RED GLOW-CONE
• FLASHLIGHT
• RED WAND/BANTON
SBL
NBL
END ROAD WORK
80' - 120' to the worker installing sign
SHADOW / work VEHICLE
2ND FLAGGER
1ST FLAGGER
ROAD WORK AHEAD
Section 6G.25 (03-07)
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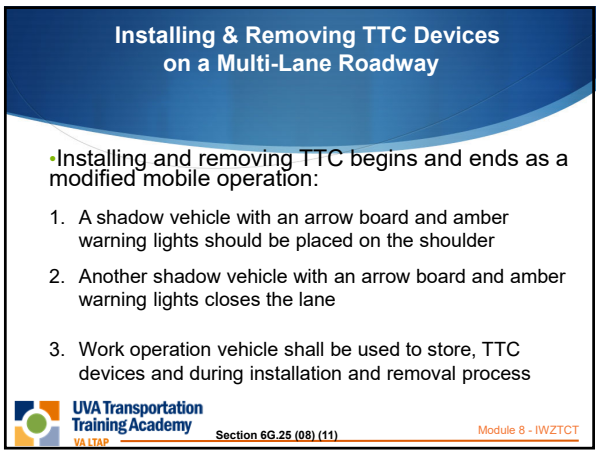
Installing & Removing TTC Devices on a Multi-Lane Roadway
•Installing and removing TTC begins and ends as a modified mobile operation:
1. A shadow vehicle with an arrow board and amber warning lights should be placed on the shoulder
2. Another shadow vehicle with an arrow board and amber warning lights closes the lane
3. Work operation vehicle shall be used to store, TTC devices and during installation and removal process
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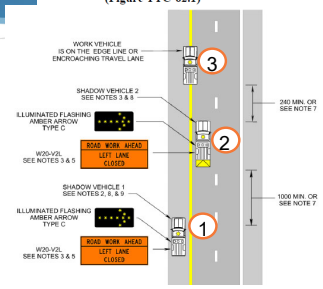
## Installing & Removing TTC Devices on a Multi-Lane Roadway

1. Shadow Vehicle on the shoulder
2. Shadow Vehicle closes the lane
3. Work Vehicle is used to install traffic control devices



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## Installing & Removing TTC Devices on a Multi-Lane Roadway

- TMA required on shadow vehicle when:
  - Posted speed limit is 45 or greater
    - **If shadow vehicle is partially or full in the travel lane**
- The work operations vehicle may be equipped with a TMA; however it must also be protected by a shadow vehicle.
- Workers should not run across open travel lane(s) of traffic to install or remove TTC devices unless a slow roll TTC operation is performed.



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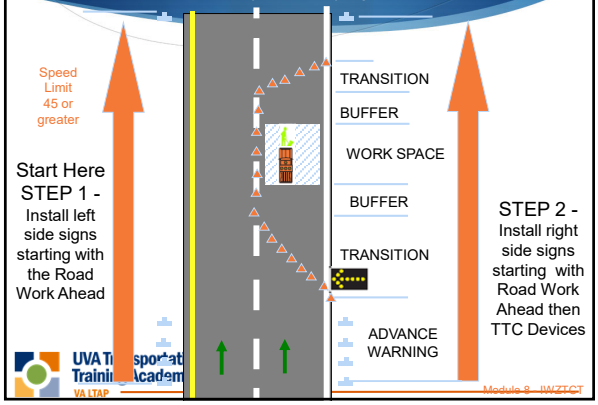
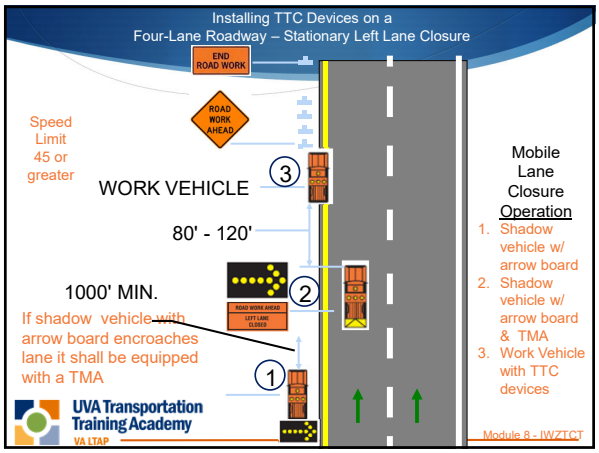
## Installing TTC Devices on a Four-Lane Roadway – Stationary Right Lane Closure






291


Installing TTC Devices on a
Four-Lane Roadway – Stationary Left Lane Closure
END ROAD WORK
ROAD WORK AHEAD
Speed Limit 45 or greater
WORK VEHICLE
3
80' - 120'
1000' MIN.
2
If shadow vehicle with arrow board encroaches lane it shall be equipped with a TMA
1
Mobile Lane Closure Operation
1. Shadow vehicle w/ arrow board
2. Shadow vehicle w/ arrow board & TMA
3. Work Vehicle with TTC devices
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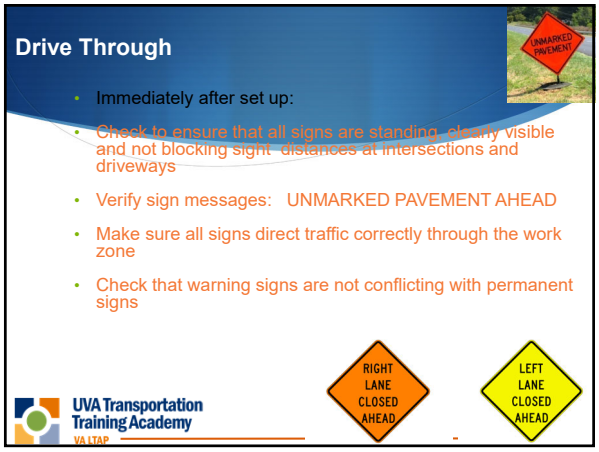
Drive Through
UNMARKED PAVEMENT
Immediately after set up:
Check to ensure that all signs are standing, clearly visible and not blocking sight distances at intersections and driveways
Verify sign messages: UNMARKED PAVEMENT AHEAD
Make sure all signs direct traffic correctly through the work zone
Check that warning signs are not conflicting with permanent signs
RIGHT LANE CLOSED AHEAD
LEFT LANE CLOSED AHEAD
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Drive Through
Immediately after set up:
Check the visibility and operation of:
Channelizing devices
Flagger
Arrow Board(s),
TMA and PCMS
Tapers
Delineation of PCMS and Arrow Boards
Make adjustments to TTC if necessary
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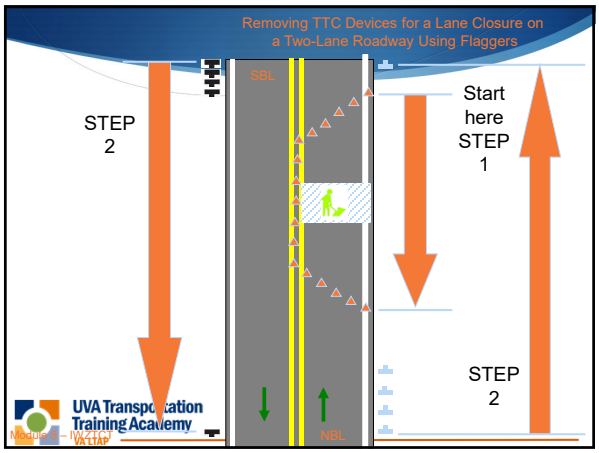
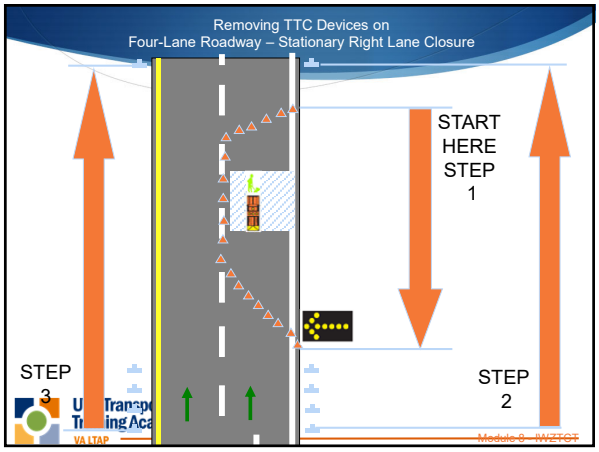



295

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## Tips for working in a Mobile Operation:

- Vehicle warning lights shall be on all vehicles
  - high intensity amber rotating, flashing, or oscillating light or combinations
  - 180°visibility when equipped with arrow board or CMS otherwise 360°visibility
- The vehicle mounted warning sign may be replaced by CMS with 10" min. letter height
  - Each word message phase should be followed by the Type B arrow display
- Shall have radio communication between vehicles
- Shadow vehicles must be seen by approaching vehicles – adjust spacing for horizontal and vertical curves

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## Tips for working in a Mobile Operation (Continued)

- Shadow Vehicle 1 shall travel along the paved shoulder with either a flashing arrow or a PCMS advising of the operation ahead
  - If the shadow vehicle partially encroaches the travel lane it shall be equipped with a TMA.
- Shadow Vehicle 2 with TMA shall straddle the edge line or travel fully in the lane & Shadow Vehicle 3 with TMA (if required) shall travel fully in the lane it is closing
- Position of the Shadow Vehicle with TMA behind the work operations vehicle
  - Stationary (stopped) behind work vehicle 80' - 120'
  - Moving position 240' ±

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## Mobile Operation TMA Placement

1st TMA Shadow Vehicle on the shoulder

2nd straddles edge line or is in the closed lane & 3rd when required is in the closed lane

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## Building Work Zone Skills Knowledge Check

List the component parts in the order discovery in order to determine where the "ROAD WORK AHEAD" sign is to be placed. Flagging Operation no Rumble Strips

- 1.
- 2.
- 3.
- 4.

- Remember – start where the work begins and work your way backward

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## Building Work Zone Skills Knowledge Check

- In a multi-lane mobile operation there is always a truck on the shoulder. What is the rule regarding any special equipment it should have on It?

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## Making Adjustments to TTC & Documentation

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## Determining when adjustments are needed

- Minimum straight line typical applications for temporary traffic control requirements are found in the:
  - WAPM
  - Pocket Guide
- A typical application should be altered, when necessary, to fit the conditions of a particular location.

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Section 6B.01 TOC

Module 9 - IWZTCT

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## Adjustment Factors

- The factors that lead most often to the decision to adjust the minimum typical application are:
  - Traffic volumes
  - Travel speeds
  - Roadway characteristics
    - **Terrain / Geometric conditions**
    - **Railroad crossings**
    - **Intersections**
    - **Entrances / driveways**

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## Rules to Enhancing WZ

To enhance the Work Zone layout

Add to the layout
- Signs
- Channelizing devices
- Flaggers to a work zone
  - Rolling terrain
  - Curves
  - Access points
  - Slow sign

Alert and Slow Traffic

W21-V10

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## Hills and Curves

- Place TCD in advance of curves
- to maximize visibility
  - Increase sign spacing
  - Extend closure
    - **Longer buffer space**
  - Strive to provide a clear line of sight from the graphic warning signs to the:
    - **Arrow board**
    - **Flagger stations**

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## Drivers - Hills and Curves

Cone of Vision basically is the straight ahead vision we see as drivers.

Sight Obstructions:

- Horizontal curve
- Vertical curve
- Trees, shrubs, vegetation
- Longitudinal barrier
- Rock outcroppings



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## Hills and Curves

Motorists should be able to see the lane closure taper from the last warning sign.

Extending the lane closure devices in advance of the curve improves sight distance, reducing surprises.



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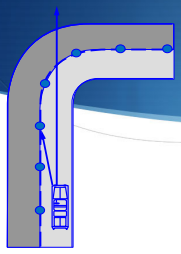
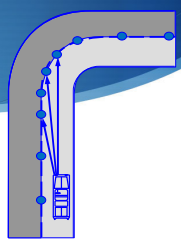
## Hills and Curves

### Curvature of Road



Motorist tend to "look through" channelizing devices if spacing is not reduced on curves.



Reducing the spacing of th devices on curves minimiz the "look through" effect.



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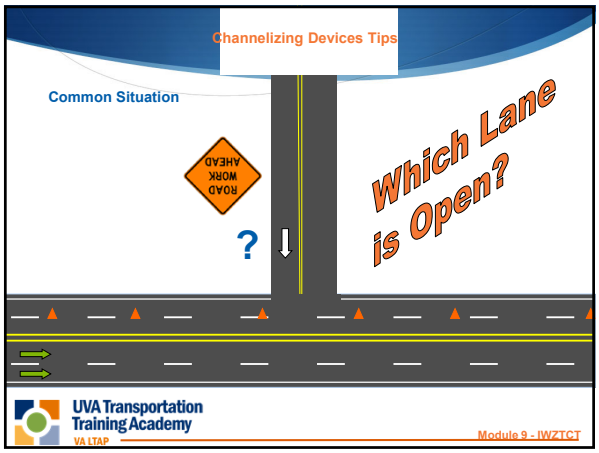
Channelizing Devices Tips
Common Situation
ROAD WORK AHEAD
?
Which Lane is Open?
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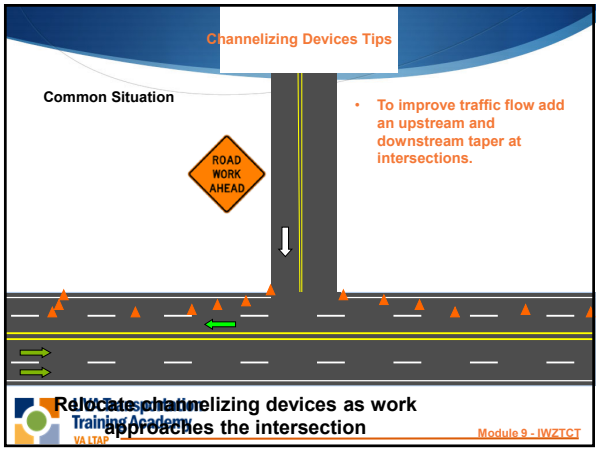
Channelizing Devices Tips
Common Situation
ROAD WORK AHEAD
• To improve traffic flow add an upstream and downstream taper at intersections.
Relocate channelizing devices as work approaches the intersection
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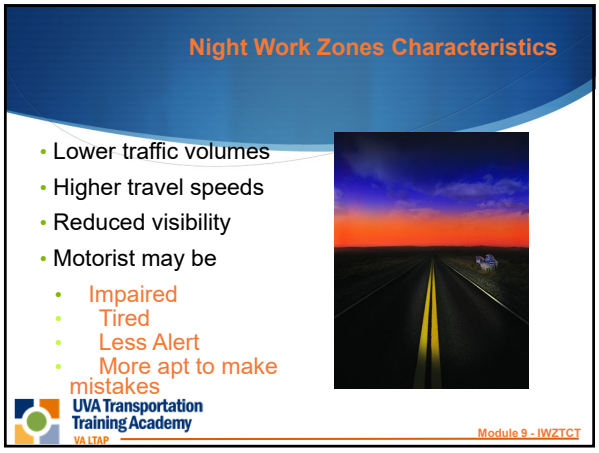
Night Work Zones Characteristics
• Lower traffic volumes
• Higher travel speeds
• Reduced visibility
• Motorist may be
• Impaired
• Tired
• Less Alert
• More apt to make mistakes
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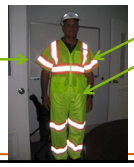
## Night Work Zones

- Night Activities -
- Traffic control should be installed for nighttime operations from 30 minutes before sunset to 30 minutes after sunrise.
  - ❖ **Allowable work hours defined by the Regional Traffic Engineer or locality should be followed**

Since July 1, 2012 Workers Class 3 Apparel



Class 3 Apparel & Type E Trousers - flaggers as well as workers installing, removing & maintaining TCD

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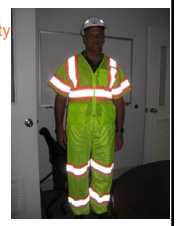
## Night Work Zones

Workers & Flaggers highly-visibility safety apparel

- ANSI/ISEA 107-2010 Class 3 risk
- All apparel shall be securely fastened so high-visibility apparel is visible for 360° around the wearer.
- Flagging at night
  - illuminate flagger station
  - illuminate AFAD



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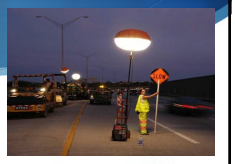
## Night Work Zones

- Flares or light sticks may enhance work zones.
- Law enforcement may enhance work zones.
- Monitor Work Zone signs for moisture/ condensation.
- Flagger may use retroreflective gloves to enhance hand movement.
- Flagger Stations shall be illuminated



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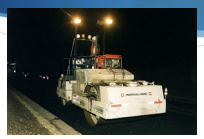
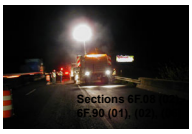
## Night Work Zones

- Ensure work lights are not blinding motorist,



otherwise use non glare air-filled light devices or anti-glare visors.



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Sections 6F.88 6F.90 (01), (02)



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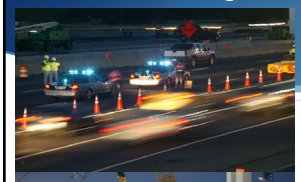
## Night Work Zones



- 36" cones must have retro-reflective sheeting/sleeves.
- Drums shall be used in the tapers on limited access highways.
- Drums only in unmanned Work Zones.
- Monitor Work Zone signs for moisture/ condensation.

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Sections 6F.72 (02): 6F.73 (08)



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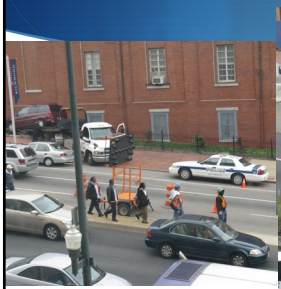
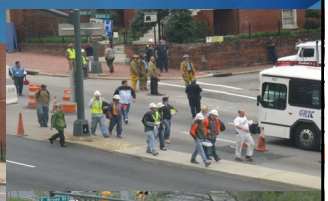
## Urban Work Zones

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## Urban Areas

- Special consideration in Urban Areas:
  - Access points / driveways
  - Intersections
  - Street layouts & directions of travel
  - Pedestrians
  - Bicyclists
  - Parking
  - Access for buses and taxis
  - Visibility of advance warning signs
  - Storage of equipment

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## Problems with Urban Work Zones

- Restricted spaces/sight distance
- Heavy traffic
- Signals
- Parking
- Conflicts with pedestrians
- Conflicts with other vehicles
  - Delivery trucks, utility equipment,
  - mopeds, buses

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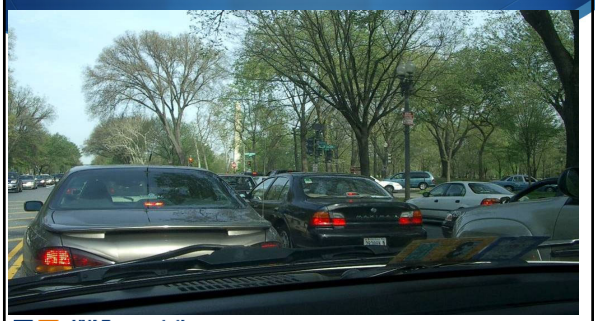
## Heavy Traffic



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## Parking

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## Pedestrian Accessibility

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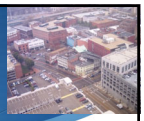
## Urban Areas (Continued)



- Possible enhancements include:
- Use additional devices
  - **Special message signs**
  - **Reduce sign spacing (one block area)**
  - **Reduce spacing of channelizing devices**
  - **High level warning devices**
- Upgrade devices
  - **Use flags on signs**
  - **Wider pavement markings**
  - **Larger signs**

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## Intersections

- Keep work zone small.
- Work in stages.
- Reduce traffic volumes by road closure or upstream diversions.
  - Work zone public announcements.
- Police shall control operating signalized intersections.
- Flagger shall only be used if the signal is turned off completely.

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## Intersections
## TTC-28 & TTC-67

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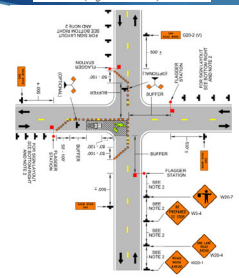
Lane Closure Operation in an Intersection
(Figure TTC-28.1)



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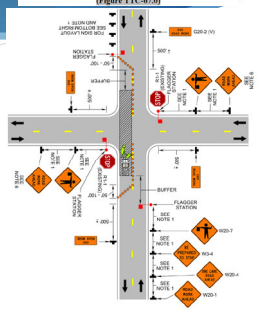
Lane Closure Operation through an Unsignalized Intersection
(Figure TTC-67.0)



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## Urban Areas (Continued)

- Adjust Work Zone layout for sight distance and actual speed of traffic.
- Communicate with business owners, city employees and emergency units.
  - How operations will affect them
  - Keep all involved updated on work progress
- Maintain all entrances and accesses in serviceable conditions.

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## Steel Plates

- Adequate warning must be given for hazards which can't be removed:

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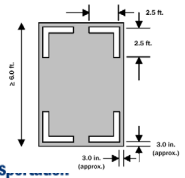
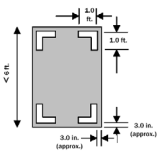
## Steel Plate Conspicuity Markings

- 2004 legislation requires 4-inch wide Type B, Class VI white tape on the corners of steel plates used in roadways.
- Section 6G.15 of the 2011 WAPM:

6' or >




Less than 6'

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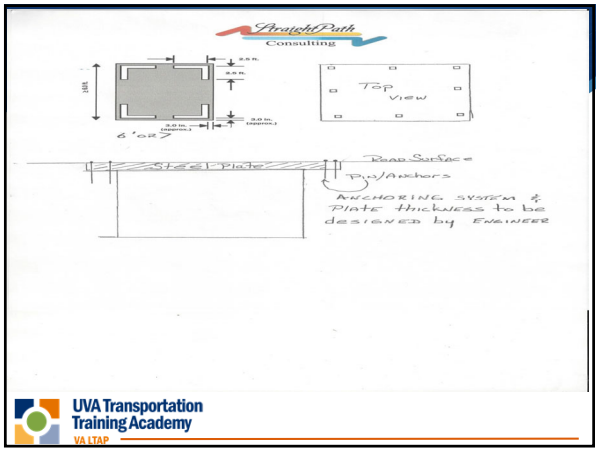


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## WZ Diversions & Detours

- ***DIVERSION directs traffic around the Work Zone***
  - *Temporary Roadway*
  - *Temporary alignment*
  - *Shoulder*
- DETOUR reroutes traffic onto adjacent routes
  - Entire route must be clearly signed
  - Signs direct traffic to the original roadway

- Detours & diversions shall be reviewed and approved by RTE or jurisdiction

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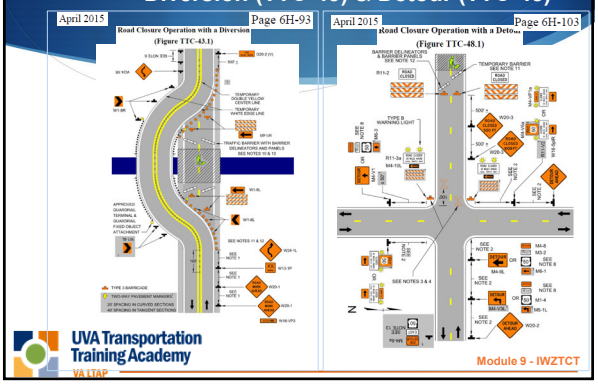
## VWAPM – Diversion (TTC-43) & Detour (TTC-48)

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## Working During Inclement Weather

- Planned work activities should be avoided, if possible, during inclement weather conditions because of:
  - Lack of visibility
  - Greater slowing and stopping distance required
  - Increased difficulty of controlling a vehicle
  - Increased distraction and anxiety for the road user

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## WAPM - Work During Inclement Weather

**Section 6G.28 Work During Inclement Weather**

Support:

01 Inclement weather (rain, snow, fog, etc.) creates the following conditions for road users:

- Lack of visibility to the road and temporary traffic control devices;
- Greater distance required for slowing and stopping a motor vehicle;
- An increase in the difficulty of controlling a motor vehicle, and;
- An increase in the distraction and anxiety for road users while traveling on the roadway.

*Guidance:*

02 *Therefore, planned work activities should be avoided, if possible, during inclement weather conditions.*

Option:

03 Emergency operations (snow removal, debris cleanup, etc.), however, may be performed where inaction would be worse for motorists than allowing the condition to remain unattended.

Support:

04 See Chapter 6I, Control of Traffic Through Traffic Incident Management Areas, for TTC.

Remember high-visibility apparel is required

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## Work During Inclement Weather

- Review Work Zone TCD immediately after a storm or severe weather event.
- Reposition or replace damaged TCD.
- Clean signs and channelizing devices after snow, sleet or ice storms to improve visibility and safety through the work zone.

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## Control of Traffic Through Incident Area

- You may be asked to create a work zone to help manage an emergency situation
  - Police
  - Rescue
  - Fire
  - Hazmat
  - Towing & recovery

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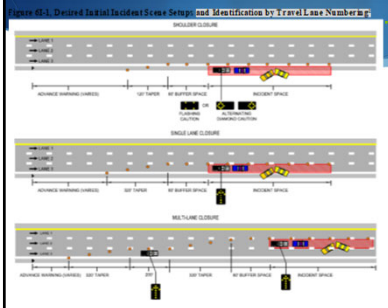
## Control of Traffic Through Incident Area

Figure 6I-1. Desired Initial Incident Scene Setups and Identification by Travel Lane Numbering



Desired Initial Incident Scene Setup:

- EMERGENCY VEHICLE AHEAD sign
- 120 foot shoulder taper area and 320' merging taper – flares, light sticks, cones, etc.
- 80 foot buffer area
- Incident Area - emergency vehicle operating warning lights and arrow board

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## Control of Traffic Through Incident Area

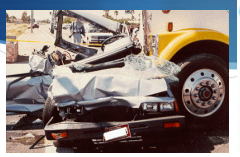

Table 6I-1, VDOT Traffic Incident Levels

| Traffic Incident Levels (Based on Traffic Impact) | | |
|---|---|---|
| Level 1 | Minor | Impact to the traveled roadway is estimated to be less than 30 minutes with no lane blockage or with minor lane blockage |
| Level 2 | Intermediate | Impact to the traveled roadway is estimated to be between 30 minutes and 2 hours with lane blockages, but not full closure of the roadway |
| Level 3 | Major | Impact to the traveled roadway is estimated to be more than 2 hours, OR the roadway is closed in any single direction; significant area-wide congestion is expected |

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## Safety Issues to Consider

- Always wear your safety vest, hard hat and other personal protection equipment when out of the vehicle.
- Always have a planned escape route and try to avoid working with your back to traffic.
- Be aware of the effect of the rising or setting sun.
- Avoid planning work during special events.

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## Safety Issues to Consider, Continued

- Use your amber vehicle warning lights when slowing down, pulling off of the roadway, or when entering the roadway.
- In work zones use caution when exiting your parked vehicle, especially on shoulders.
- Parked vehicles not perceived as a hazard, should turn off vehicle warning light to prevent distracting motorist.
- Ensure parked vehicles or advance warning signs do not block motorist sight distance at driveways and intersections.



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## WAPM - Work During Inclement Weather

**Section 6G.28 Work During Inclement Weather**

Support:

01 Inclement weather (rain, snow, fog, etc.) creates the following conditions for road users:
- Lack of visibility to the road and temporary traffic control devices;
- Greater distance required for slowing and stopping a motor vehicle;
- An increase in the difficulty of controlling a motor vehicle, and;
- An increase in the distraction and anxiety for road users while traveling on the roadway.

*Guidance:*

02 *Therefore, planned work activities should be avoided, if possible, during inclement weather conditions.*

Option:

03 Emergency operations (snow removal, debris cleanup, etc.), however, may be performed where inaction would be worse for motorists than allowing the condition to remain unattended.

Support:

04 See Chapter 6I, Control of Traffic Through Traffic Incident Management Areas, for TTC.

Remember high-visibility apparel is required



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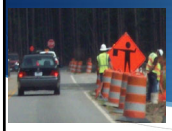

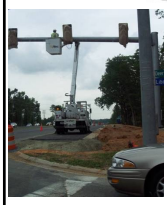

## Safety Issues to Consider

- **In work zones use caution when exiting your parked vehicle, especially on shoulders.**
- **Avoid working with your back toward traffic.**
- ***Travel lanes or shoulders shall be closed when work is performed over head, unless it is physically improbable to drop materials, equipment, personnel.***
- **Document Work Zone deviations/changes from the TTC Standards in the WAPM.**



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## Knowledge Check

Name some typical sight obstructions we might find in setting up a work zone

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What if today, we were just grateful for everything?

We are getting close to finishing!!!

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Rev June 2017, April 2016

VDOT
Virginia Department of Transportation

## Law Enforcement in Work Zones, New TTC Figures, Documentation & LCAMS

Module 10 - IWZTCT

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## Work Zone Training for Law Enforcement Officers (LEO)

**Why is LEO required (Federal Regulation (Law):**
*Training—all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability. Workers having specific TTC responsibilities should be trained in TTC techniques, device usage, and placement.*

- LEO Computer Base or Online training:
- VSP (in house) LEO training is complete
- Local Law Enforcement officers – still under development
  - LEO is not required for project/permit contractors



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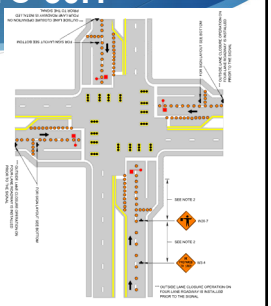
## Flagging Operation at a Signalized Intersection - TTC-30.1

**Notes 12 & 13:**
**When a Law Enforcement Officer directs traffic:**
- **The signal may be on the flash mode**
- **The travel and turn lanes may remain open at the discretion of the Law Enforcement Officer.**





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## Law Enforcement Number 1 Rule

**Multi-lane roadways:**

***A shadow vehicle (shadow vehicle with a TMA on high-speed roadways) should always protect the law enforcement vehicle unless the police are assisting with a slow roll operation; otherwise they should be as far off the shoulder as possible.***

- **Law enforcement, if assisting with traffic control installation, may be placed on the shoulder in advance of the shadow vehicle.**
- **If the law enforcement vehicle encroaches the travel lane it shall be protected by a shadow vehicle as noted above**



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## Use Of Law Enforcement In Work Zones

**Suggested placement of Law Enforcement Vehicle:**

- if assisting with traffic control installation and mobile operation, should be placed beside or protected by the first shadow vehicle.
- 500'-1000' in advance of first crew in the closed lane for free flowing traffic.
- An unprotected law enforcement vehicle should be parked completely off the shoulder or partially straddling the paved and grass shoulder.
  - When parked in advance of backups/traffic queues
  - When parked in the closed lane (500' to 800') in advance of the first work crew.

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## Use Of Law Enforcement In Work Zones

- *VDOT arranges onsite meeting with Law Enforcement to discuss operations and placement of the officer.*
- *During the work period, VDOT relays any changes to the placement of the officer.*
  - *Share contact information*
- *Officer's vehicle should be equipped with lights and a radar unit.*
  - **To increase their effectiveness, the officer should operate the radar unit and periodically stop speeders.**

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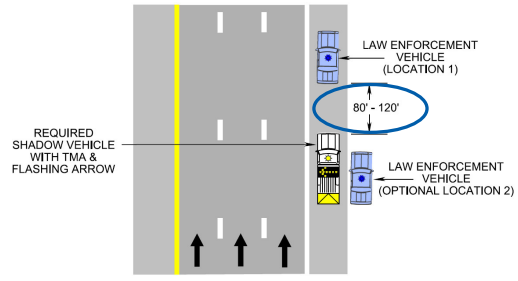
## LEO VEHICLE PLACEMENT
### Mobile/Moving Operation

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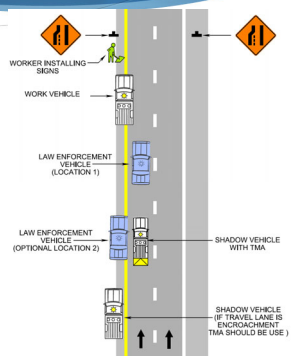
## LEO VEHICLE PLACEMENT
### Assisting with installation of TTC devices

- LEO vehicles should never be in an open travel lane unless protected by a shadow vehicle.
- If the speed limit is 45 or greater, a TMA is required on a multi-lane roadway.

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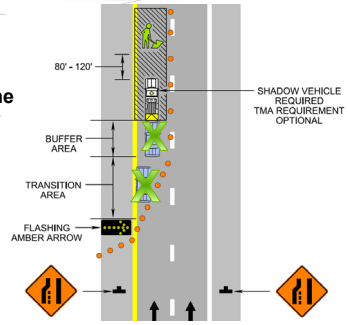
## IMPROPER PLACEMENT OF LEO VEHICLE

A law enforcement vehicle should not be parked within the transition or buffer area except in exigent circumstances

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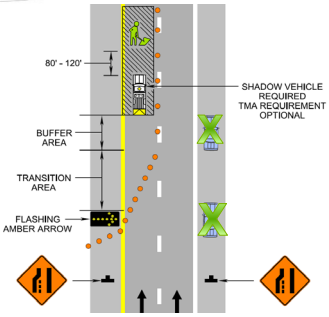
## IMPROPER PLACEMENT OF LEO VEHICLE

A law enforcement vehicle should also avoid parking on any portion of the opposite shoulder within the transition or buffer area except in exigent circumstances

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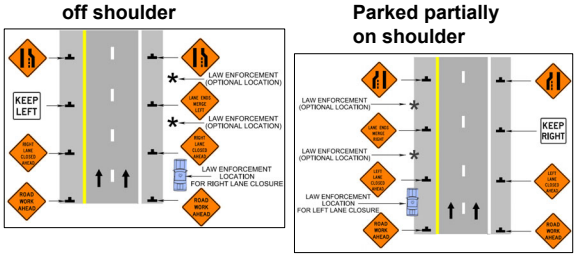
## LEO VEHICLE PLACEMENT: Within Signs of a Stationary Lane Closure

Parked completely off shoulder

Parked partially on shoulder




LEO parks on same side as arrow board being careful not to block signs

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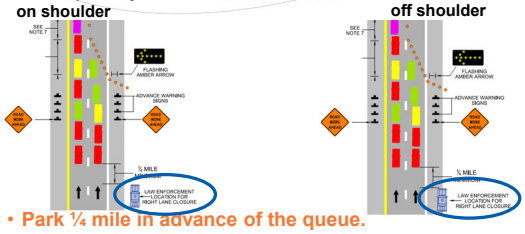
## LEO VEHICLE PLACEMENT Traffic Queue

Parked partially on shoulder

Parked completely off shoulder




- Park ¼ mile in advance of the queue.
- Do not park encroaching the travel lane
- Adjustments to the PCMS & signs may be necessary when backups continually occur.

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## What's new in Typical Traffic Control Figures & Notes

The number represents the TTC note.

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# WZ Documentation

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## Added Queue Management System definition

- A system that warns motorists of potential slowed or stopped traffic. The system can consist of warning signs, queue management vehicles or ITS technology.

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## REVISED TABLE 6G-1, INTERSECTION SIGHT DISTANCE (ISD) IN FEET FOR CONSTRUCTION ENTRANCES

| Posted Speed (mph) | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Lane Major Road | 225 | 280 | 335 | 390 | 445 | 500 | 555 | 610 | 665 | 720 | 775 |
| Left Turn, 3-4 Lane Road (Undivided) | 250 | 315 | 375 | 440 | 500 | 565 | 625 | 690 | 750 | 815 | 875 |
| Right Turn, 3-4 Lane Road (Undivided) | 240 | 295 | 355 | 415 | 475 | 530 | 590 | 650 | 710 | 765 | 825 |
| Left Turn, 4 Lane Road (Divided-18' Median) | 275 | 340 | 410 | 480 | 545 | 615 | 680 | 750 | 820 | 885 | 955 |
| Right Turn, 4 Lane Road (Divided-18' Median) | 240 | 295 | 355 | 415 | 475 | 530 | 590 | 650 | 710 | 765 | 825 |
| Left Turn, 5 Lane Road (2-Way Turn Lane) | 265 | 335 | 400 | 465 | 530 | 600 | 665 | 730 | 800 | 860 | 930 |
| Right Turn, 5 Lane Road (2-Way Turn Lane) | 250 | 315 | 375 | 440 | 500 | 565 | 625 | 690 | 750 | 815 | 875 |
| Left Turn, 6 Lane Road (Divided-18' Median) | 290 | 360 | 430 | 505 | 575 | 645 | 720 | 790 | 860 | 935 | 1005 |
| Right Turn, 6 Lane Road (Divided-18' Median) | 250 | 315 | 375 | 440 | 500 | 565 | 625 | 690 | 750 | 815 | 875 |
| Right Turn, (No Left Turns Allowed or Physically Restricted) | 210 | 260 | 310 | 365 | 415 | 465 | 515 | 570 | 620 | 670 | 725 |

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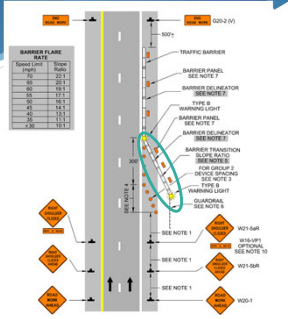
## Operations with Barrier (Delineator spacing)

10. Barrier delineators shall be spaced on 20' centers along the transition or taper sections and spaced on 80' centers and centered in-between the barrier panels along the parallel or tangent sections.

Applies to the following:
TTC-6.2
TTC-7.1
TTC-8.1
TTC-43.2
TTC-48.2



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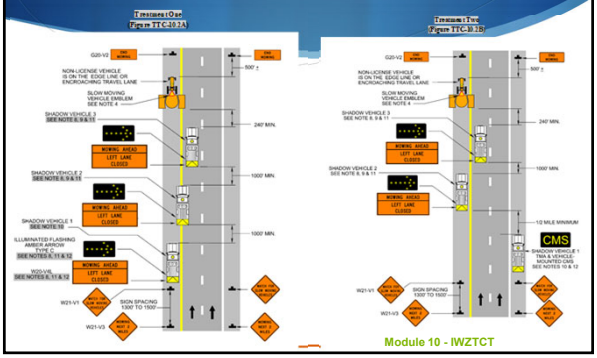
## Non-Licensed Vehicle Operation with Encroachment on Limited Access Highways – TTC-10.2A & 10.2B



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## Portable Temporary Rumble Strips

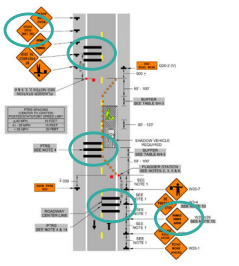
Table 6F-3, Spacing of Portable Temporary Rumble Strip[2]

| Posted/Statutory Speed Limit | ≤ 40 mph | 41 – 55 mph | > 55 mph |
|---|---|---|---|
| PTRS Spacing (Center to Center) | 10 Feet | 15 Feet | 20 Feet |

When used, three portable temporary rumble (PTRS) strips shall be installed across the entire travel lane adjacent to the BE PREPARED TO STOP (W3-4) sign. The portable temporary rumble strips shall be monitored and adjusted as necessary during the work shift to ensure proper placement on the roadway. When the PTRS are installed, the RUMBLE STRIPS AHEAD (W20-V26) sign shall also be utilized.

PTRS Req'd:
TTC-23.2
TTC-24.2
TTC-28.2
TTC-31.2
TTC-51.2
TTC-54.2
TTC-56.2
TTC-28.2
TTC-54.1
TTC-41.2
TTC42.2

PTRS OPTIONAL
TTC-16.2
TTC-17.2
TTC-18.2
TTC-19.2
TTC-26.2
TTC-27.2
TTC-30.2
TTC32.2
TTC-33.2



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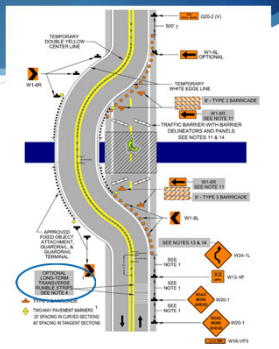
## OPTIONAL LONG TERM TRANSVERSE RUMBLE STRIPS

Each rumble strip shall be minimum 4 inches wide at the base and between 250 and 375 mils thick. Strips shall be spaced 5 feet center-to-center on roads with speed limits of 35 mph or less, and 8 feet center-to-center on roads with speed limits of 40 mph or greater, unless specified otherwise on the plans.

Optional for use in the following:
TTC-16.2
TTC-17.2
TTC-18.2
TTC-19.2
TTC-20.2
TTC-25.2
TTC-41.2
TTC-43.2
TTC-44.2



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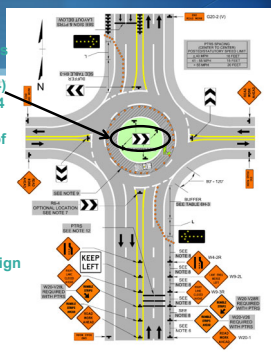
## Inside Lane Closure on a Multi-lane Roundabout– TTC-32.2

7. On long-term projects where the central island of a roundabout allows for the installation of signs, the Roundabout Directional Arrow (R6-4) shall be used and mounted at least 4 feet, measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way otherwise the R6-4 sign can be installed in the approached islands, see the MUTCD Sections 2B-40 and 2B-48.
11. The ONEWAY (R6-1R) sign may be installed underneath the R6-4 sign as a supplement.

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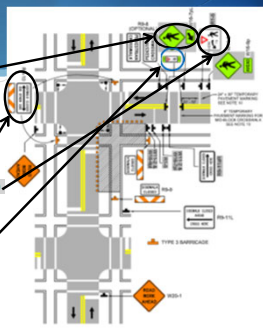
## Crosswalk Closure and Pedestrian Detour– TTC-36.2

8. The fluorescent yellow-green background for school warning signs shall be used in TTC zones.
9. The SIDEWALK CLOSED (R9-9) sign and the SIDEWALK CROSS HERE (R9-11) sign shall be installed above the Type 3 Barricade. The KEEP RIGHT sign can cover the top rail of the Type 3 Barricade.
11. The YIELD HERE TO PEDESTRIANS (R1-5) sign shall be placed at the Yield Line.
12. Fluorescent yellow-green PEDESTRIAN TRAFFIC (W11-2) symbol sign, AHEAD (W16-9p) plaque and ARROW (W16-7p) plaque shall be used to identify the work zone crosswalk.



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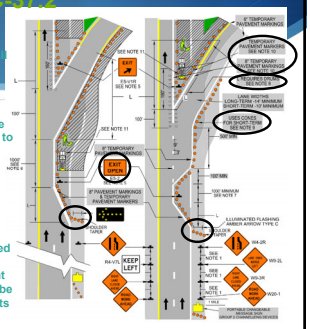
## Work Operation in the Vicinity of an Exit Ramp– TTC-37.2

7. The EXIT OPEN or the EXIT CLOSED sign shall be installed 500 feet in advance of the ramp's taper.
8. On roadways with paved shoulders having a width of 8 feet or more, channelizing devices shall be used to close the shoulder in advance of the merging taper to direct vehicular traffic to remain within the traveled way.
9. In stationary lane closures, the right side exit ramps drums shall be used on the left side taper (L) starting at the work zone's gore and extending down the ramp. On left side exit ramps, drums shall be used on the right side taper (L) starting at the work zone's gore and extending down the ramp. Cones shall be used on the opposite side of the taper.
10. For long term stationary operations, pavement markers and 8 inch pavement markings shall be installed to provide clear guidance to motorists exiting the highway.

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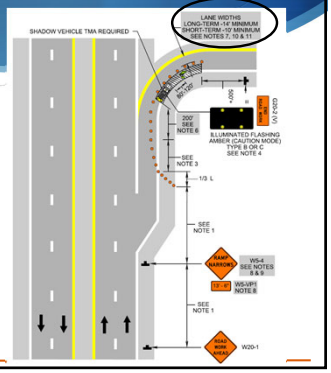
## Work in the Vicinity of an Exit Ramp TTC-39.2

- Long Term 14' Min.
- Short Term 10' Min.

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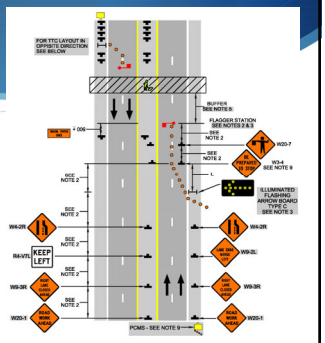
## TTC-50 - Disruption Operation on a Multi-lane Roadway

- Changed stoppage time to 15 minutes in lieu of 20 minutes
- Lane closure required if flaggers are controlling traffic – flagger controls only one lane
- Lane closure and center lane turn lane must be closed if using flaggers or if performing a slow roll operation

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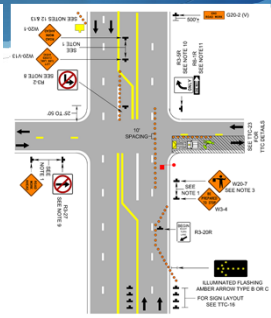
## NEW – Lane Closure Operation for Flagging Operations on an Intersecting Roadway – TTC-68.0



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## CHAPTER 6I – Control of Traffic Through Incident Management Areas

Standard:

- While parked on the shoulder, the Alternating Diamond caution mode shall only be displayed by VDOT/Contractor traffic operations incident management vehicles to assist in distinguishing them from a normal work vehicle. The 4-corner caution mode can be used until June 1, 2023 at which time the Alternating Diamond caution mode shall only be used.

Flashing Caution

Alternating Diamond Caution

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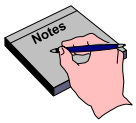
## Documentation

Characteristics of Good Documentation:

- Prepared in a timely manner
- Complete and legible
- Permanently recorded (use ink)
- Dated and signed signature
- Filed in a manner easy to retrieve
- Uniform and consistent manner

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## WZ Safety Checklist Form

- ✓ TCD should be reviewed daily to ensure that safe conditions exist for all road users.
- ✓ Projects should be reviewed weekly using the checklist form.
- ✓ Reviews should also be conducted after a change in traffic patterns or after severe weather.
- ✓ A night review should be conducted.



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## WZ Safety Checklist Form

- What was observed:
  - Condition of TC Devices
  - Position of TC Devices
  - Weather conditions
  - Pavement markings and Eradication
  - Traffic flow
  - Flagging operations
  - Signs of Incidents



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## WZ Safety Checklist Form

- Items needing to be corrected.
- When a modification was made.
- Inspect through the duration of the entire project.
- Use alternate methods of documentation -
  Pictures
  Video

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## Five C's of Documentation

- Complete
- Comprehensive
- Concise
- Clear
- Correct

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**Typical Traffic Control**
***Ancillary Inspection at a Signalized Intersection***

## NOTES

*Guidance:*

1. *The control of traffic through the intersection in order of preference should be:*
   a. *Obtain the services of law enforcement personnel with the approved signing as shown.*
   b. *Divert the effective routes to other roads and streets as approved and directed by the District Traffic Engineer.*
   c. *Place a state certified flagger on each leg of the intersection with the approved signing as shown in the 2011 Virginia Work Area Protection Manual Rev. 2.*
2. *Sign spacing distance should be 350'-500' where the posted speed limit is 45 mph or less, 500'-800' where the posted speed limit is greater than 45 mph. For urban streets sign spacing distance should be 225'-275' where the posted speed limit is 30 to 35 mph, and 100' -200' where the posted speed is 25 mph or less .*

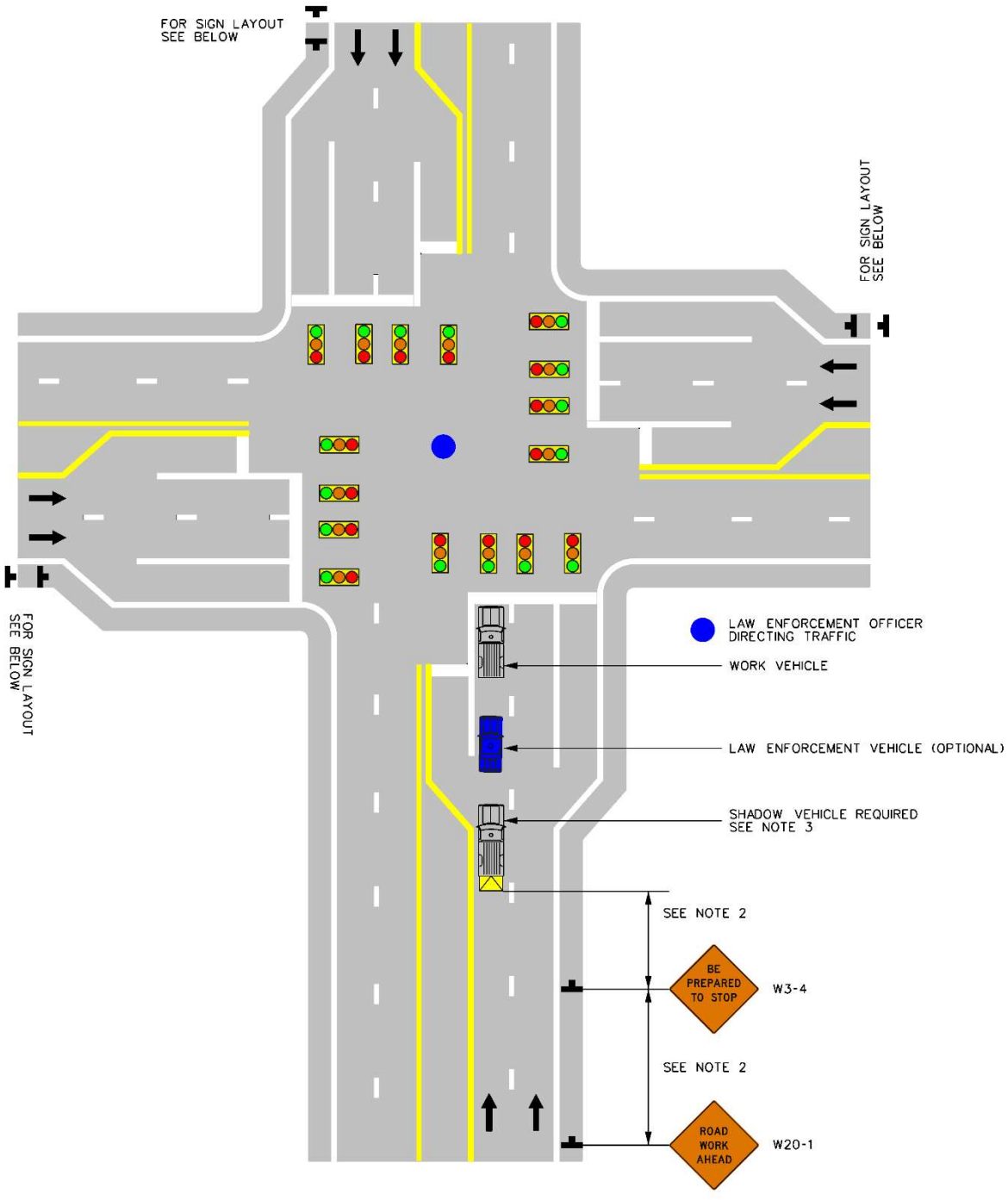
**Standard:**

3. **A shadow vehicle is required with at least one amber rotating, flashing or oscillating lights shall be parked 80' – 120' in advance of the work crew or law enforcement vehicle when in the travel lane behind the work truck. The shadow vehicle shall be equipped with a truck mounted attenuator (TMA), unless a law enforcement vehicle is being using in advance of the work vehicle and after the shadow vehicle, then the TMA is optional.**
4. **Install ROAD WORK AHEAD (W20-1) and BE PREPARED TO STOP (W3-4) in advance of the intersection on all approaches.**
5. **On divided highways having a median wider than 8', right and left sign assemblies shall be required.**

Option:

6. Traffic signals may be in standard operation or in flash mode when traffic through the intersection is controlled by a law enforcement officer.

**Typical Traffic Control**
***Ancillary Inspection at a Signalized Intersection***



# 2011 Virginia Work Area Protection Manual Revision 2
# Frequently Asked Questions and Discrepancies Found

1. **When does Revision 2 take affect?** Revision 2 of the WAPM became effective Sept. 1 2019 for all work performed by State Force unless the work is under a contract that references the Rev. 1 of the WAPM. It will become effective on all projects advertised on or after January 1, 2020.

2. **Table 6F-1 some of the Section numbers listed in the table do not match the signs listed?** This is an error and will be corrected in the next version of the WAPM, please find the appropriate section number you are seeking by using the index.

3. **TTC-16.2 the notes from Sign W4-2R to the beginning of the taper and the end of the taper say See Note 2?** This is an error and will be corrected in the next version of the WAPM. The note from the W4-2R sign to the beginning of the taper should reference Notes 2 & 4 and the Notes from the beginning of the taper to the end of the taper should reference Note 6 as shown on TTC-17.2

4. **TTC-23.2 Are the middle set of Rumble strips required? The TTC references Note 4?** This is an error and will be corrected in the next version of the WAPM. The Middle set of Rumble Strips are not a requirement but are Supplemental and Optional and may be eliminated. See TTC-27.2 Note 11.

5. **Section 6F.98 Note 11 paragraph E. states a TMA Shall be used for planned work operations involving snooper trucks or bucket trucks regardless of the posted speed limit?** The only exception to this would be for Ancillary Signal Inspection and a Law Enforcement Vehicle is parked in advance of the Shadow Vehicle, in this scenario a TMA is not required but recommended.

6. **The Guidelines for Temporary Traffic Control Pocket Guide page 74 Properly Equipped Flaggers references Class 2 Visibility apparel for daytime work?** This is an error and will be corrected in the next edition, as per the WAPM Class 3 High visibility safety apparel shall be worn at all times day or night time.

7. **When and who shall wear the Type E trousers?** Leg Gaiters are now allowed as an alternative for Type E trousers for those installing removing or maintaining traffic control devices Day or Night and for Flaggers in Daytime Operations. Type E trousers are still required for Flaggers during nighttime operations.

8. **Are Utility Companies required to use PTRS?** PTRS are optional for utility companies at this time as per IIM-TE-386. We do have the following language in Section 6F.99, paragraph 7 in Revision 2 to the 2011 Work Area Protection manual which backs this up: PTRS shall be used by state forces on roadways using flaggers that meet the conditions in paragraph 4 (see TTC-23, TTC-24, TTC-28, TTC-31, and TTC-67) and by others only when specified as a pay item in contracts with a special provision provided for their use.

9. **TTC-50 Stoppage of traffic on a Multi-lane Roadway.** We developed TTC-50.2 to specifically remove the flagger from the left side of the roadway and provide a better way to control traffic through an operation requiring periodic stoppage of traffic on a multi-lane highway. We have had several instances where flaggers have been struck performing this type of operation, especially when they have little to no room for escape on the left side of the roadway. Other states have removed flaggers from the left side of the roadway due to this fact. Traffic is better controlled when reduced to one lane, with the flagger better protected by standing in the closed right lane. It does take a little longer to install an extra set of signs and cones to close off the right or left travel lane but control of approaching motorist is greatly improved by this method. This is the preferred temporary traffic control layout to use, especially if multiple lines are being installed or multiple stoppages are needed to complete an operation. If only one line is being pulled and

installed across the roadway, or only one stoppage of traffic is needed to complete an operation and there is ample room on both sides of the travel lanes for a flagger to safely stand and move out of the way of an errant vehicle, then the typical traffic control from TTC-50.0 may continue to be deployed.

10. What would be the speed limit whereby a crash cushion would be required? Typically 45mph or greater and for planned work operations involving a snooper truck or bucket truck regardless of the speed limit

11. Is a Road Closed Ahead sign required before a Road Closed sign? In the VA WAPM Rev. 2 section 6F.26 paragraph 1 The ROAD (STREET) CLOSED AHEAD (W20-3) sign ***should*** be used in advance of the point where a highway is closed to all road users, or to all but local road. This is a Guidance statement which means while it is not requirement or shall condition it is highly recommended and if it is not going to be used a well-documented reason should be filed with the plan records. In other words unless you have a really good reason as to why it would not be used, then it should be used.

12. Clarification on the requirement for a TMA for snooper and bucket truck operations: The decision to require the use of a TMA shadow vehicle for snooper truck and bucket truck operations stemmed from a request from the operators of the snooper truck and from the district safety managers. Employees working under a bridge on a snooper truck or in the air in a bucket truck are highly vulnerable if the vehicle is struck by an errant vehicle into the work zone, which has occurred on multiple occasions. . For flagging operations on two-lane roadways, a shadow vehicle without a TMA should be sufficient since the speeds of approaching traffic is controlled by the flaggers on site. Also, for roadways posted 25 mph or less, a shadow vehicle without a TMA should also be sufficient due to the low speeds. For speeds higher than 25 mph, we believe the shadow vehicle with a TMA should continue to be used.

13. Section 6F.03 Paragraph 24 states that certain signs when mounted with portable sign supports shall be mounted a minimum of 5' from the pavement surface, however TTC-37.2 and TTC-39.2 Note 5 says the signs should be mounted 7' from the roadway surface, which is right? Section 6F.03 Paragraph 24 is correct with the 5' height, TTC-37.2 and 39.2 Note 5 are incorrect and will be correct in the next edition of the WAPM with the 5' height requirement.

14. Section 6C.11 Paragraph 01 In the next revision we will be adding Commercial/Private to the language to describe entrances, the second sentence will read: Commercial/Private High Volume Entrances and Commercial/Private Low Volume Entrances.

15. Table 6F-1 TTC Zone sign and Plaque Sizes (Sheet 7 of 8) Route Shield and Route Marker Signs M1-1, M1-4, M1-V1a thru M1-V1d and M1-V2a thru M1-V2f sizes for Non-Restricted Highway are listed as 36"x 36" and 45"x 36". This is an error and will be corrected in the next edition, to maintain uniformity with standard US Route Shield and Marker signs these signs shall be 24" x 24" for 2 digit signs and 30" x 24" for 3 digit signs.

16. Appendix A Page A-12. Temporary Barrier Service Anchoring Requirements. The 3rd bullet after the first paragraph: Where materials and/or equipment are stored within the deflection area of the TBS for more than 3 days. Should say "for more than 72 consecutive hours".

17. Spacing Between Double Yellow Pavement Markings will be revised to 7" from 6' in the next edition of the WAPM to reflect the revision made to the Road and Bridge Standards guidance as to the new Standard as follows:

With implementation of Plastic Inlaid Markers (PIMs), increasing spacing between the double yellow center-line from 6-inch to 7-inch was incorporated in the Road & Bridge Standards.
This change helps the contractor installing the markings to minimize over-spray on the Lens and provides added tolerance if the double yellow was already installed and the PIM groove needs to be cut. This change also helps the Pavement Markings Retrace Contracts to minimize over-spray.
DIRECTION:
A 7 inch space between the double yellow for projects in the Paving Schedule requiring PIMs should be noted at preconstruction.
If the PIM is not required, the spacing can be 6 inches or be at the preferred 7 inches for the 2020 Schedule.

18. Can a reduced advisory speed be used for surface treatment operations?
On those occasions where a reduced advisory speed limit is requested for surface treatment operations, the request shall go to the District Traffic Engineer for review. If approved, the Advisory Speed Limit sign shall be post mounted below the LOOSE GRAVEL (W8-7) sign.

19. Can a Supplemental Flagger still be used?
Yes, A Supplemental Flagger can still be used. In the next revision of the WAPM TTC-23.2 Note 8 and Section 6E.09 note 11 will be revised to include the use of a Supplemental Flagger or a "SLOW" sign.

20. In the Pocket Guide page 57 the drawing suggest that one AFAD Device can be used in conjunction with a Flagger on the other end of the Work Zone, is this acceptable?
No, as stated in the WAPM if using AFAD's you must use 2 AFADS, one at each end of the Work Zone. This drawing will be updated in the next revision.

21. Are Portable Temporary Rumble Strips (PTRS) required in slurry seal/latex emulsion overlay or surface treatment operations? PTRS should be used when meeting the conditions stated in Section 6F.99 paragraph 4 for slurry seal and latex overlay operations. For surface treatment operations PTRS should be used in both travel directions on the first day at a location. For multiple day operations at the same location, the PTRS would be used on the unimproved approach to that day's operation, but not on the completed surface treatment side of the roadway due to loose gravel.

22. New TTC for Ancillary Signal Inspection at a signalized Intersection to be included in the next revision of the WAPM. For more information and a copy of the approved TTC please contact Jeff Legg @ Paul.Legg@VDOT.Virginia.gov .

Where does the Road Work Ahead (W20-1) Sign Go?

***Challenge 1***

Description:
2 lane road
25 MPH
No center line

Where does the Road Work Ahead (W20-1) Sign Go?

## *Challenge 2*

Description:

2 lane road

25 MPH

This road has a center line

Where does the Road Work Ahead (W20-1) Sign Go?

***Challenge 3***

Description:

2 lane road

10 foot lane

25 MPH

This road has a center line

Where does the Road Work Ahead (W20-1) Sign Go?

***Challenge 4***

Description:

4 lane road

12 foot lane

45 MPH

This road has a center line

Where does the Road Work Ahead (W20-1) Sign Go?

***Challenge 5***

Description:

4 lane road

12 foot lane

55 MPH

This road has a center line

Where does the Road Work Ahead (W20-1) Sign Go?

***Challenge 6***

Description:

4 lane Interstate Road

12 foot lane

65 MPH

This road has a center line

Where does the Road Work Ahead (W20-1) Sign Go?

***Challenge 7***

Description:

4 lane Interstate Road

12 foot lane

Maintaining 2 lanes around a work area – 3 ‘ shift

65 MPH

Use all options