MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Basic Work Zone Training

September 2025

Maryland State Highway Administration

Office of Traffic and Safety

Key Objective

What is the goal?

This training aims to provide an overview of work zone traffic control and the available tools that can be implemented in work zones to enhance safety and **prevent injuries and fatalities**.

Training Overview

Learning Material:

- **SECTION 1: Introduction to Work Zone Safety**
- **SECTION 2: Temporary Traffic Control (TTC) Devices**
- **SECTION 3: Principles of TTC Design**
- **SECTION 4: SHA Specific WZ Requirements**
- **SECTION 5: Other Safety Tools**
- **SECTION 6: Additional Training and Resources**

shutterstock.com · 2458403169

SECTION 1: Introduction to Work Zone Safety

Section 1

1.1: Importance of Work Zone Safety

1.2: Worker's Responsibilities

1.3: Types of Highway Work

1.4: Work Zone Components

1.5: Governing Standards on SHA Roadways

1.1 Importance of Work Zone Safety

What is work zone safety?

- Work zone safety refers to the measures taken to protect both road workers and motorists in areas where construction, maintenance, or utility work is happening, ensuring a safe and efficient flow of traffic

- At the end of the day, everyone needs to go back home safely to their family

1.1 Importance of Work Zone Safety

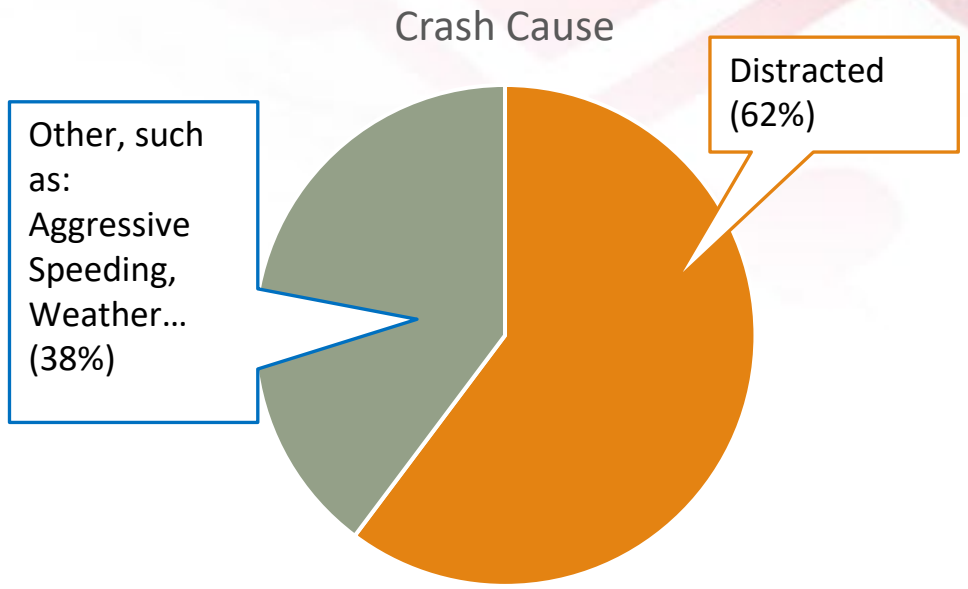
- Safety is our #1 priority
- In the US, 898 people were killed and 40,170 people were injured in work zone crashes in 2023 alone *
- In the US, on average 54 worker-pedestrians are killed per year after being struck by a non-construction vehicle in a work zone*
- Adhering to proper work zone safety standards **decreases** injuries and **prevents** deaths

*Source: National Safety Council. https://injuryfacts.nsc.org/motor-vehicle/motor-vehicle-safety-issues/work-zones/

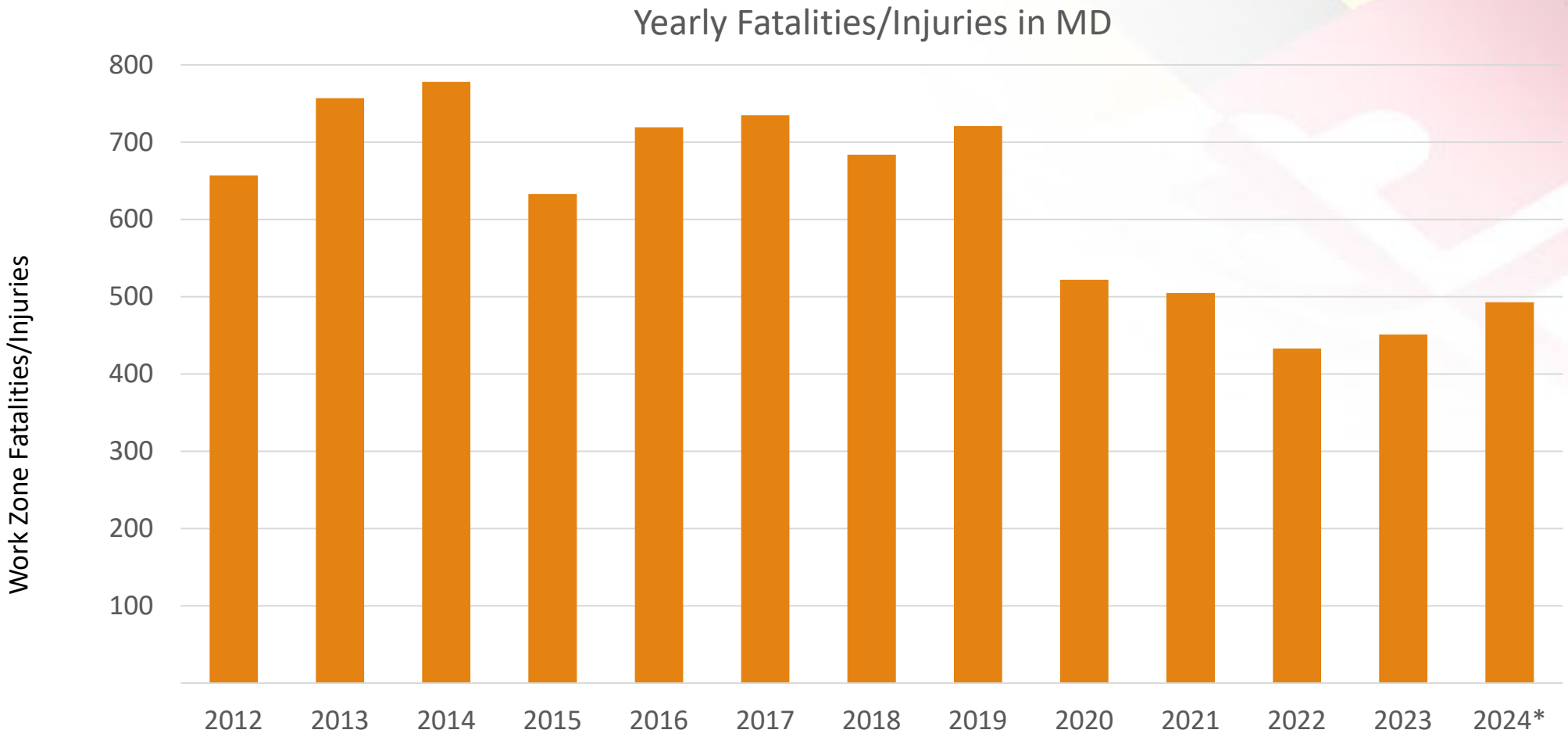
1.1 Importance of Work Zone Safety

Causes of Work Zone Crashes in Maryland:

- **Inattentive driving** - distracting behaviors such as using handheld devices, eating, drinking, etc.
- **Excessive speed** - exceeding the posted highway speed limit.
- **Aggressive driving** - Tailgating, Weaving in and out of traffic, etc.
- **Unexpected** or **confusing** work zone sites.
- **Obstructions**.
- **Improper** temporary traffic control **setup**.



Work Zone Crashes in Maryland



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024*
Fatalities	3	10	9	6	6	14	12	7	8	6	12	12	12
Injuries	654	747	769	627	713	721	672	714	514	499	421	439	481

*The 2024 crash data presented is preliminary and covers the period from January 1, 2024, to December 31, 2024.

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

1.2 Workers' Responsibilities

At a minimum, a worker should:

- Understand that all operations are required to **follow SHA-approved Traffic Control Plans** and/or SHA **Standards**.
- **Identify** the necessary Temporary Traffic Control (TTC) Devices for your work.
- **Ensure** all TTC Devices meet standards.
- **Install** TTC Devices as specified in the SHA-approved traffic control plan/standard.

Image Sourced from Traffic Control Services | Lane Closures, Flagging & Signage — Traffic Control & Safety Compliance | CTS Crew

1.2 Workers' Responsibilities

- **Stay vigilant** of surroundings and maintain a safe distance from moving traffic.
- **Avoid using distracting devices** while working in the work zone.
- Plan and **have an escape route** when working near traffic.
- **Turn on vehicle flashing warning lights** when entering/exiting the work area or operating within the work zone.

Image Sources from: Maryland Safezones Program Overview

1.4 Work Zone Components

What is a Work Zone (WZ)?

- A WZ is an area of a highway with **construction, maintenance, or utility work activities.**
- A WZ is typically **marked by** signs, channelizing devices, barriers, pavement markings, and/or work vehicles.
- A WZ **extends** from the 1st warning sign or vehicle with approved lights to the 'End Road Work' sign or last Temporary Traffic Control (TTC) device.

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

1.4 Work Zone Components

What are the four work zone components?

1.4 Work Zone Components

1. Advance Warning Area

Where the WZ starts, and drivers are told what to expect ahead.

2. Transition Area

Where traffic is moved out of its normal path.

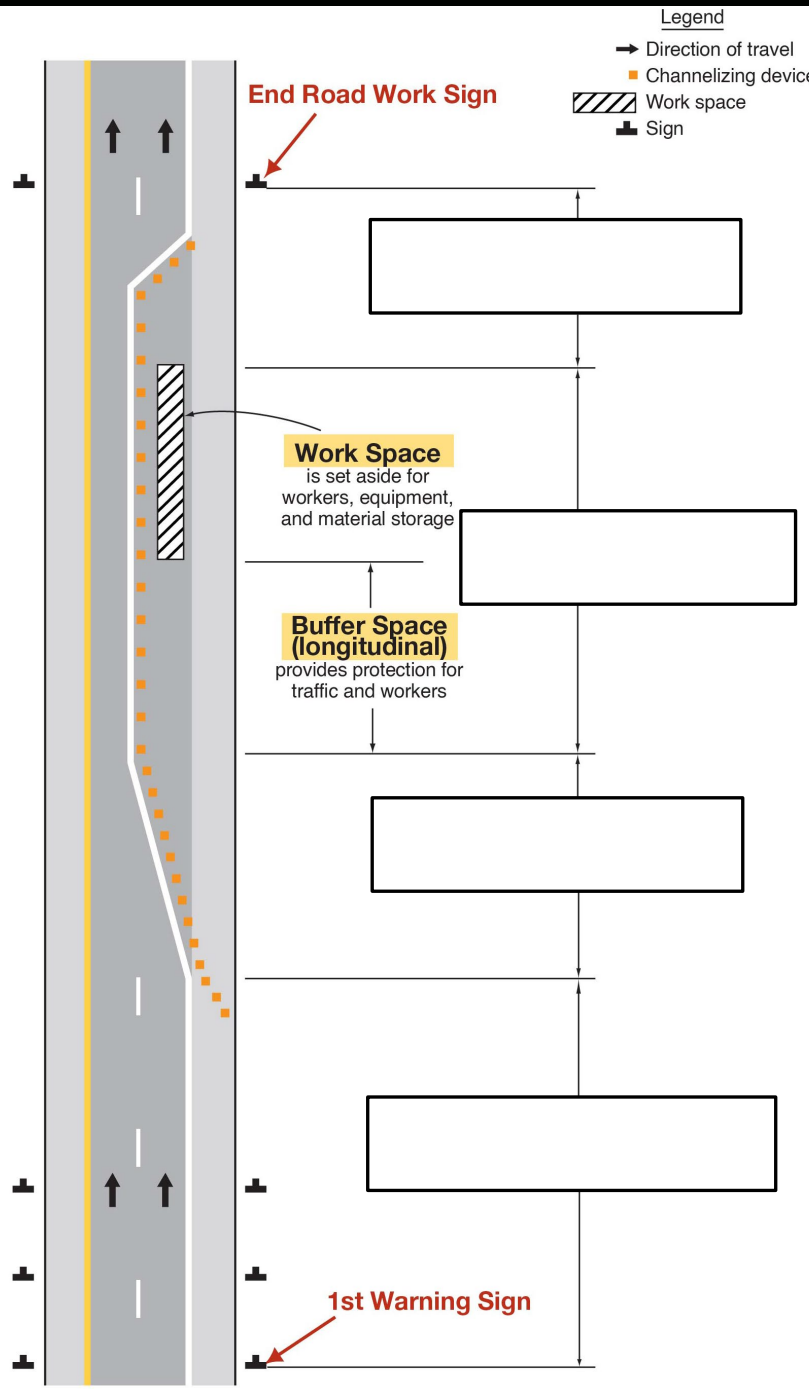
3. Activity Area

Divided into two sub areas.

- Buffer Space: Provides protection for workers and road users.
- Work Space: Where work activity is occurring.

4. Termination Area

Where the WZ ends, and drivers are moved back to normal operation.



1.4 Work Zone Components

Most WZ have 4 Main Areas.

1. Advance Warning Area

Where the WZ starts, and drivers are told what to expect ahead.

2. Transition Area

Where traffic is moved out of its normal path.

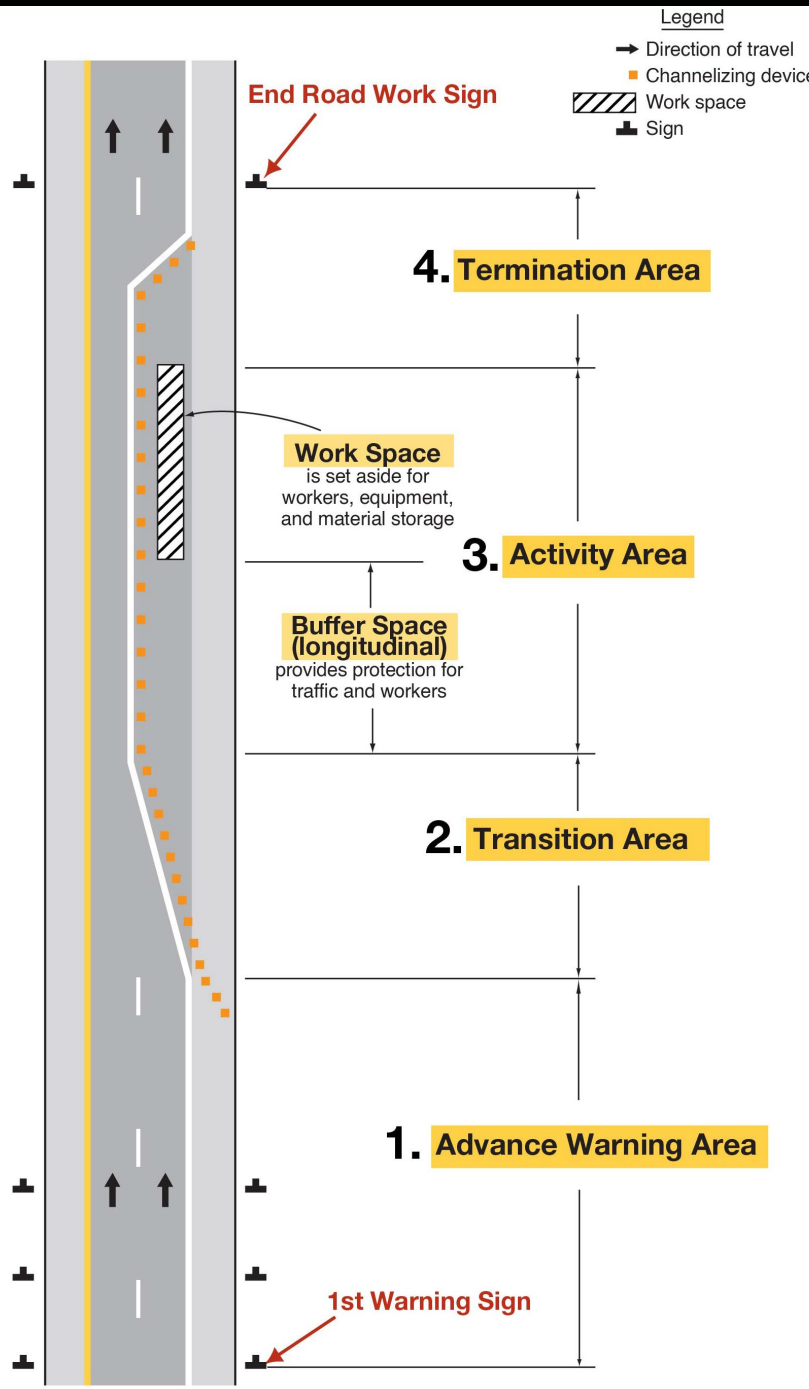
3. Activity Area

Divided into two sub areas.

- Buffer Space: Provides protection for workers and road users.
- Work Space: Where work activity is occurring.

4. Termination Area

Where the WZ ends, and drivers are moved back to normal operation.



1.4 Work Zone Components

Buffer Space Requirements

- Except in cases determined to be impracticable or infeasible, **a longitudinal buffer space shall be provided** in work areas along SHA highways.
- Neither work activity nor storage of equipment, vehicles, or material should occur within a buffer space.
- A protection vehicle may be deployed in the buffer space, provided it is in proximity to the active work area. Increase the buffer length to include the length of the protection vehicle and the anticipated roll-ahead distance.

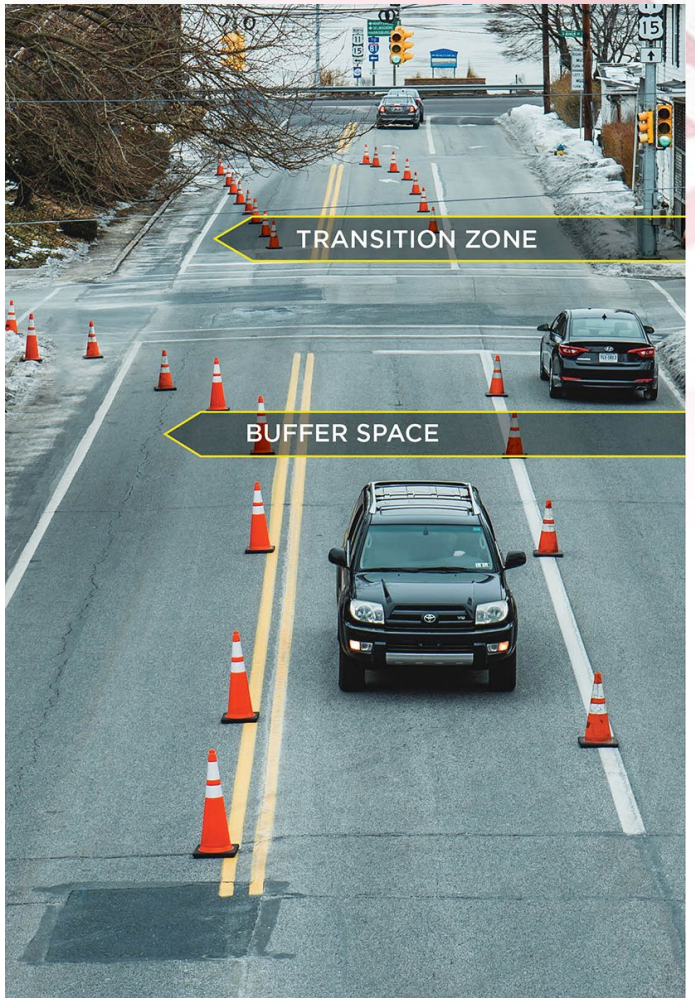


Image Sourced from: Traffic Control Best Practices: Buffer Space | Safety Resources

1.5 Governing Standards on SHA Roadways

Maryland MUTCD

- Contains additions or modifications to the Federal MUTCD.
- Additions or modifications specific to Maryland are shown in blue.
- Part 6 applies to TTC and includes Typical Applications

Link:
https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=835

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

1.5 Governing Standards on SHA Roadways

Book of Standards For Highway and Incidental Structures

The Book of Standards is maintained by Maryland Department of Transportation State Highway Administration (MDOT SHA)'s Office of Highway Development to provide Engineering Personnel and Contractors with a complete and up-to-date catalog of Standards for Highways, Incidental Structures and Traffic Control Applications by and for the MDOT SHA. Hard copies of the book are no longer being printed and updates will only be available online at this location.

- Revisions to the Book of Standards
- Category 0 - General
- Category 1 - Preliminary
- Category 3 - Drainage
  - Table of Approved Substitutes
- Category 4 - Structural Standards Manual Vol. 1 and 2
- Category 5 - Paving
- Category 6 - Shoulders
  - Approved Units for End Treatments
- Category 7 - Landscape
- Category 8 - Traffic

- A catalog of standards published online
- Temporary Traffic Control Typical Applications (TTCTAs) are under "**CATEGORY 1** - PRELIMINARY".

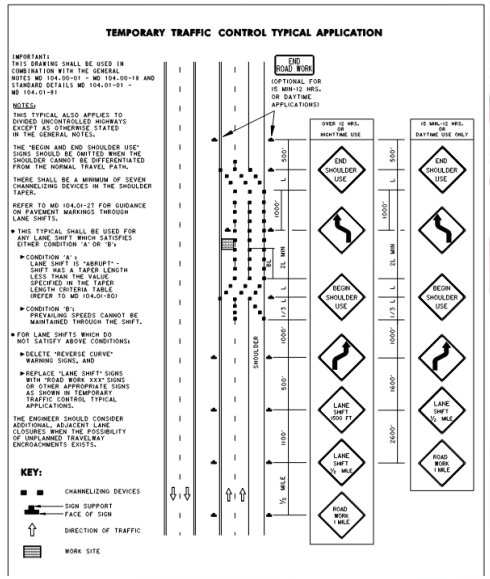
Link:
https://apps.roads.maryland.gov/businesswithsha/bizstdsspecs/desmanualstdpub/publicationsonline/ohd/bookstd/index.asp

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

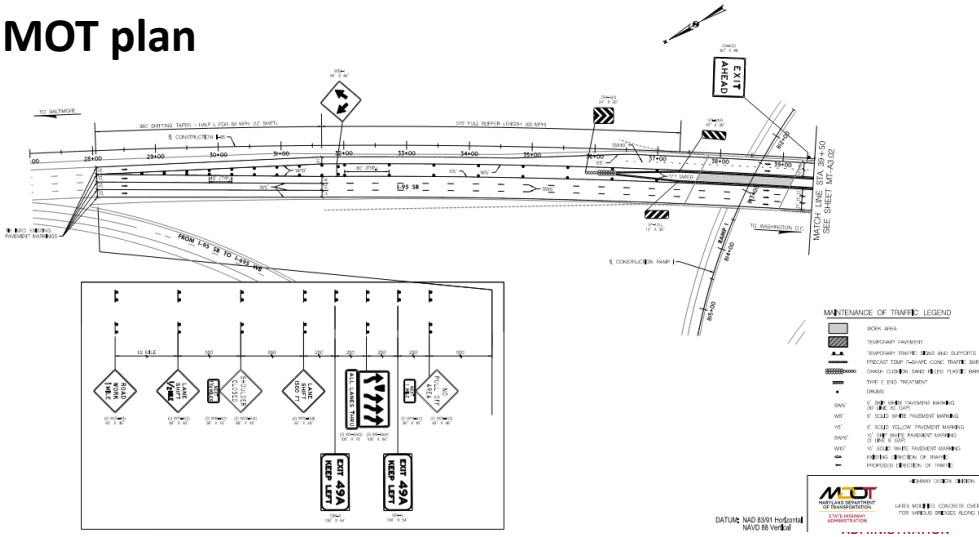
1.5 Governing Standards on SHA Roadways

- SHA Temporary Traffic Control Typical Applications (TTCTA) show the minimum requirements for temporary traffic control.
- TTCTAs address wide variety of conditions, but not ALL
- Non-standard scenarios maybe covered by combinations of multiple Typical Applications and may require a site-specific MOT Plan

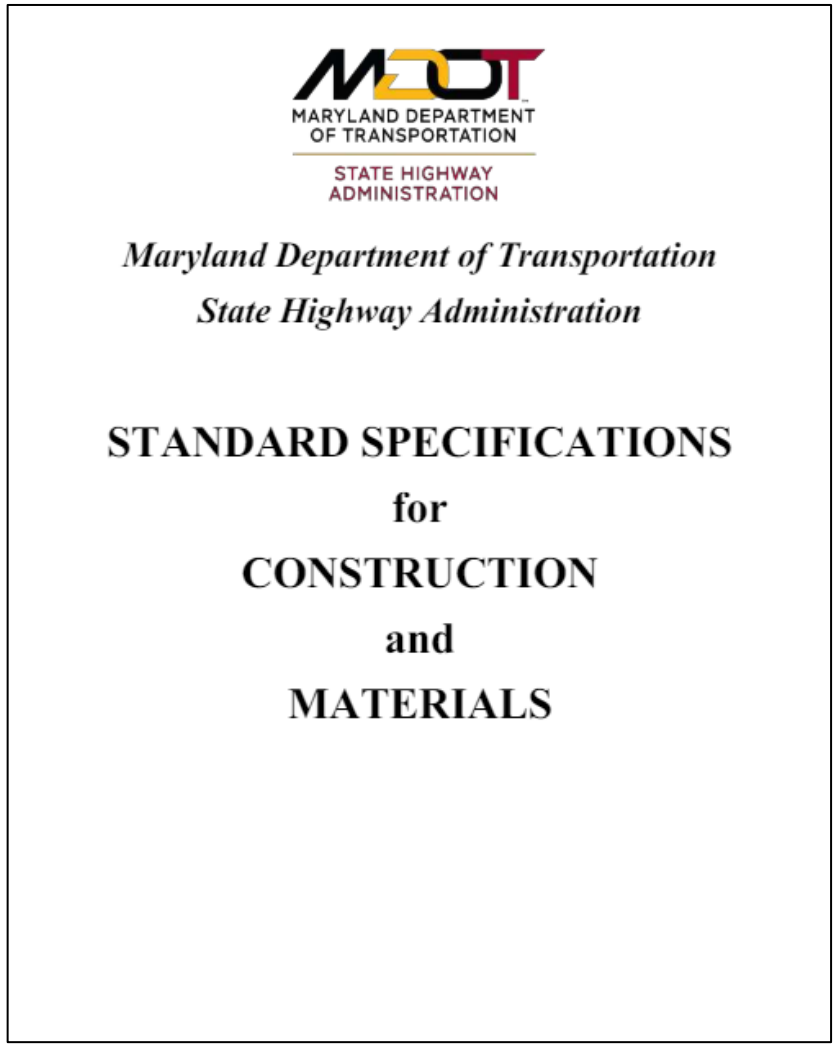
TTCTA



MOT plan



1.5 Governing Standards on SHA Roadways



Standard Specifications For Construction and Materials

- Includes standard specifications and general provisions for construction and materials.
- Published yearly by SHA.
- Approved updates to the book are listed as Special Provision Inserts and may also be downloaded as PDFs.

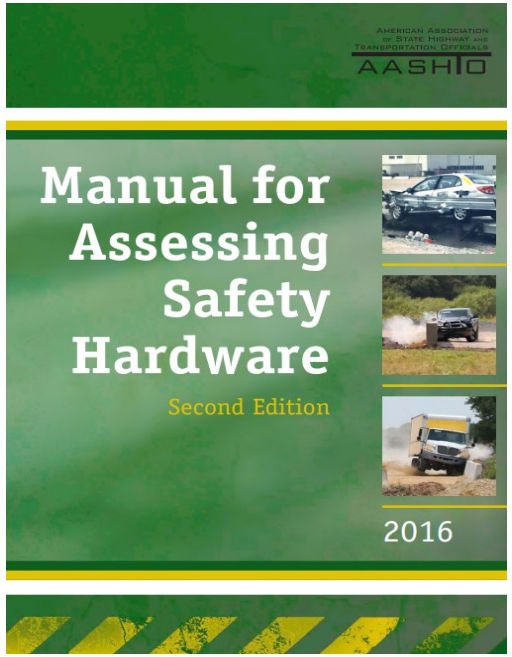
Link to the most recent book:

https://www.roads.maryland.gov/mdotsha/pages/sscm.aspx?PageId=853&lid=SSP

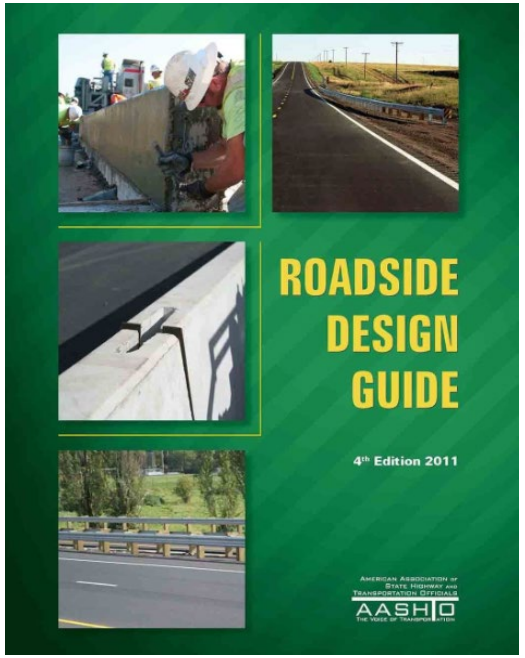
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

1.5 Governing Standards on SHA Roadways

AASHTO MASH: Presents uniform guidelines for **crash testing** permanent and temporary highway safety features and recommends evaluation criteria to assess test results.



AASHTO Roadside Design: Presents operating practices related to **roadside safety**, focusing on safety treatments that can minimize the likelihood of serious injuries when a motorist leaves the roadway.



1.5 Governing Standards on SHA Roadways

Qualified Product List (QPL)

- The QPL list the sources of materials and material producers that have been qualified by SHA for use on Maryland State projects.
- All Temporary Traffic Control Devices used on SHA roads must be on the QPL.

Traffic Control Materials, Qualified and Temporary

- Product Qualification Procedures: Traffic Control Materials, Temporary (PDF, 300 KB)
- Qualified Products
  - Arrow Panel (PDF, 200 KB)
  - Automated Flagger Assistance Device (PDF, 200 KB)
  - Barricades (PDF, 200 KB)
  - Cones (PDF, 200 KB)
  - Drums (PDF, 200 KB)
  - Portable Rumble Strip (PDF, 200 KB)
  - Portable Traffic Signals (PDF, 200 KB)
  - Portable Variable Message Sign (PDF, 200 KB)
  - Protection Vehicle Attenuator (PDF, 200 KB)
  - Speed Display Trailers (PDF, 200 KB)
  - Speed Feedback Sign (PDF, 200 KB)
  - Temporary Concrete Traffic Barrier (PDF, 200 KB)
  - Temporary Crash Cushion, Sand Filled Plastic Barrel (PDF, 200 KB)
  - Temporary Steel Traffic Barrier (PDF, 200 KB)
  - Temporary Traffic Sign (PDF, 200 KB)
  - Truck Mounted Variable Message Signs (PDF, 200 KB)
  - Tubular Marker (PDF, 200 KB)
  - Water Filled Barrier (PDF, 200 KB)
  - Workers Present Trailer (PDF, 200 KB)

Link: https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=600#tcmqt

SECTION 2: Temporary Traffic Control (TTC) Devices

Section 2 Overview

2.1: Temporary Traffic Control Devices

2.2: Arrow Panels

2.3: Portable Changeable Message Signs

2.4: Truck Mounted Changeable Message Signs

2.5: Signs

2.6: Temporary Traffic Signals

Section 2 Overview cont'd

2.7: Temporary Pavement Markings

2.8: Temporary Traffic Barriers

2.9: Crash Cushions and End Treatments

2.10: Channelizing Devices

2.11: Protection Vehicles

2.12: Flagging

2.1 Temporary Traffic Control Devices

- Temporary Traffic Control (TTC) Devices include **signs, signals, markings, channelizing devices** and **other devices** (such as arrow panels) used **to regulate, warn, or guide** road users in work zones.
- The design and application of TTC devices used in work zones **should consider the needs of all road users** (motorists, bicyclists, and pedestrians), including those with disabilities.
- All TTC devices **should comply** with the applicable provisions of the MdMUTCD and SHA Standards and Specifications.

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

2.1 Temporary Traffic Control Devices

To be **effective**, TTC devices should meet **5 basic requirements**:

- Fulfill a need
- Command attention
- Convey a clear, simple meaning
- Command respect from road users
- Give adequate time for a proper response

Sign **Not** commanding respect

Signs **Not** conveying a clear message

Image Sourced from: https://www.roads.maryland.gov/OOTS/Basic_TTC_January2010.pdf

2.2 Arrow Panels

What is an Arrow Panel (AP)?

- An arrow panel is a sign with a matrix of elements capable of flashing.

Purpose

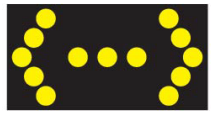
- It is used to **provide additional warning and directional information** to assist in merging and controlling road users through or around the WZ.

Image Sourced from: Dynamic Lane Merge System - Street Smart Rental

2.2 Arrow Panels

Permitted Displays

<u>**Used** along State roadways</u>

Operating Mode	Display (right arrow shown; left is similar)
Flashing Arrow	 Merge Right
Flashing Double Arrow	 Merge Right or Left
Flashing Caution	 Flashing Caution

<u>**Shall not be used** along State roadways</u>

Display (right arrow shown; left is similar)

Flashing Caution or Alternating Diamond Caution

2.2 Arrow Panels

Acceptable AP Placement

Arrow panels are functional, and close to the beginning of the taper as possible with proper channelizing devices

Unacceptable AP Placement

Channelizing devices missing

Additional channelizing devices missing from shoulder taper

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

2.3 Portable Changeable Message Signs

What are PCMS?

- Temporary Traffic Control Devices with the flexibility to display a variety of messages.

Purpose:

- Advise road users of unexpected situations; they are capable of:
- Conveying complex messages.
- Displaying real-time information about conditions ahead.
- Providing information to assist road users in making decisions before the point where actions must be taken.

2.3 Portable Changeable Message Signs

- The PCMS shall not replace standard traffic control devices, but is to supplement these devices
- No more than two displays shall be used within any message cycle
- For a list of standard messages/abbreviations, contact SHA
- PCMS should be used if there is significant change to traffic patterns, unexpected road conditions, or safety concerns that may require caution/diversion.
- PCMS should be placed on the shoulder of the roadway or farther from the traveled lane

DISPLAY - 1

DISPLAY - 2

Images Sourced form: https://www.roads.maryland.gov/OOTS/Basic_TTC_January2010.pdf

2.3 Portable Changeable Message Signs

Acceptable PCMS Placement

PCMS is not obstructed and within a taper with proper channelizing devices

Unacceptable PCMS Placement

Obstructed PCMS

2.4 Truck Mounted Changeable Message Signs

What are TCMS?

- TCMS (also known as Truck Mounted Variable Message Sign (TVMS)) is a type of changeable message sign typically mounted on work truck/trailer allowing for a mobile message display of dynamic messages.

Purpose

- TCMS are only used as a supplement to other required traffic control devices.
- Can be used for Mobile operations.

Image Sourced from: Wanco Message Board Parts - NatCap

2.4 Truck Mounted Changeable Message Signs

New Legislation – HB 1375

- New legislation allows a tow truck to display a TCMS while at the scene of a crash or a disabled vehicle.
- TCMS must conform to SHA specification and can only display messages approved by SHA.

- Effective Date: October 1st, 2025

2.5 Signs

Purpose:

Provides regulations, warnings, and guidance information for road users.

- Words, symbols, and arrows are used to convey the messages.

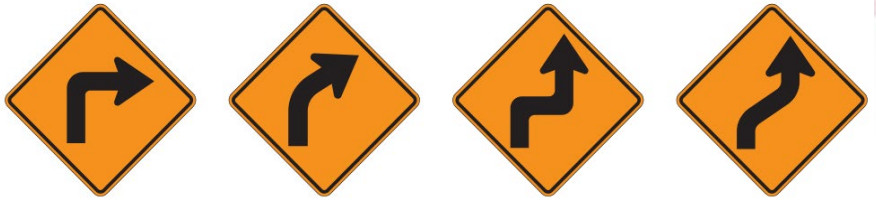
Classification of Signs:

- Regulatory Signs
- Warning Signs
- Guide Signs
- Special Signs

2.5 Signs

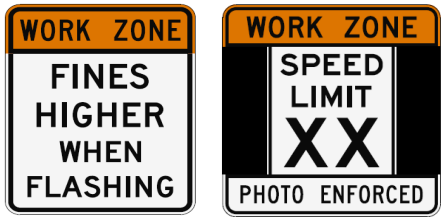
Regulatory Signs: Inform road users of **traffic laws** or **regulations.**

Warning Signs: Calls attention to unexpected conditions, **diamond-shaped** with a black legend and border on an **orange background**



Guide Signs: **Provide** road users with **information** to help them along their way through the TTC zone.

Special Signs: Non-standard traffic signs that provide road users with applicable information.



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

2.5 Signs

Types of Installations

Portable signs

Shall be mounted so that the bottom of the sign is at least **1 ft above** the roadway pavement elevation.

Ground-mounted signs

Shall be mounted so that the bottom of the sign is at least **7 ft above** the roadway pavement elevation.

Barrier-mounted signs

Shall be mounted so that the bottom of the sign is at least **14 ft above** the shoulder and **17 ft above the travel portion of the roadway.**

2.5 Signs

Signs shall not be hidden by trees, poles, construction equipment, other signs, etc.

Acceptable Sign Placement

Not obstructed with clear message and not in travel lane

Unacceptable Sign Placement

Blocked by a tree

Hidden by other signs

Two signs with two different messages

For more information about Signs refer to Maryland 104 Standards.

2.6 Temporary Traffic Signals

What are Temporary Traffic Signals?

- Devices temporarily installed using fixed or portable traffic control signal units **to manage traffic during construction or maintenance work**, such as when reconstructing a signalized intersection or during a one-lane closure on a two-lane, two-way road.

Purpose:

- To provide traffic signal control during Maintenance of Traffic.

Temporary Traffic Signal

Image Sourced from:
https://www.roads.maryland.gov/OOTS/Basic_TTC_January2010.pdf

Portable Traffic Signal

Image Sourced from:
https://x.com/TheMDTA/status/1796547464050213149

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

2.7 Temporary Pavement Markings

What are Temporary Pavement Markings?

- Temporary markings are those pavement markings or devices that are placed within TTC zones to provide road users with a clearly defined path of travel through the TTC zone **when the permanent markings** are either **removed or obliterated** during the work activities.

Purpose:

- Provides road users with a **clearly defined path of travel** through the work zone when the permanent markings are either removed or obliterated during work activities or when lane shift is needed.

Image Sourced from: https://brawnerbuilders.com/building-relationships-not-just-structures/portfolio/infrastructure/

2.7 Temporary Pavement Markings

- Temporary pavement markings **in conflict with existing pavement markings** shall be **removed** (or covered with black tape).

Acceptable Pavement Markings

No extra lines, clear path.

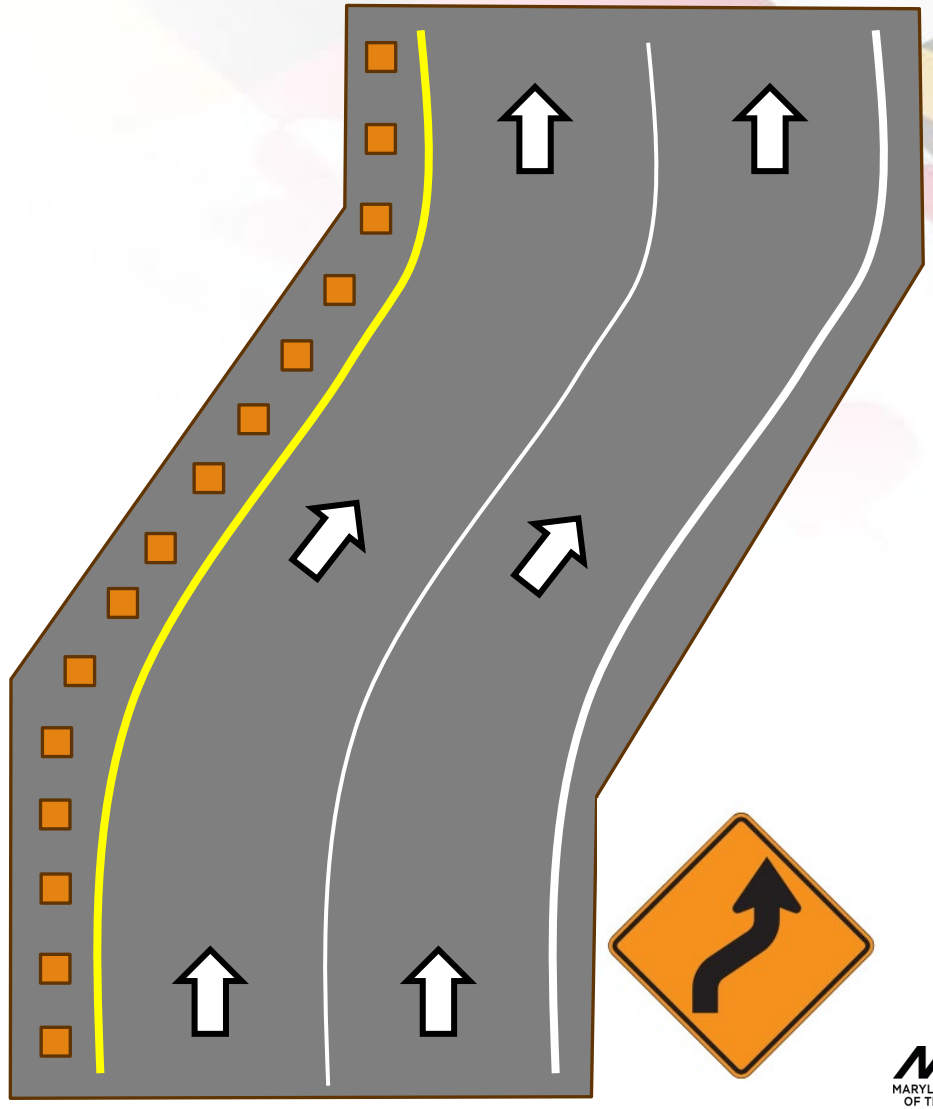
Unacceptable Pavement Markings

Double white; existing pavement markings not eradicated

2.7 Temporary Pavement Markings

- For any abrupt lane **shift solid pavement lines shall be used** to improve navigation
- For any abrupt lane shift or when prevailing speeds cannot be maintained **additional signing** (e.g., reverse curve warning signs) shall be mounted in advance of the shift

An **abrupt** lane shift is any shift with a taper length less than a value specified by SHA in the taper length criteria table



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

2.8 Temporary Traffic Barriers

What are Temporary Traffic Barriers?

- Temporary traffic barriers are safety structures designed to protect both people and property. On highways and major roads, they function like permanent barriers but are installed for short-term use.

Purpose:

- Designed to provide positive protection.
- Keep vehicles from entering work areas with workers or hazards, such as excavations.
- Can be used to separate workers, bicyclists, and pedestrians from motor vehicle traffic or to separate two-way vehicular traffic.

Concrete Traffic Barrier

2.9 Crash Cushions and End Treatments

What are Crash Cushions and End Treatments?

- Crash cushions are either directly attached to or placed in front of fixed hazards to help reduce the severity of roadway departure crashes.
- End Treatments are installed to prevent the end of a barrier system from being exposed to direct end impact.

Purpose:

- Designed to **mitigate** the effects of errant vehicles that strike obstacles by:
  - Helping to decelerate the vehicle to a stop upon impact
  - Absorbing kinetic energy to protect vehicle occupants
  - Protecting road users from the exposed barrier end, fixed objects, and other obstacles

Types of Crash Cushions:

- Stationary
- Truck-mounted attenuator (more discussion later)

2.9 Crash Cushions and End Treatments

Types of Stationary Crash Cushions Include:

Non-re-directive
Sand-Filled Plastic Barrels

Re-directive
W-beam crash barriers

Images Sourced from: https://worksafetci.com/2020/03/what-are-highway-impact-attenuators-used-for/
& https://www.trafficsafetysystems.eu/en/crash-cushion-leonidas-124744008.html

2.9 Crash Cushions and End Treatments

Acceptable Crash Cushion and End Treatment Placement/Condition

Proper end treatment placement

Unacceptable Crash Cushion and End Treatment Placement/Condition

Improper or missing end treatment

Damaged End Treatment

Crash Cushion missing top

2.10 Channelizing Devices

What are Channelizing Devices?

- Channelizing devices include cones, tubular markers, vertical panels, drums, barricades, and longitudinal channelizing devices.

Purpose:

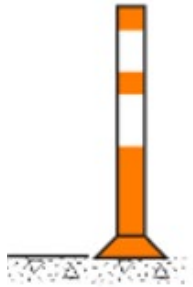
- The function of channelizing devices is to warn road users of conditions created by work activities in or near the roadway and to guide road users.

Drum

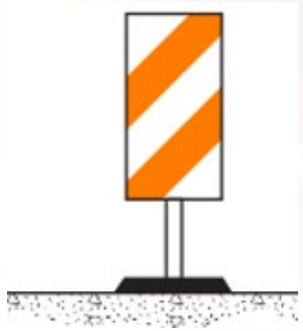
Cone

Tall Weighted Cone

2.10 Channelizing Devices

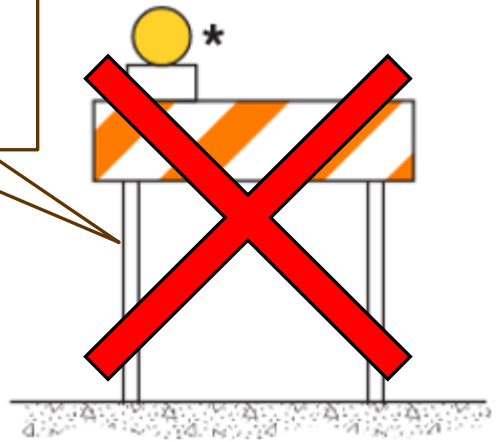


Tubular Marker

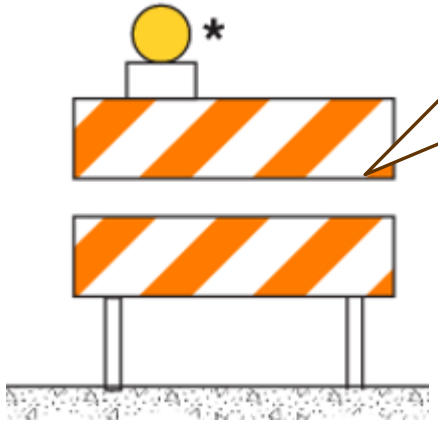


Vertical Panel

Type 1 Barricade not used on SHA roads

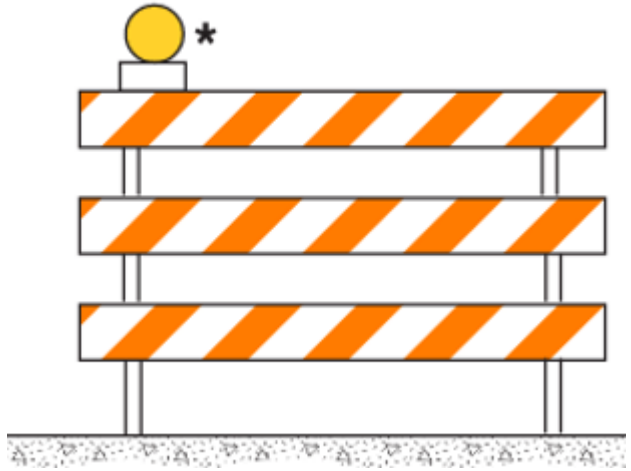


Type I Barricade



Type 2 Barricade only used on roads with posted speeds of 40 MPH or lower.

Type II Barricade

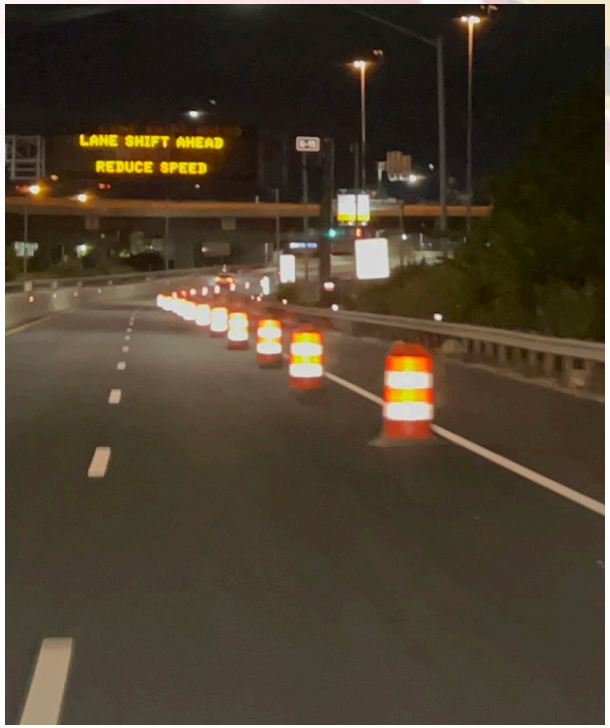


Type III Barricade

* Warning Light (Optional)

2.10 Channelizing Devices

- Channelization devices **shall be retro-reflectorized for daytime or nighttime use**.
- **Warning lights** are not permitted to be attached to cones, drums, tubular markers, and vertical panels.
- **Warning lights** may be attached to barricades.



2.10 Channelizing Devices

Acceptable Channelizing Devices Placement

Channelizing devices are providing a clear path. Channelizing Devices are up to specification (like new condition and spaced correctly).

Unacceptable Channelizing Devices Placement

Truck driving on double yellow line, no clear path. Channelizing Devices are not up to specification.

2.11 Protection Vehicle

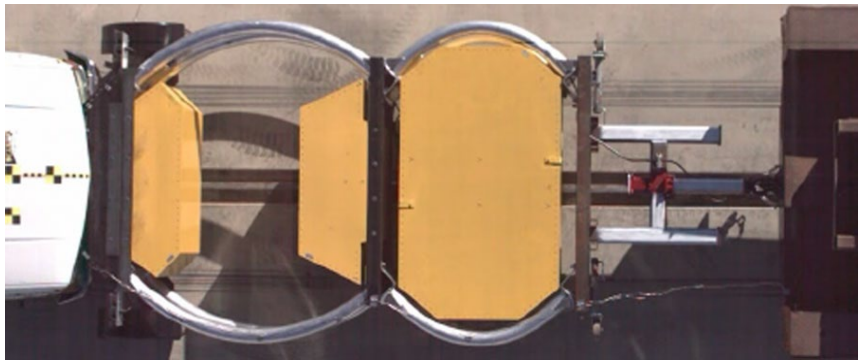
What is a Protection Vehicle (PV)?

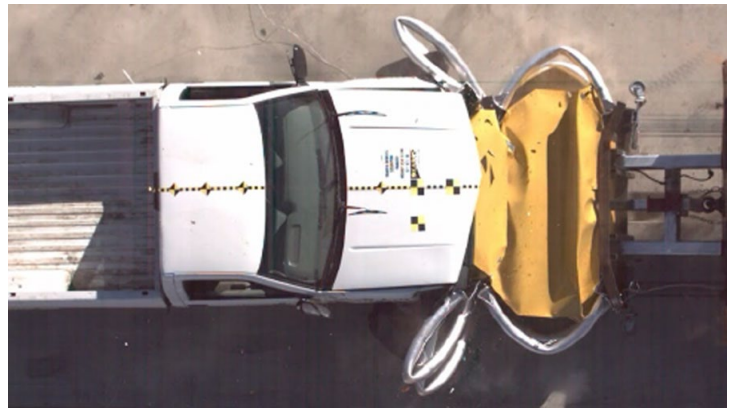
A PV is a work vehicle with approved **Flashing Lights**, **Arrow Panel**, Truck or Trailer-Truck Mounted **Attenuator** (**TMA/TTMA**) used to protect workers, drivers or work equipment from errant vehicles.

2.11 Protection Vehicle

Purpose

- To protect both workers and motorists
- Designed to lessen the impact of vehicles that strike the attenuator.
- Absorb impact energy.
- Reduce crash severity.





Images: Traffix Devices

2.11 Protection Vehicle

Attenuator Types

Truck Mounted Attenuator (TMA)
Attenuator that is mounted to the rear of a truck

Trailer Truck Mounted Attenuator (TTMA)
Attenuator that is made as a trailer that can be pulled by a truck

Images Sourced from: https://ttbarricade.com/rentals/truck-mounted-attenuators/

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

2.11 Protection Vehicle

- The **Gross Vehicle Weight Rating (GVWR)** of the work vehicle shall be a **minimum** of **14,000 lbs.**
- **Total weight of the TMA**, exclusive of the work vehicle, shall **not exceed 2,100 lbs**. unless it is trailer-mounted
- Fuel tank or container of hazardous materials shall be at least 10.5 ft from the rear of the work vehicle

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

2.11 Protection Vehicle

- **No modifications** to the attenuator, lighting, signage, or mounting **are permitted** unless they meet manufacturer specifications and have SHA approval.

- **Not Approved Modification include:**
- Modifying the weight of the host vehicle to meet the SHA Specification
- Customization of the PV impacting the attenuator performance
- Using the PV for both material storage and protection

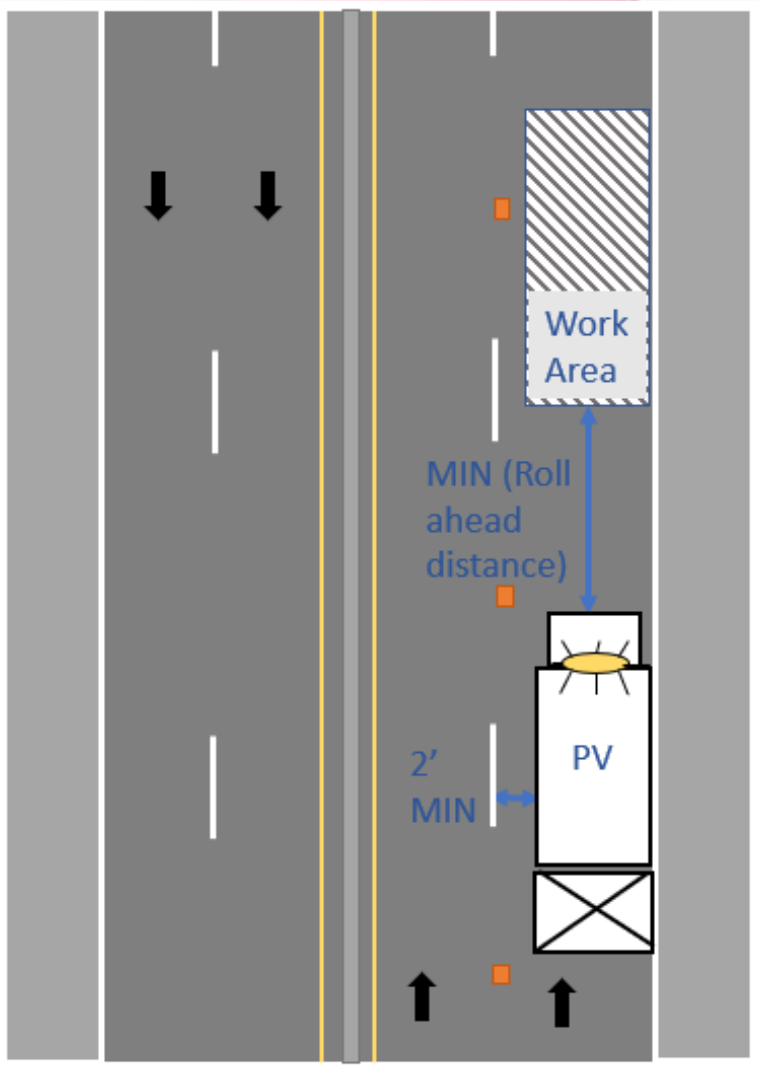
2.11 Protection Vehicle

What is a Roll Ahead Distance (RAD)?

- The RAD is the distance the PV will move, or be displaced, when struck.
- The RAD is needed so that the PV does not roll into the Work Area when struck.

Factors influencing the length of the RAD

- Speed of traffic - Oncoming vehicle will be travelling at this speed
- Weight of the PV - A light PV will roll further than a heavy PV
- Mobility status of PV (stationary or mobile) - When struck, a moving PV will roll further than a stationary PV.



2.11 Protection Vehicle

Rule of thumb guidance on minimum spacing between the PV and the work area

Posted Speed Limit	Distance between PV and Work Area	
	Stationary Operations	Mobile Operations
≤ 40 MPH	50 - 100 ft	250 - 500 ft
> 40 MPH	100 - 175ft	250 - 500 ft

Source: SHA PROTECTION VEHICLE (PV) USAGE GUIDELINES

2.12 Flagging

Flaggers practice and training skills:

- Stand on shoulders in clear view
- Always face traffic
- Use clear hand signals
- Stay alert, focused
- Always stand at the flagging station
- Have a way to communicate with crew and supervisors
- Use only authorized communication devices
- Stay in clear view of other crew and traffic
- Maintain a clear escape route

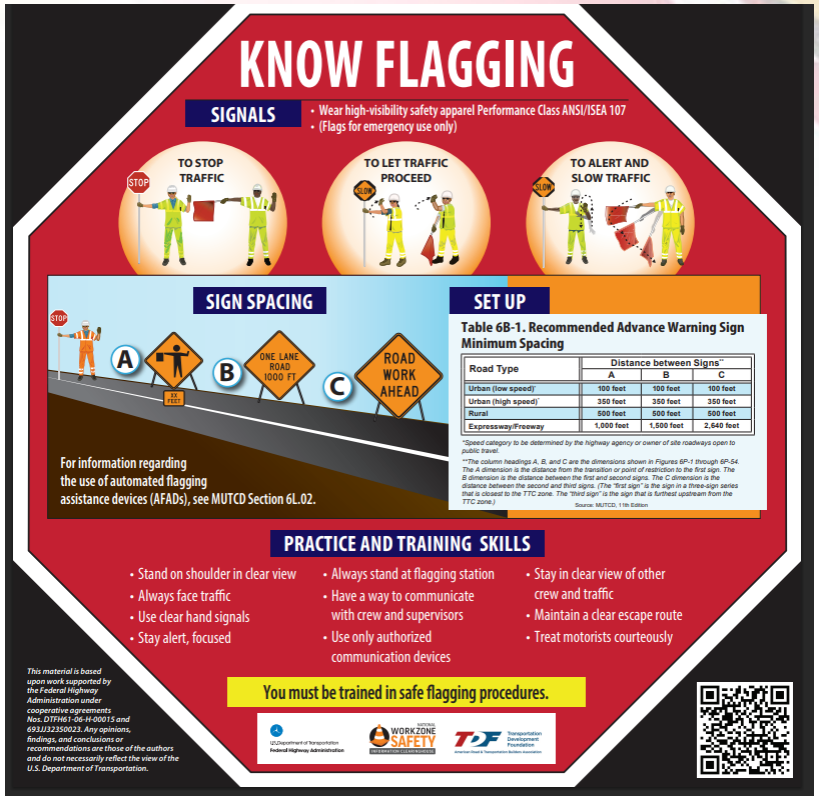


Image Sourced from: https://workzonesafety.org/public-awareness/outreach-posters/

2.12 Flagging

Flaggers should be able to:

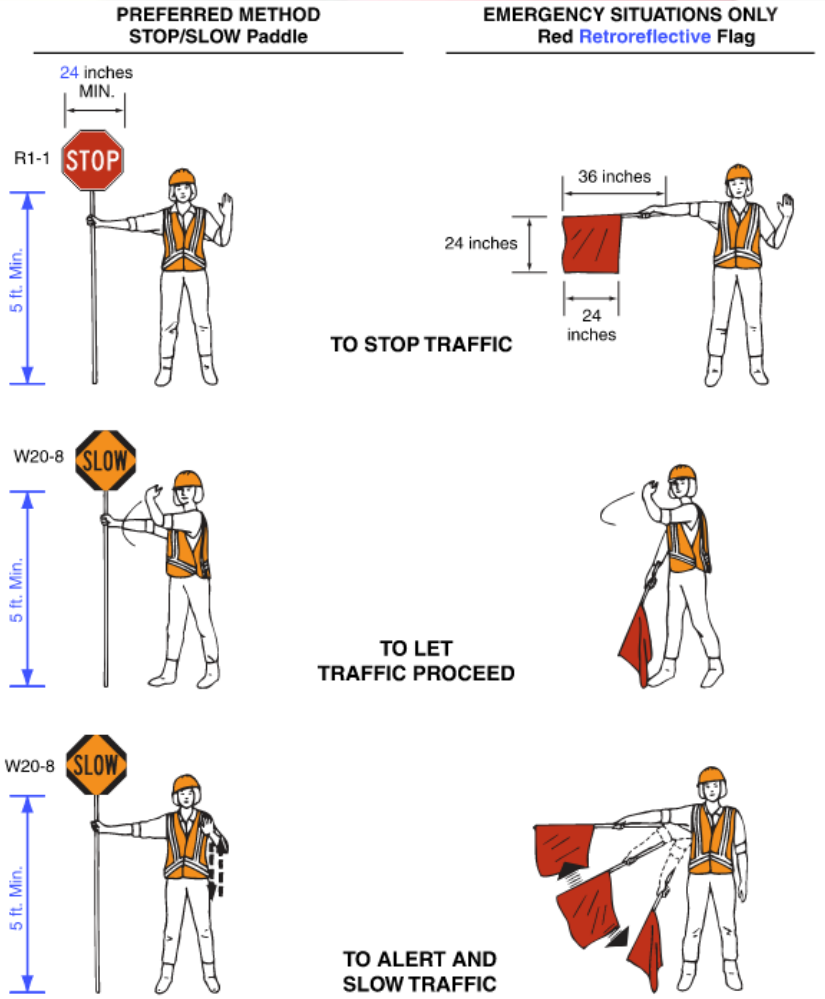
- To **receive** and **communicate** specific **instructions** clearly, firmly, and courteously.
- To **maneuver quickly** to avoid danger from **errant** vehicles.
- To control signaling devices (paddles and flags) to provide **motorist guidance.**
- To understand and apply safe traffic control practices.
- To **recognize** dangerous situations and **warn workers in sufficient time.**

Image Sourced from:
https://www.flickr.com/photos/nddot/14652219821

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

2.12 Flagging

- Flaggers must wear SHA-approved **High Visibility Apparel**.
- Flaggers must be **certified and pass** approved SHA training.
- 24" STOP/SLOW paddle shall be the primary and preferred hand-signaling device.
- The use of red flags shall be limited to emergency situations.
- When flagging at night, the flagging station must be illuminated



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

SECTION 3: TTC - Design and Layouts

Section 3 Overview

3.1: Roadway Types

3.2: Work Location

3.3: Work Duration

3.4: Tapers

3.5: Pavement Drop Off

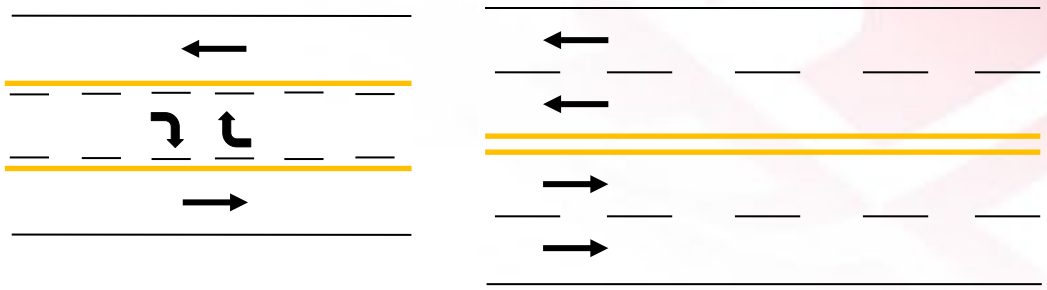
3.6: Working at Night

3.7: Pedestrians and Bicyclists Accommodation

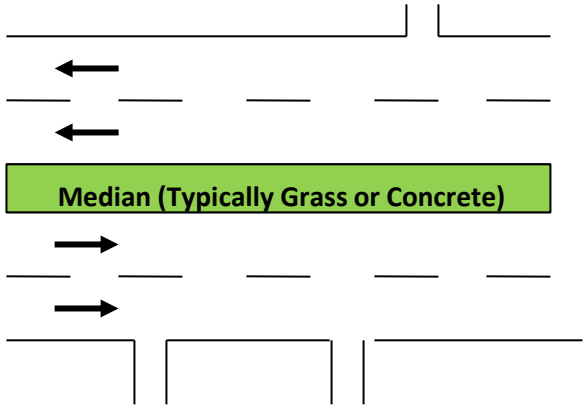
3.1 Roadway Types

Two-Lane, Two-way

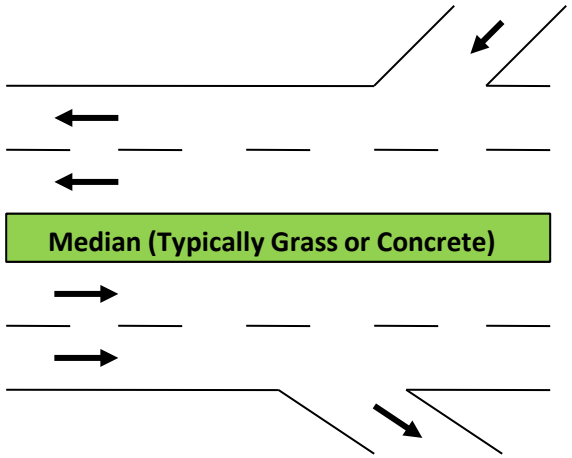
Multilane Undivided



Multi-lane Divided Uncontrolled Access

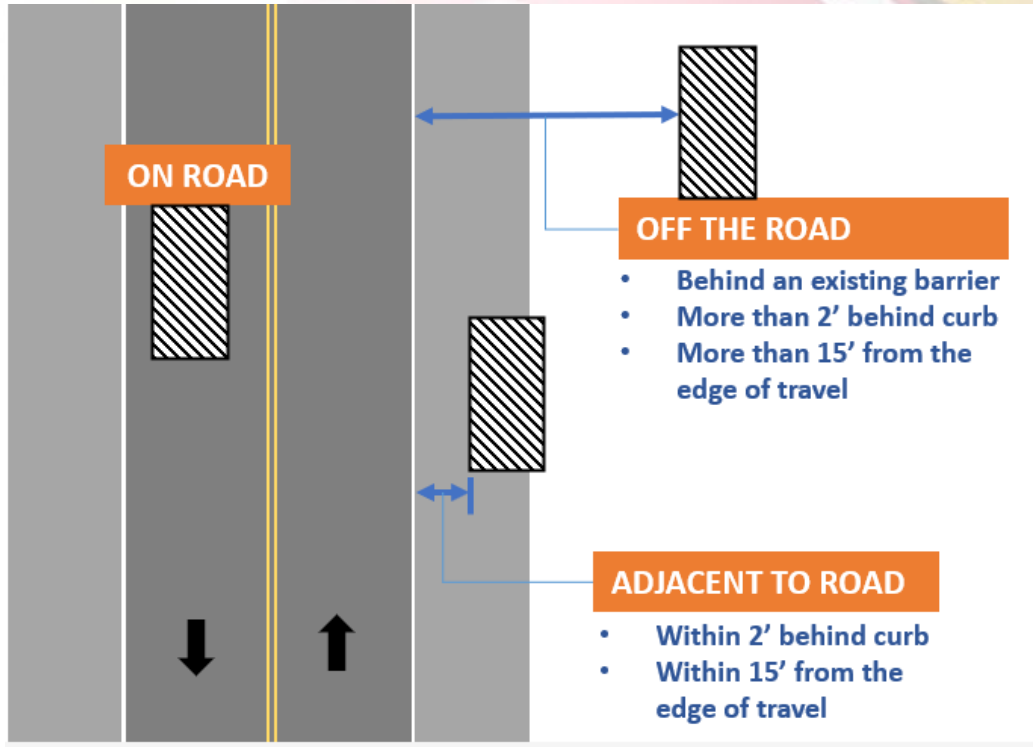


Multi-lane Divided Controlled Access (Expressway/Freeway)



3.2 Work Location

- **On Roadway** – When the work area is within the travel lane(s).
- **Adjacent to Road**
  - For roads with curb: Within 2 feet from the face of the curb.
  - For roads without curb: Within 15 feet from the edge of the travel lane.
    - For roads without edge lines, the 15 feet is measured from the edge of the pavement.
- **Off the Road (Beyond the Shoulder)**
  - More than 15 feet from the edge of travel.
  - More than 2 feet behind the curb.
  - Behind a positive protection.



3.3 Work Duration

Short duration activity: Work that occupies a location for less than 15 minutes.

Short-term stationary work activity: Daylight work that occupies a location from 15 minutes to 12 hours.

Image Sourced from: https://www.thebluebook.com/iProView/838481/phd-llc/subcontractors/gallery/

Long-term stationary work activity : Nighttime work, or daytime work that occupies a location more than 12 hours.

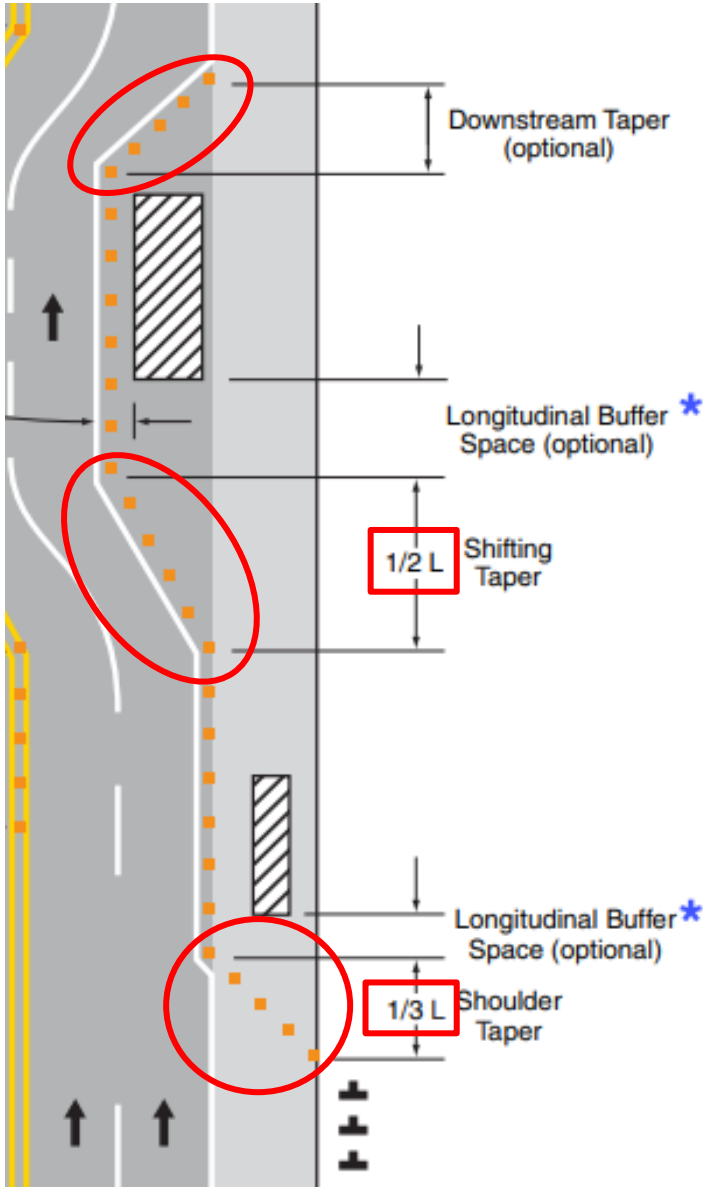
3.2 Work Duration

Mobile operations – Work activity that **moves along** the roadway either **intermittently or continuously**; it may involve stops as long as 15 minutes. *Ex: pavement marking application, sweeping, chemical spraying, etc.*

- **Moving Normal** - Mobile work traveling **at or within 15 mph** of the posted speed limit.
- **Moving Slow** - Mobile work traveling more than **15 mph** below the posted speed limit.

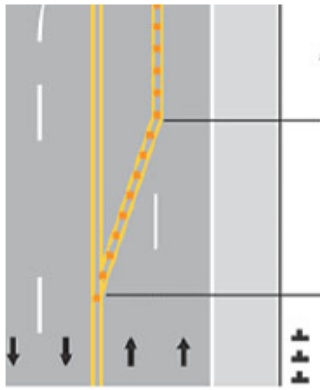
Image Sourced from: Self-driving vehicles could reduce risk in mobile work zones: study | Safety+Health

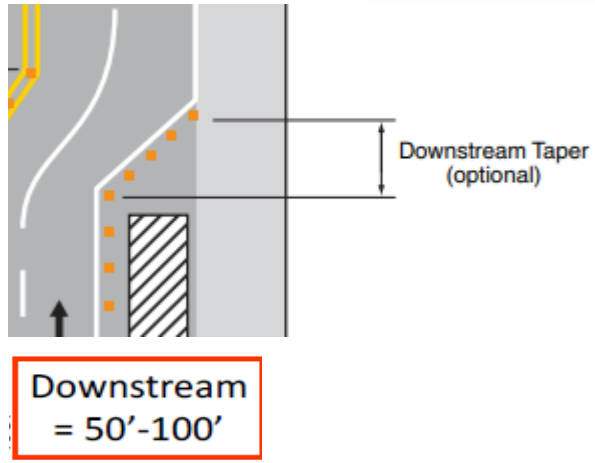
3.4 Tapers



Different types of **Tapers:**

- **Merging** Taper
- **Shifting** Taper
- **Shoulder** Taper
- **Downstream** Taper





MdMUTCD - Figure 6C-2. Types of Tapers and Buffer Spaces

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

3.5 Pavement Drop Off

- Drop-offs occur when there are **height differences between a paved road and the adjacent graded material.**
- SHA's latest drop-off guidelines are illustrated in the SHA Traffic Control Typical Applications.
- Pavement drop-offs 2.5 inches between travel lanes and shoulders typically only require warning signing.
- Larger drop-offs require specific treatments like fillets, barrier protection, or traffic control devices
- When a need for temporary barrier is anticipated, formal Traffic Control Plans shall be submitted for approval.

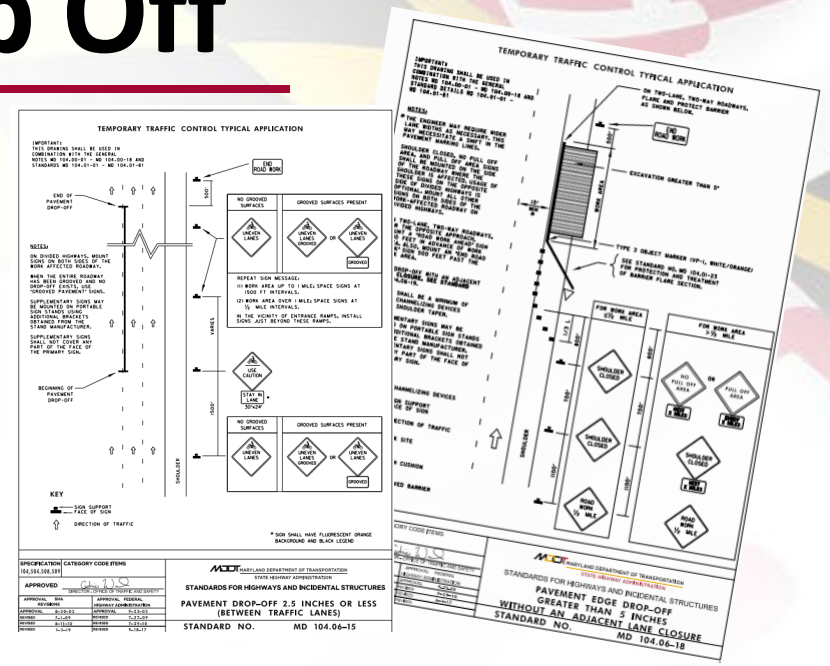


Image Sourced from:
https://www.langdonemison.com/practice/highway-construction-defectsunsafe-pavement-edge-dropoffs/

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

3.6 Working at Night

- **Night Work** has many advantages but can present a concern for workers and road users.
- Workers are less visible to motorists
- Enhanced temporary traffic control is needed to mitigate night work hazards
- **Example enhancements:**
  - Additional advanced warning signs
  - Set arrow panels to night time to reduce glare
  - Temporary work zone lighting
  - Additional high visibility apparel
  - Additional barrier and crash cushions
  - Use ITS devices
  - Police Presence

Image Sourced from: http://dot.state.mn.us/workzone/

3.7 Pedestrian and Bicyclists Accommodation

- Signed alternate route should be provided when designated **bicycle** route/lane is closed.
- If an existing **pedestrian** route is blocked an alternate route should be provided to maintain the continuity of movement.
- The existing facility should be replaced with a reasonably safe, convenient and accessible pathway/bikeway that replicates characteristics of the existing facility or route.

Image Sourced from: https://www.pss-innovations.com/bipartisan-infrastructure-law/october-2022/highway-safety-improvement-program-funds-protecting-vulnerable-road-users

SECTION 4: SHA Specific Work Zone Requirements

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Section 4 Overview

4.1: Lane Closure Permit Request

4.2: High Visibility Safety Apparel

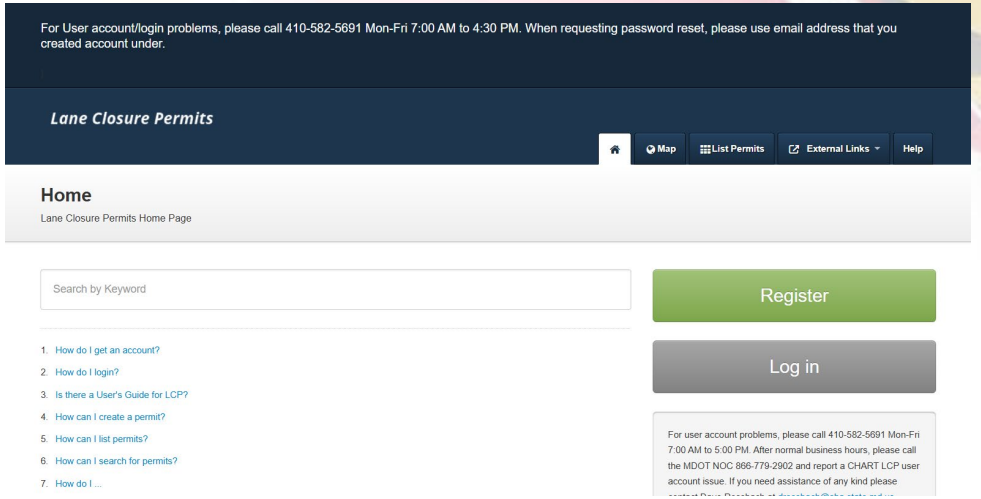
4.3: Vehicles with Approved Lights

4.4: Example 1 - Determine if PV is required

4.5: Example 2 – Determine the appropriate TTC Application from the Maryland Book of Standards

4.1 Lane Closure Permit (LCP) Request

- A **Traffic Control Permit** must be obtained for all temporary lane closures or shoulder closures on SHA roads.
- Contractor must apply at least 5 business days before the needed closure.
- Closures must be coordinated with adjacent work zones.
- **Permittee must call the State Operations Center (SOC)** to activate their approved Traffic Control Permit each day the permit is in effect.



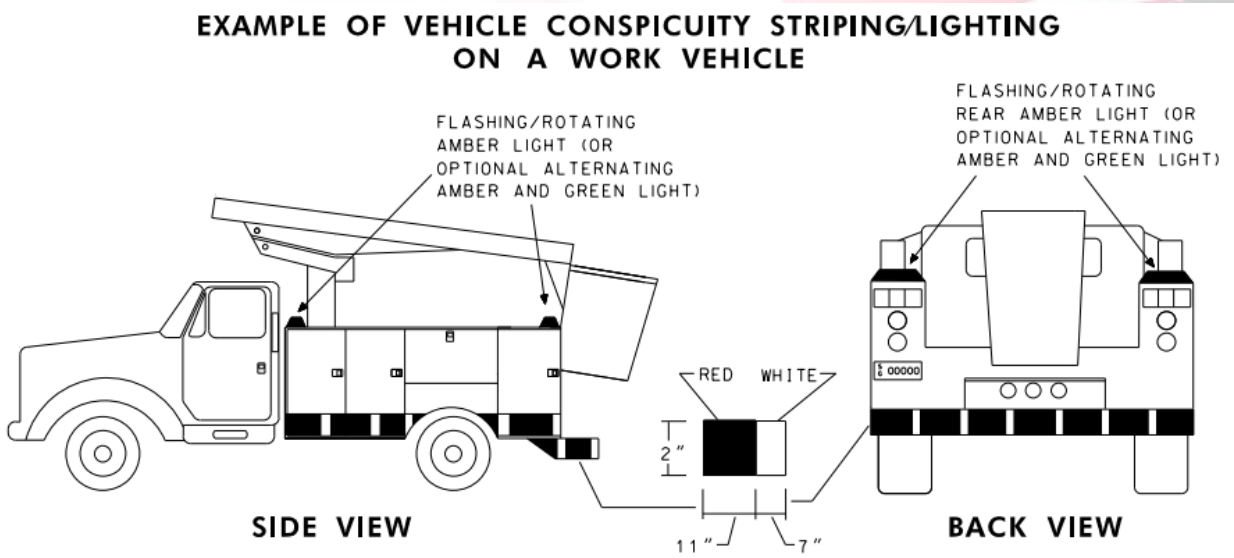
4.2 High Visibility Safety Apparel

- **Wear** SHA-approved **High Visibility** Apparel for visibility to motorists.
- Class 3 safety garment on the upper torso required
- Consult the latest **SHA High Visibility Policy**.

Link to policy:
https://www.roads.maryland.gov/OPPEN/High_Visibilty_Safety_Apparel_Policy.pdf

4.3 Vehicles with Approved Lights

- All work vehicles in work zones **must display approved warning amber lights** according to the SHA standards.
- Highway maintenance and service vehicles can display **green flashing lights simultaneously with amber** flashing lights during the course of snow removal or **when used for workers protection**.
  - The number of green lights may not exceed the number of amber flashing lights equipped and displayed.



4.4 Example 1

Determine if PV is required according to Standard MD 104.00-11A

Scenario:

A **work crew** will perform pavement repair **in the right shoulder** on Interstate I-97 in Gambrills, MD.

The posted speed limit on I-97 is 65 MPH. The work will take place during the day and is expected to take 3 Hours.

QUESTION:
Is a protection vehicle required to protect the work area?

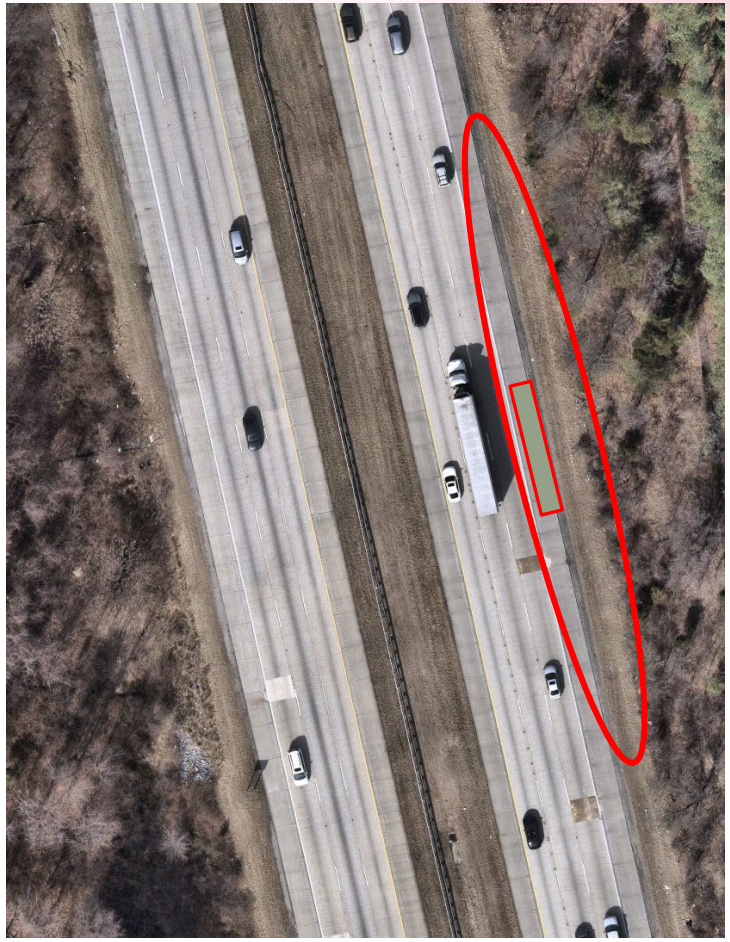
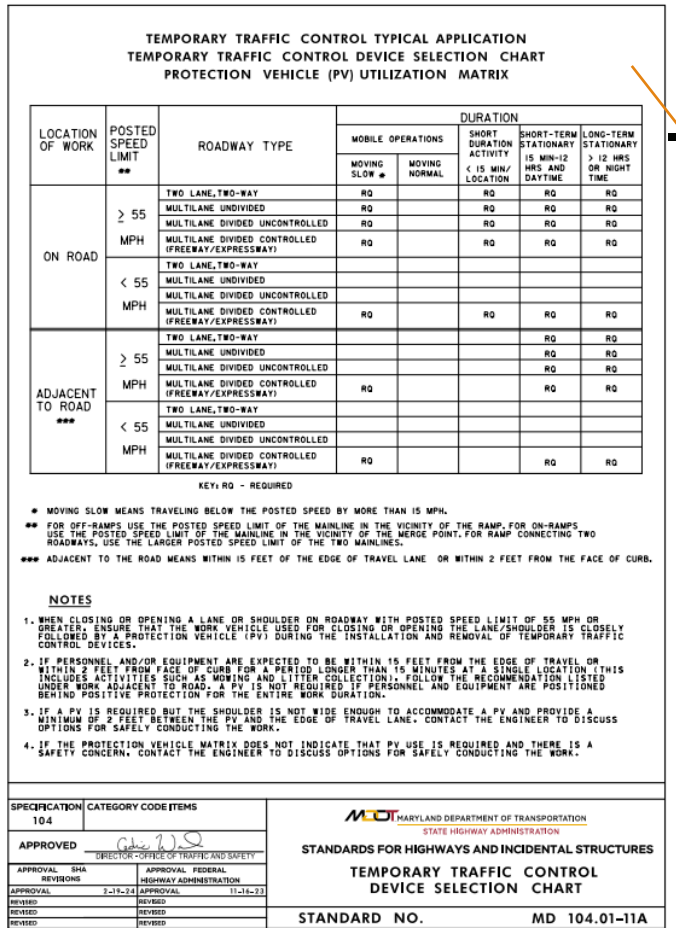


Image Sourced from: Nearmap

4.4 Example 1



TEMPORARY TRAFFIC CONTROL TYPICAL APPLICATION
TEMPORARY TRAFFIC CONTROL DEVICE SELECTION CHART
PROTECTION VEHICLE (PV) UTILIZATION MATRIX

LOCATION OF WORK	POSTED SPEED LIMIT **	ROADWAY TYPE	DURATION				
			MOBILE OPERATIONS		SHORT DURATION ACTIVITY	SHORT-TERM STATIONARY	LONG-TERM STATIONARY
			MOVING SLOW *	MOVING NORMAL	< 15 MIN/ LOCATION	15 MIN-12 HRS AND DAYTIME	> 12 HRS OR NIGHT TIME
ON ROAD	≥ 55 MPH	TWO LANE,TWO-WAY	RQ		RQ	RQ	RQ
		MULTILANE UNDIVIDED	RQ		RQ	RQ	RQ
		MULTILANE DIVIDED UNCONTROLLED	RQ		RQ	RQ	RQ
		MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ		RQ	RQ	RQ
	< 55 MPH	TWO LANE,TWO-WAY					
		MULTILANE UNDIVIDED					
		MULTILANE DIVIDED UNCONTROLLED					
		MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ		RQ	RQ	RQ
ADJACENT TO ROAD ***	≥ 55 MPH	TWO LANE,TWO-WAY				RQ	RQ
		MULTILANE UNDIVIDED				RQ	RQ
		MULTILANE DIVIDED UNCONTROLLED				RQ	RQ
		MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ			RQ	RQ
	< 55 MPH	TWO LANE,TWO-WAY					
		MULTILANE UNDIVIDED					
		MULTILANE DIVIDED UNCONTROLLED					
		MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ			RQ	RQ

KEY: RQ - REQUIRED

* MOVING SLOW MEANS TRAVELING BELOW THE POSTED SPEED BY MORE THAN 15 MPH.

** FOR OFF-RAMPS USE THE POSTED SPEED LIMIT OF THE MAINLINE IN THE VICINITY OF THE RAMP. FOR ON-RAMPS USE THE POSTED SPEED LIMIT OF THE MAINLINE IN THE VICINITY OF THE MERGE POINT. FOR RAMP CONNECTING TWO ROADWAYS, USE THE LARGER POSTED SPEED LIMIT OF THE TWO MAINLINES.

*** ADJACENT TO THE ROAD MEANS WITHIN 15 FEET OF THE EDGE OF TRAVEL LANE OR WITHIN 2 FEET FROM THE FACE OF CURB.

NOTES

1. WHEN CLOSING OR OPENING A LANE OR SHOULDER ON ROADWAY WITH POSTED SPEED LIMIT OF 55 MPH OR GREATER, ENSURE THAT THE WORK VEHICLE USED FOR CLOSING OR OPENING THE LANE/SHOULDER IS CLOSELY FOLLOWED BY A PROTECTION VEHICLE (PV) DURING THE INSTALLATION AND REMOVAL OF TEMPORARY TRAFFIC CONTROL DEVICES.
2. IF PERSONNEL AND/OR EQUIPMENT ARE EXPECTED TO BE WITHIN 15 FEET FROM THE EDGE OF TRAVEL OR WITHIN 2 FEET FROM FACE OF CURB FOR A PERIOD LONGER THAN 15 MINUTES AT A SINGLE LOCATION (THIS INCLUDES ACTIVITIES SUCH AS MOWING AND LITTER COLLECTION), FOLLOW THE RECOMMENDATION LISTED UNDER WORK ADJACENT TO ROAD. A PV IS NOT REQUIRED IF PERSONNEL AND EQUIPMENT ARE POSITIONED BEHIND POSITIVE PROTECTION FOR THE ENTIRE WORK DURATION.
3. IF A PV IS REQUIRED BUT THE SHOULDER IS NOT WIDE ENOUGH TO ACCOMMODATE A PV AND PROVIDE A MINIMUM OF 2 FEET BETWEEN THE PV AND THE EDGE OF TRAVEL LANE. CONTACT THE ENGINEER TO DISCUSS OPTIONS FOR SAFELY CONDUCTING THE WORK.
4. IF THE PROTECTION VEHICLE MATRIX DOES NOT INDICATE THAT PV USE IS REQUIRED AND THERE IS A SAFETY CONCERN, CONTACT THE ENGINEER TO DISCUSS OPTIONS FOR SAFELY CONDUCTING THE WORK.

SPECIFICATION	CATEGORY CODE ITEMS
104	

APPROVED _____ DIRECTOR - OFFICE OF TRAFFIC AND SAFETY

APPROVAL SHA REVISIONS		APPROVAL FEDERAL HIGHWAY ADMINISTRATION	
APPROVAL	2-19-24	APPROVAL	11-16-23
REVISED		REVISED	
REVISED		REVISED	
REVISED		REVISED	

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES

TEMPORARY TRAFFIC CONTROL DEVICE SELECTION CHART

STANDARD NO. MD 104.01-11A

LOCATION OF WORK	POSTED SPEED LIMIT **	ROADWAY TYPE	DURATION				
			MOBILE OPERATIONS		SHORT DURATION ACTIVITY	SHORT-TERM STATIONARY	LONG-TERM STATIONARY
			MOVING SLOW *	MOVING NORMAL	< 15 MIN/ LOCATION	15 MIN-12 HRS AND DAYTIME	> 12 HRS OR NIGHT TIME
ON ROAD	≥ 55 MPH	TWO LANE,TWO-WAY	RQ		RQ	RQ	RQ
		MULTILANE UNDIVIDED	RQ		RQ	RQ	RQ
		MULTILANE DIVIDED UNCONTROLLED	RQ		RQ	RQ	RQ
		MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ		RQ	RQ	RQ
	< 55 MPH	TWO LANE,TWO-WAY					
		MULTILANE UNDIVIDED					
		MULTILANE DIVIDED UNCONTROLLED					
		MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ		RQ	RQ	RQ
ADJACENT TO ROAD ***	≥ 55 MPH	TWO LANE,TWO-WAY				RQ	RQ
		MULTILANE UNDIVIDED				RQ	RQ
		MULTILANE DIVIDED UNCONTROLLED				RQ	RQ
		MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ			RQ	RQ
	< 55 MPH	TWO LANE,TWO-WAY					
		MULTILANE UNDIVIDED					
		MULTILANE DIVIDED UNCONTROLLED					
		MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ			RQ	RQ

4.4 TTC Selection Chart Example

LOCATION OF WORK	POSTED SPEED LIMIT **	ROADWAY TYPE	DURATION				
			MOBILE OPERATIONS		SHORT DURATION ACTIVITY	SHORT-TERM STATIONARY	LONG-TERM STATIONARY
			MOVING SLOW *	MOVING NORMAL	< 15 MIN/ LOCATION	15 MIN-12 HRS AND DAYTIME	> 12 HRS OR NIGHT TIME
ADJACENT TO ROAD ***	≥ 55 MPH	MULTILANE DIVIDED CONTROLLED (FREEWAY/EXPRESSWAY)	RQ			RQ	RQ

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

4.5 Example 2

Determine what Standard to use

Scenario:

A work crew will perform stationary night work that would require closing two right lanes on a multi-lane divided uncontrolled highway with posted speed of 55 MPH.

Image Sourced from: Nearmap

QUESTION:
What typical application should be selected?

4.5 MD 104.05-09

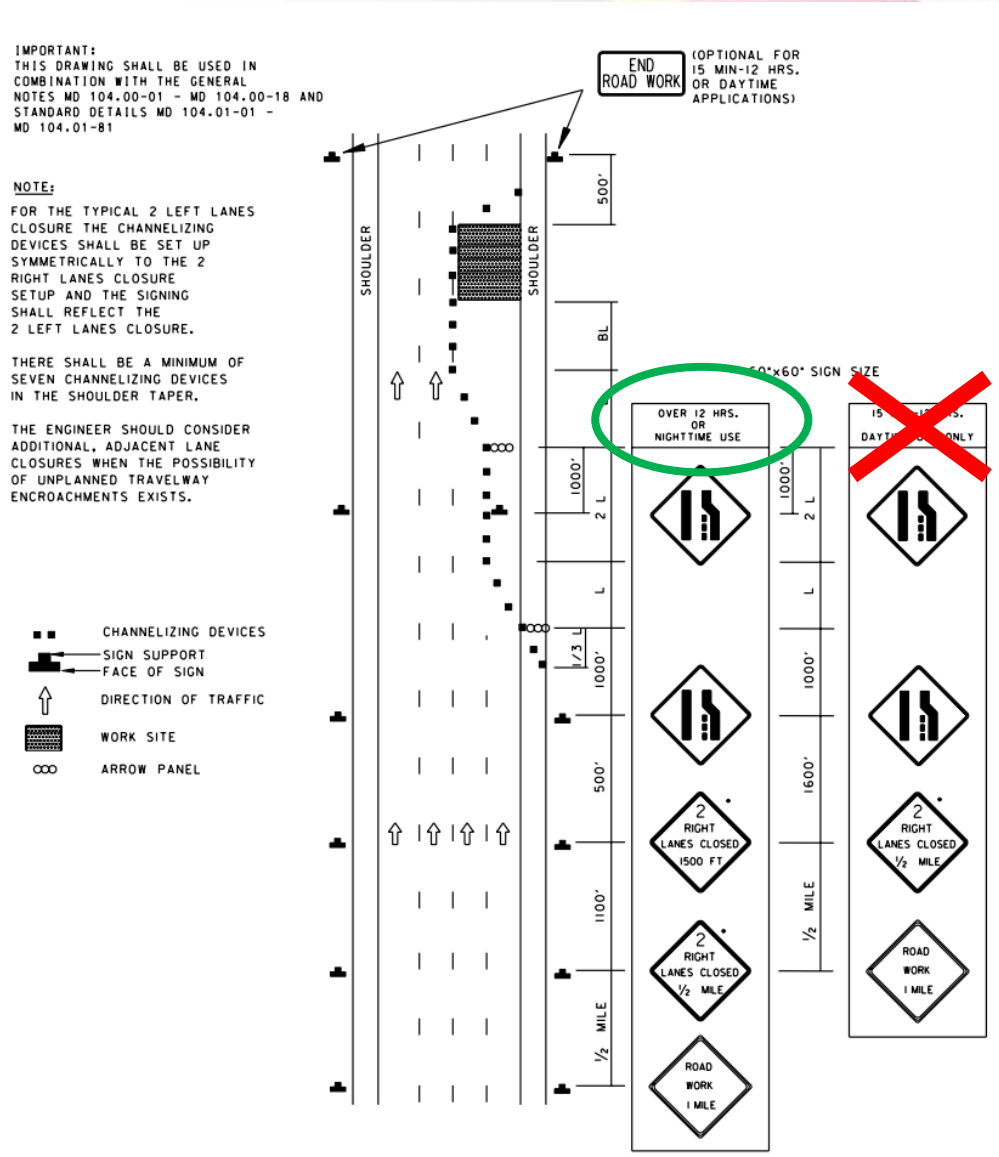
Maryland Department of Transportation
STATE HIGHWAY ADMINISTRATION
STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES

2 RIGHT (LEFT) LANES CLOSURE/EXP–FREEWAY GREATER THAN 40 MPH

2 Right Lanes Closure ✓

Expressway-Freeway ✗

Greater than 40 MPH ✓



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

4.5 MD 104.05-10

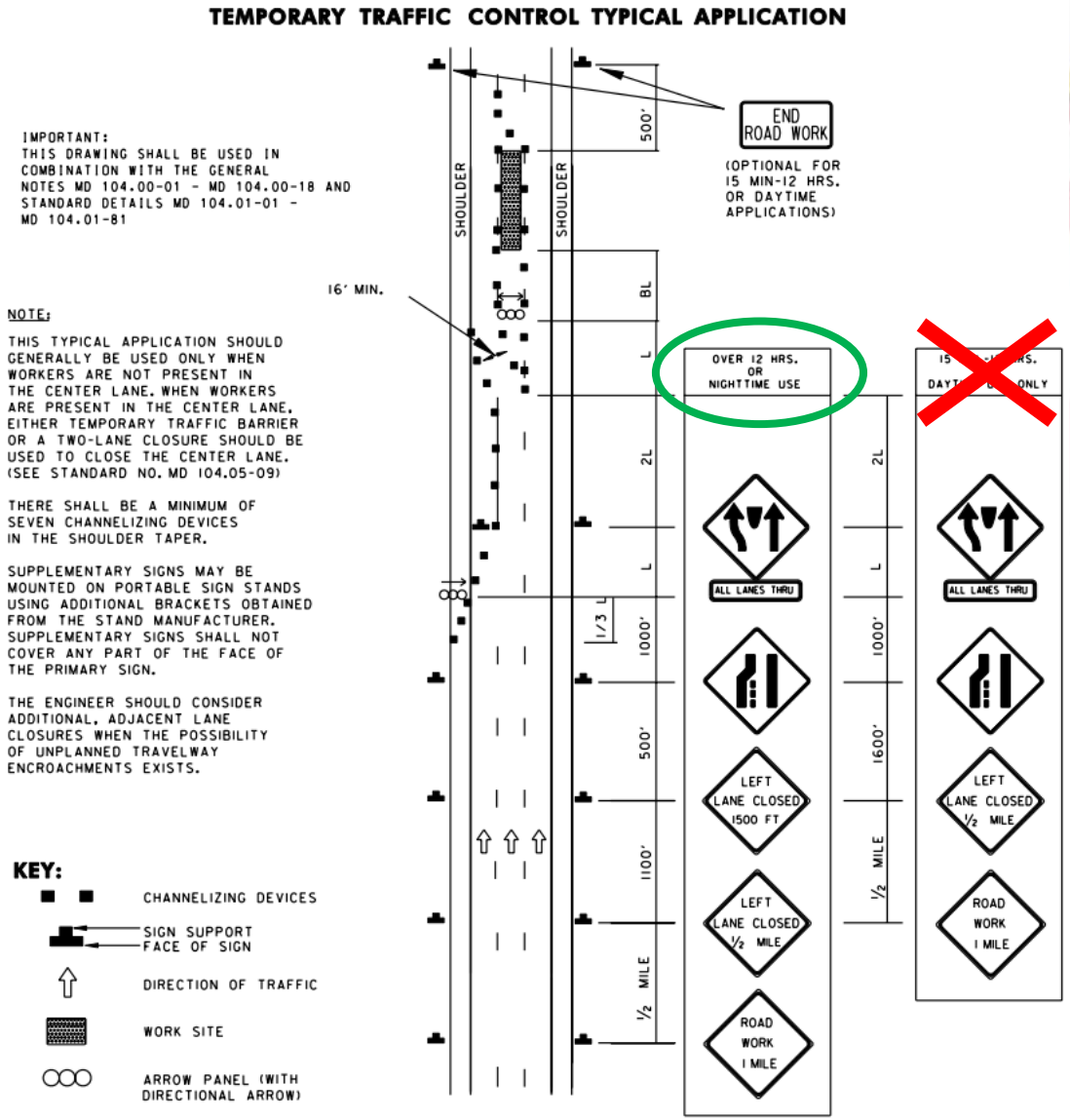
Maryland Department of Transportation
STATE HIGHWAY ADMINISTRATION
STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES

CENTER LANE CLOSURE/EXP-FREEWAY GREATER THAN 40 MPH

Center Lane Closure ✗

Expressway-Freeway ✗

Greater than 40 MPH ✓



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

4.5 MD 104.04-10

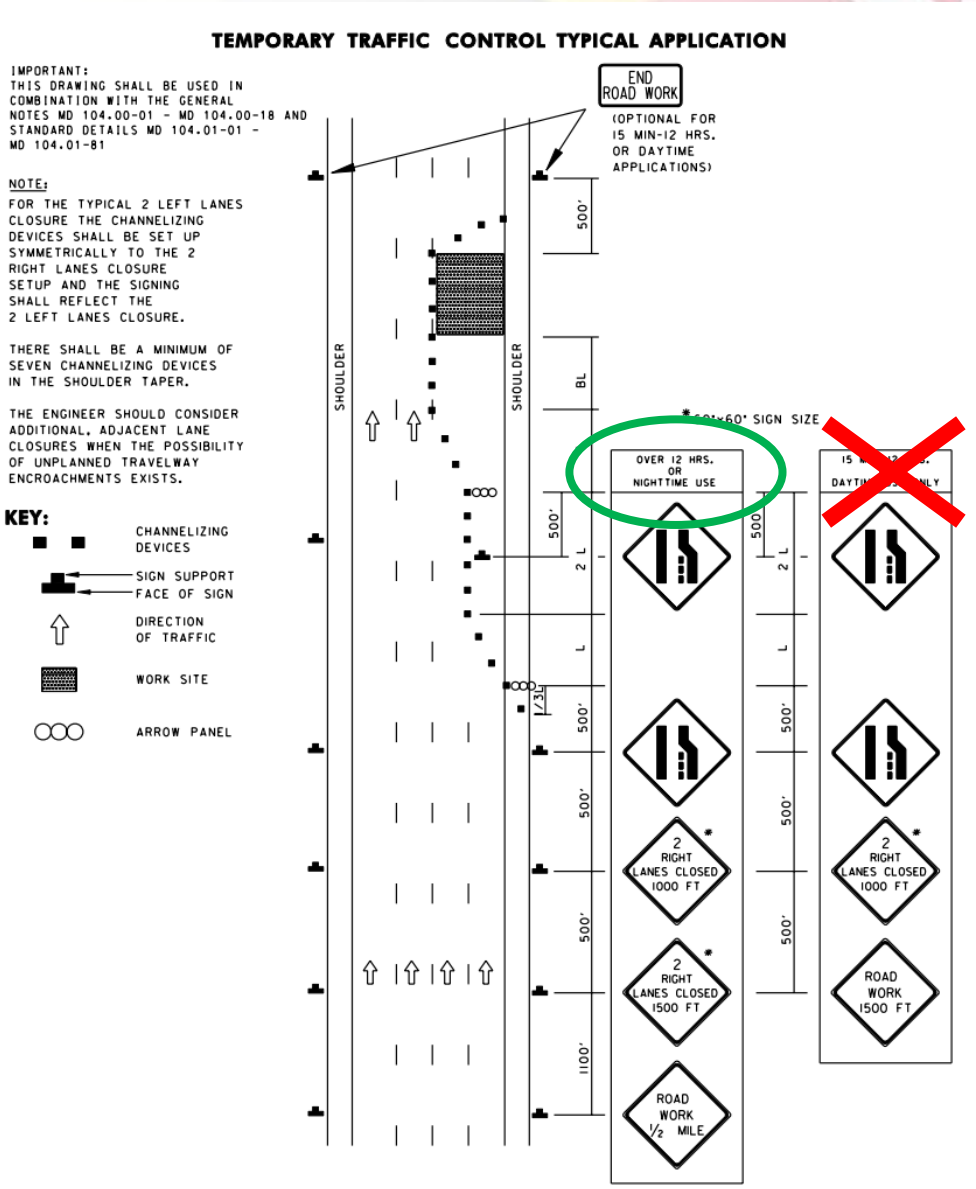
Maryland Department of Transportation
STATE HIGHWAY ADMINISTRATION
STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES

2 RIGHT (LEFT) LANES CLOSURE/
DIVIDED UNCON./EQL/LESS THAN 40 MPH

2 Right Lanes Closure ✓

Divided Uncontrolled ✓

Less than 40 MPH ✗



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

4.5 MD 104.04-09

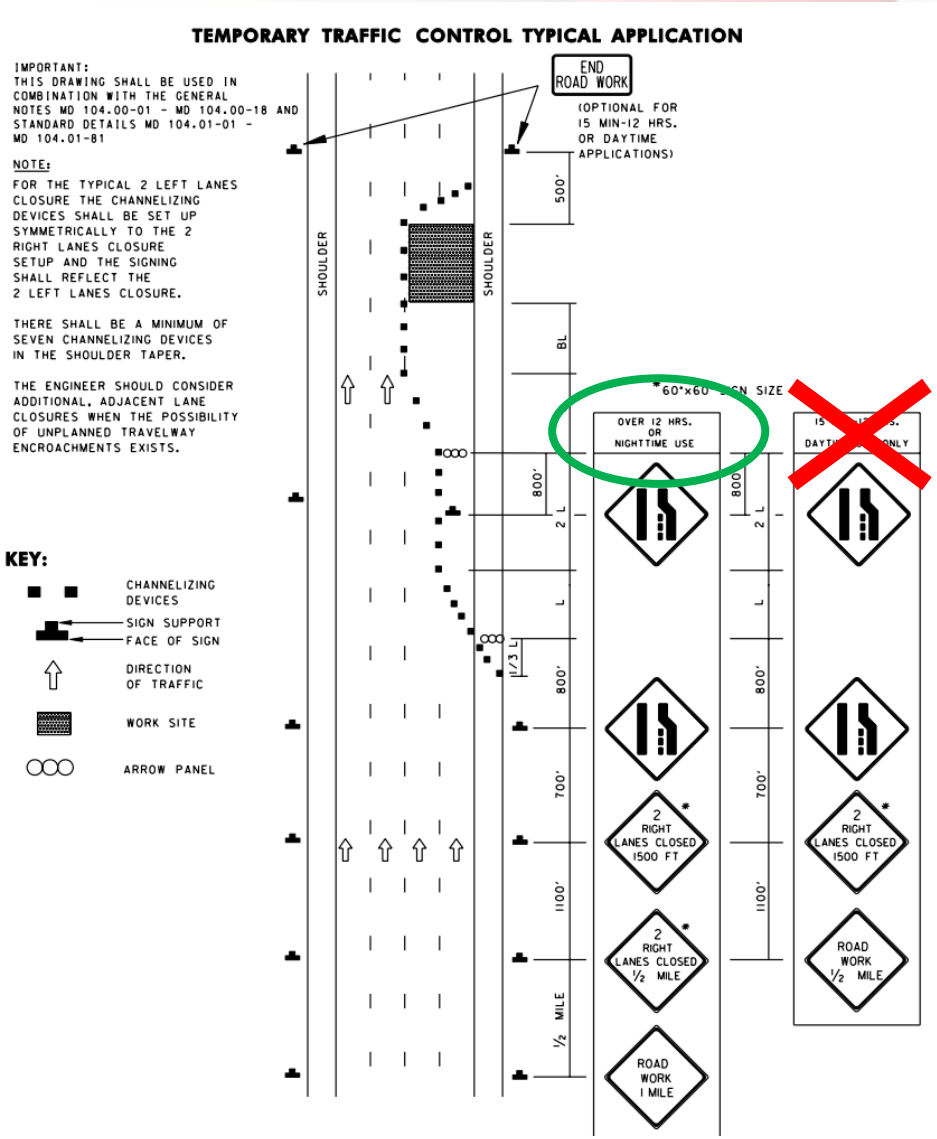
Maryland Department of Transportation
STATE HIGHWAY ADMINISTRATION
STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES

2 RIGHT (LEFT) LANES CLOSURE/
DIVIDED UNCON./GREATER THAN 40 MPH

2 Right Lanes Closure ✓

Divided Uncontrolled ✓

Greater than 40 MPH ✓



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

SECTION 5:
Other Safety Tools

Other Safety Tools

- Consider other traffic control safety measures to reduce work zone crashes and risks and consequences of traffic intrusion into the workspace
- Measures can be considered in combination as appropriate

USE OF LAW ENFORCEMENT

SPEED LIMIT REDUCTION

PROTECTION VEHICLE (PV)

ENHANCED CHANNELIZATION

WORKERS PRESENT TRAILER (WPT)

ADDITIONAL BUFFER LANE CLOSURE

MOVE OVER LAW

AUTOMATED FLAGGER ASSISTANCE DEVICE (AFAD)

SPEED DISPLAY TRAILER (SDT)

TEMPORARY PORTABLE RUMBLE STRIPS (TPRS)

ITS TECHNOLOGY

Other Safety Tools

Use of Law Enforcement Officers (LEOs) in Work Zones

- Maryland State Police (MSP) and their vehicles **may be used to enhance the safety** of highway workers and the traveling public.
- The presence of LEOs in work zones **leads to improved compliance** with the law by all road users.
- Work zone services **are provided by off-duty officers**.
- LEOs provide enforcement, speed management, and traffic control
- **The MSP** and the Maryland State Highway Administration (SHA) have an Interagency Agreement.
- MSP must be requested **by SHA.**

Image Sourced from: https://www.northernvirginiapolicecars.com/Law-Enforcement/Maryland-Law-Enforcement/Maryland-State-Police/Patrol-Vehicles

Other Safety Tools

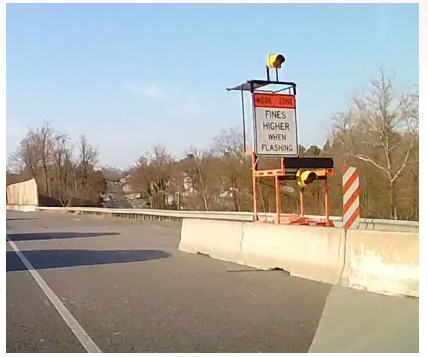
Speed Limit Reduction

- **Reduced speed limits** shall be considered for roadways with posted speed limits of 45 mph or greater when:
  - Work activity occurs on or within 15 feet of an open travel lane without positive protection measures; or,
  - Work activity places pedestrians or bicyclists within 15 feet of open travel lanes without positive protection measures.
- Speed limit reductions **must be approved by the SHA District Engineer.**
- When Automated Speed Enforcement is deployed, **additional approval by Office of Traffic and Safety Director** is required.

Other Safety Tools

- **Speed Display Trailer (SDT)**
  - Displays the speed of an approaching vehicle to the vehicle operator for awareness

- **Workers Present Trailer (WPT)**
  - Designed to enhance motorists' situational awareness when entering a work zone where workers are present.
  - When activated, a WPT will display alternating flashing YELLOW beacons.

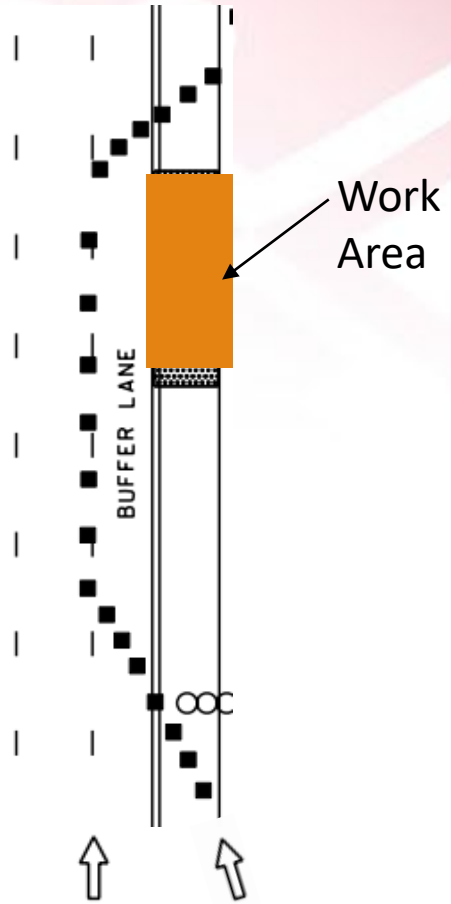


- **Automated Flagger Assistance Device (AFAD)**
  - Portable traffic control devices mounted on a trailer that can be operated remotely by certified flagging personnel.

Other Safety Tools

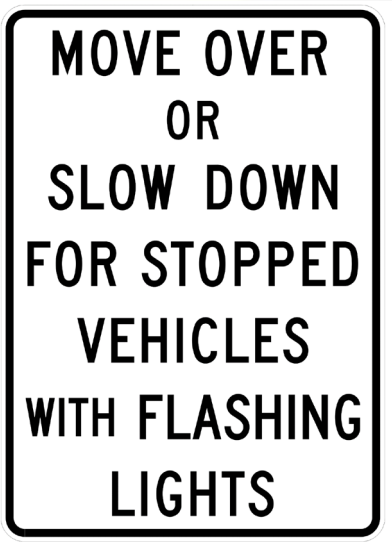
Additional Buffer Lane

- **A buffer lane** is an adjacent lane closure within a work zone designed to create additional lateral space between the active traffic flow and the work area.
- Buffer lanes may also be used for access, egress, or deliveries.



Other Safety Tools

- **Move Over Law**
  - TDSD working on additional options for smaller sign



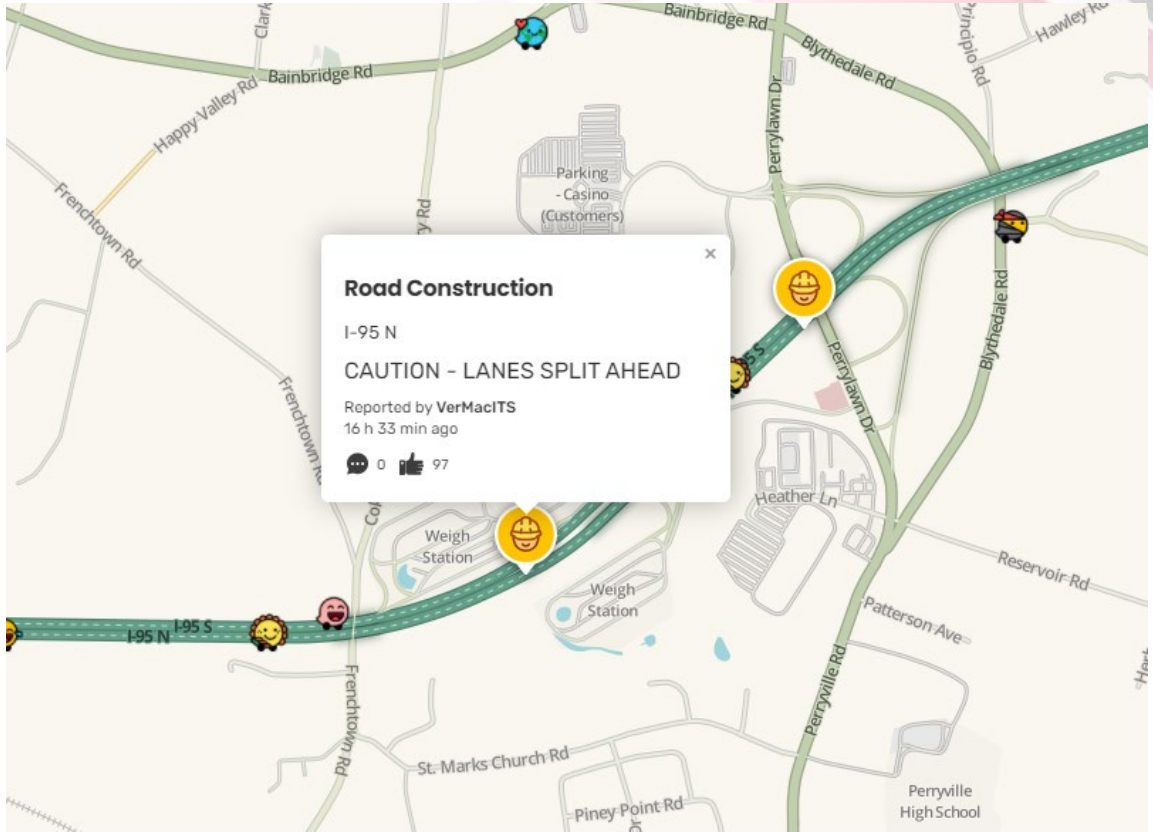
- **Enhanced channelization**
  - Reduce spacing between devices
  - Use drums in place of cones

Image Sourced from:
https://www.kbtx.com/content/sports/Texas-Aces-11U-off-to-a-great-start-in-fall-season-493980841.html

Other Safety Tools

ITS Technology

- **Connected devices** (i.e., HASS Alert) may be installed in vehicle units that could send real-time digital alerts to motorists over 3rd party platforms (e.g., Waze, Google Maps) when roadway crews are working.



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Other Safety Tools

Temporary Portable Rumble Strips (TPRS)

- TPRS are removeable raised patterns placed on the roadway to **provide audible and vibratory warnings** to drivers
- Can **alert drivers** of upcoming road condition changes such as detours, flagging, and speed limit reduction
- TPRS are typically **installed as an array**, which includes 3 strips
- **Use of TPRS is mandatory when all the following conditions are met:**
  - Work zone activities involve daytime flagging operations on a two-lane roadway, and
  - Duration of work zone activity is >3 hours, and
  - The posted speed limit is >40 MPH.

Image Sourced from: https://coralsales.com/products/roadquake-2f

SECTION 6: Additional Training and Resources

Available SHA Approved Training

Temporary Traffic Control Traffic Manager's Course (TTC-TM course)

This course provides Temporary Traffic Control (TTC) training for work zones, specifically designed **for field supervisors** and **crew leaders**. Course covers:

- The fundamentals of temporary traffic control.
- SHA's Standards and Specifications, and typical applications.
- Complete a multiple-choice online examination at the end of the course.
- Obtain a Md-specific TTC Certificate.

For registration, contact:

- https://www.mtbma.org/products/training
- Phone number: (410) 760-9505
- Approximate duration: 08:00 Hrs.

MTBMA
MARYLAND TRANSPORTATION BUILDERS AND MATERIALS ASSOCIATION

Temporary Traffic Control Manager Certification

Training

Temporary Traffic Control Manager Certification (Orange Card)

This one-day, 8-hour course is designed for field supervisors providing Temporary Traffic Control Manager (TTCM) training for work zones. Individuals will be provided an online course manual with instructional material and learn the fundamentals of temporary traffic control, SHA's Standards and Specifications, and typical applications. Individuals will then complete a multiple-choice online examination at the end of the course.

- Training modules & the exam are inside the online course.
- Each person registered must have an email address unique to them. You can not use an office email/administrative assistant's email to register multiple people.
- After registration, the course information will be made available within 2 business days. The course can then be accessed at will, day or night.
- Training is not available on an iPad, phone, or other handheld device, it must be done on a laptop or desktop computer.
- The Google Chrome browser must be used to access the training.
- The course, on average, takes 4-6 hours and can be completed online any time day or night.
- The exam has a time limit of two hours, which must be completed without interruption.
- You have two attempts to pass the exam.
- Successful completion requires a 70% or higher score on the final exam.
- If both exam attempts are failed the individual may register and pay the fee to take the course again.
- Certification is valid for 4 years from the time the exam is successfully completed.
- Registration for the certification course is valid for 6 months. If the course is not completed during that time the registration is forfeited and expired.

Contact MTBMA at training@mtbma.org with questions about the Temporary Traffic Control Managers Course.

NOTE: *You will be asked about* ***shipping information*** even though *this course is 100% online and nothing will be shipping to you or the registrant.* This information will be used to notify you that the order is **fulfilled** and the training is available to the registrant to take. Enter your company information and the email address of the individual who wants to be notified the course is available (typically the individual creating the registration).

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Available SHA Approved Training

Maryland Flagger Certification Training Course

This course covers standard flagger control references, proper flagging signal procedures, and standard flagger practices for various situations. Upon successful completion, students receive a Maryland Flagger Certification card.

Training Options

- Option #1- Online training provided by ATSSA.
- Option #2- Classroom training provided by Certified ATSSA Flagger Instructors.

For registration, contact:

- https://www.atssa.com/
- (540) 368-1701
- Approximate duration: 04:00 Hrs.

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

Thank You!

For any questions please contact:

Traffic Development and Support Division
Office of Traffic Safety
wz.tdsd@mdot.maryland.gov

Source: AI generated image