Enhanced Traffic Control Setup Procedures for I-95 Temporary Lane Closures in Maryland

Updated May 11, 2007

All are aware of the inherent danger in working on the Beltway. Safety should remain the primary focus of everyone involved with temporary lane closures including SHA, PCC, contractors and State Police officers.

As a means of enhancing safety during temporary lane closures along I-95 within the Wilson Bridge Project corridor in Maryland, the following procedures are proposed and endorsed by SHA. Specifically, the following enhancements are intended to compliment MSHA Standard Numbers MD 104.06-21 through MD 104.06-24 (attached) for the setup and removal of temporary lane closures during day and nighttime operations. For consistency, these enhancements are to be implemented on all SHA contracts within the Wilson Bridge corridor.

Specific Enhancements

1. SHA will not authorize Beltway lane closures unless the contractor uses a protection vehicle with arrow panel and Truck Mounted Attenuator (TMA) for each lane closed. Details for proper positioning and operation of the protection vehicle are specified later in this document.

2. Temporary lane closures at any location may proceed without Maryland State Police (MSP) support; however, MSP should be requested for all lane closures during nighttime Beltway lane closures. PCC will advise MSP on the planned operations for each night's activities at the location where MSP has been requested to report to the project.

   PCC will recommend that MSP:
   - Not stop in open travel lanes while assisting with the lane closure setup/removal,
   - Not take the place of a TMA,
   - Provide enhanced speed enforcement through the work zone to improve motorist compliance with posted speed limits,
   - Position its vehicle(s) on the Beltway shoulder(s) as specified in the Specific Enhancements section of this document when not providing active speed enforcement.
   - Wear high visibility vests whenever outside of their vehicles

   PCC has no authority or duty to enforce MSP compliance.

3. Install one Portable Changeable Message Sign (PCMS) for single and double lane closures on the side of the road where the lanes will be closed; install two PCMS for triple lane closures on the left and right sides of the road. All PCMS should be installed at an agreed upon location per the Engineer (preferably at least ½ mile) in advance of the first advance warning signs. Sample messages are:

LFT LANE CLOSED 2 MILES	MERGE RIGHT
2 LEFT LANES CLOSED	MERGE RIGHT
3 LEFT LANES CLOSED	MERGE RIGHT

4. Decrease drum spacing within the buffer space and work area from 100 ft to 50 ft maximum.

5. Increase the buffer space to 1,000 ft minimum.

6. During nighttime lane closures, temporary lighting towers should be setup on the shoulder within the lane closure. If inadequate room exists, consideration should be given for setting up lighting towers on the opposite side of the roadway. Lights should be setup to focus light perpendicular to traffic towards the area of the channelizing devices that separate the travel area and lane closure. The following desired locations are listed in order of priority, with the most desired location listed first:
   - At the beginning of each lane closure taper 100 ft beyond the arrow panel
   - At the end of the buffer space / beginning of the work space

7. In addition to vehicle safety lights, provide an arrow panel in caution mode (4-corners) on work vehicle. All vehicle safety lights shall adhere to MSHA Std MD 104.01-18 (attached).

8. Provide periodic use of drone radar within work zone (to be supplied by the WWB project).

9. Provide use of CB Wizard within work zone (supplied by VDOT).

Discussion

Maryland State Police

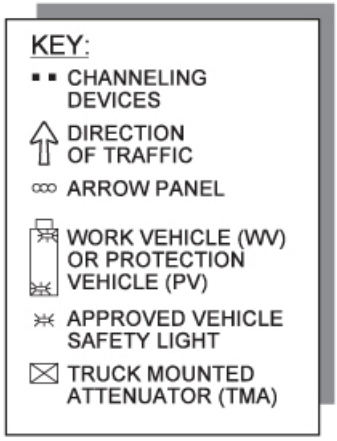
It is SHA's strong preference to use Maryland State Police (MSP) with flashing lights and radar on for all temporary, nighttime lane closures on the Beltway. During the time when the contractor is either setting up or taking down its lane closure(s), MSP should position its MSP vehicle(s) ½ mile minimum in advance of the protection vehicle or the beginning of the lane closure taper. MSP should position its vehicle(s) on the shoulder in which the lane closure is being setup (left shoulder for left lane closures, right shoulder for right lane closures).

Once the contractor completes setup of its lane closure(s), MSP should remain on the shoulder ¼ mile in advance of the beginning of the lane closure taper or end of vehicle queue. One MSP vehicle is recommended for single lane closures and two MSP vehicles are recommended for multiple lane closures. MSP should stage its vehicle(s) at the following locations:

- Single lane closures: ¼ mile in advance of the lane closure taper; located on the shoulder on the same side as the lane closure
- Multiple lane closures: ¼ mile in advance of the first lane closure taper; located on both left and right shoulders

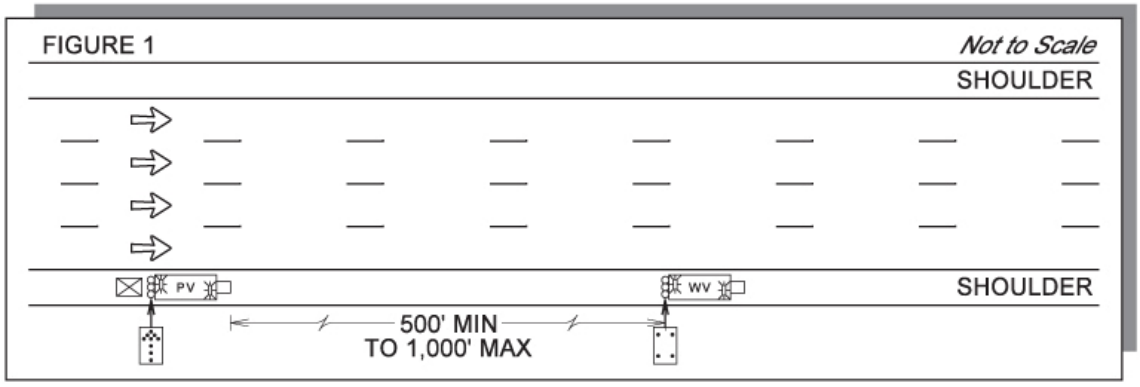
MSP vehicles are discouraged from encroaching into an open travel lane during lane closure setup or removal unless providing speed enforcement. As appropriate, MSP should provide periodic speed enforcement as necessary throughout the work zone. Once all temporary traffic control devices are removed from the roadway, MSP may leave the work zone.

The following sections outline recommended enhancements for setting up and removing traffic control devices for temporary lane closures. The key below applies to all figures.



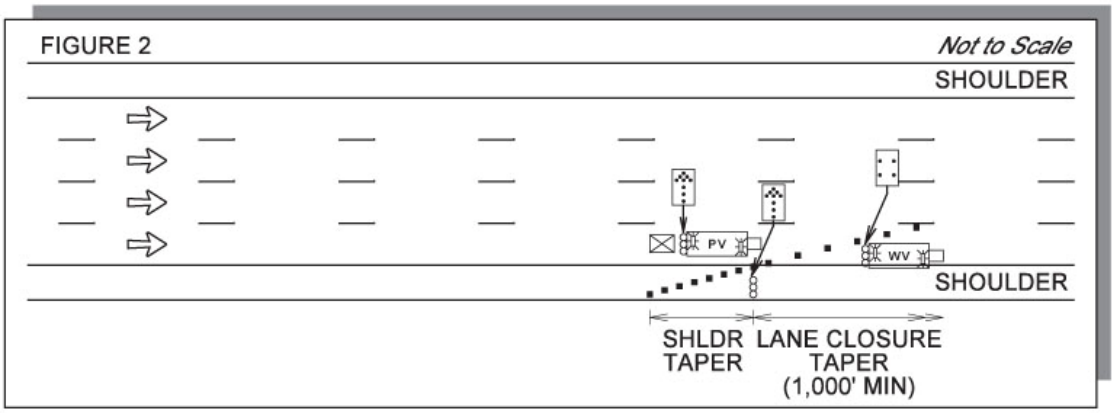
Advance Warning Sign Setup

When advance warning signs are setup, a protection vehicle with safety lights, arrow panel (in flashing arrow mode) and TMA shall be positioned on the shoulder at least 500 ft in advance of the work vehicle. This distance may be increased up to 1,000 ft where shoulders do not exist, but at no time shall the protection vehicle be closer than 500 ft to the work vehicle. The work vehicle shall have safety lights and an arrow panel in caution mode (4 corners). **See Figure 1.**



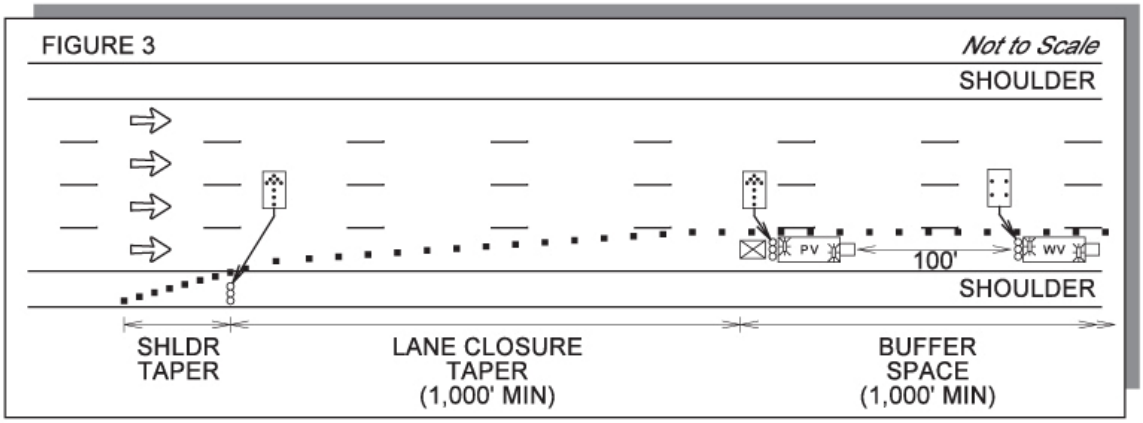
Lane Closure Taper Setup

As the lane closure taper is setup, the protection vehicle with flashing arrow and TMA should be repositioned into the lane to be closed within the shoulder taper. The work vehicle continues to operate the arrow panel in caution mode. **See Figure 2.**

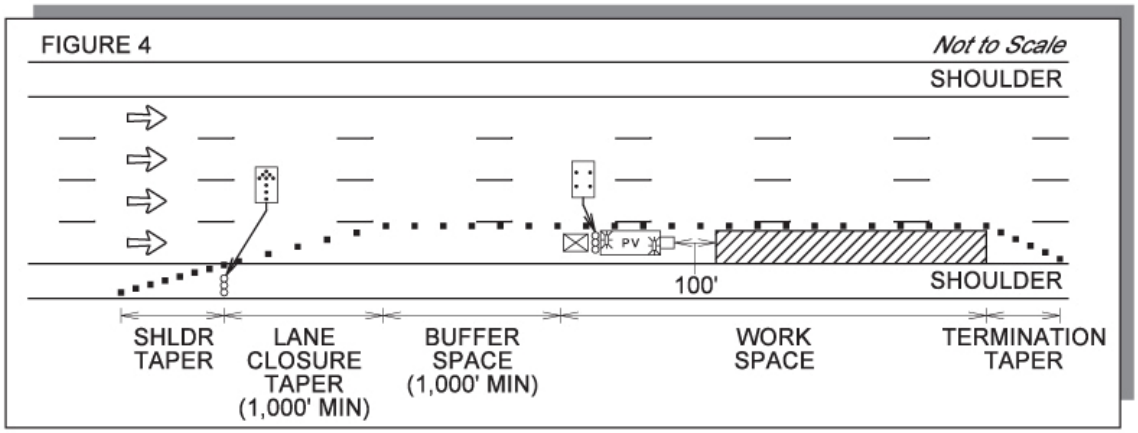


Buffer Space, Work Area and Termination Area Setup

Once the lane closure taper is setup and drums begin to be placed in the buffer space, the protection vehicle with flashing arrow and TMA shall be relocated to the end of the lane closure taper / beginning of buffer space within the closed lane. Once in place, the arrow panel should remain in flashing arrow mode and the protection vehicle should remain 100 ft behind the work vehicle. The work vehicle shall continue to setup channelizing devices throughout the buffer space, work area and termination area with the arrow panel in caution mode. **See Figure 3.**

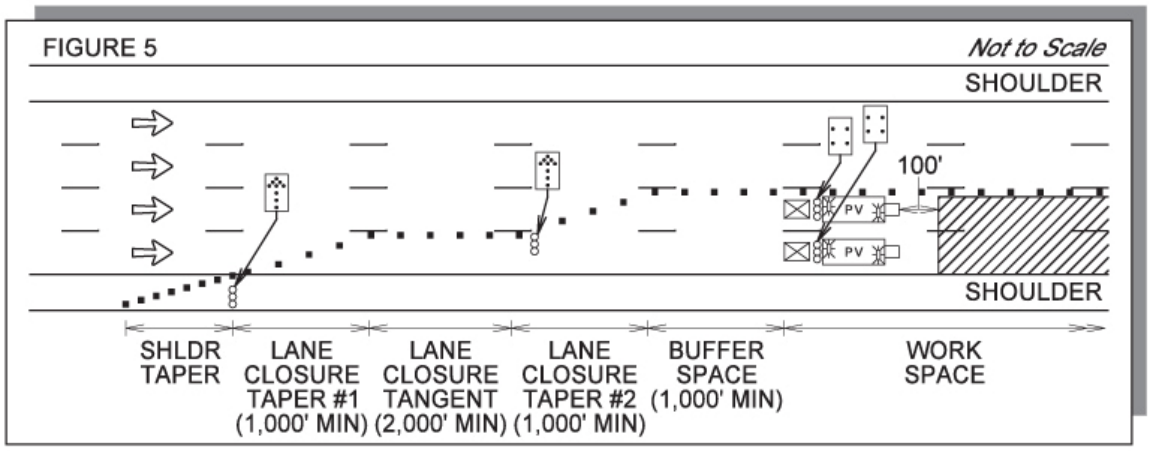


Once all channelizing devices are setup, the protection vehicle with arrow panel in caution mode and TMA shall be relocated to a location beyond the buffer space and at least 100 ft prior to any workers or equipment. **See Figure 4.**



Protection Vehicle Positioning for Multiple Lane Closures

One TMA will be required for each travel lane closed (one TMA for single lane closures, two TMA for double lane closures, three TMA for triple lane closures, etc.). When multiple lane closures are setup, protection vehicles with arrow panels in caution mode and TMA should be positioned in each closed lane 100 ft prior to the work area (reference MSHA Work Zone Safety Toolbox for Use of Police Traffic Services in Work Zones - attached). **See Figure 5.**



Lane Closure Removal

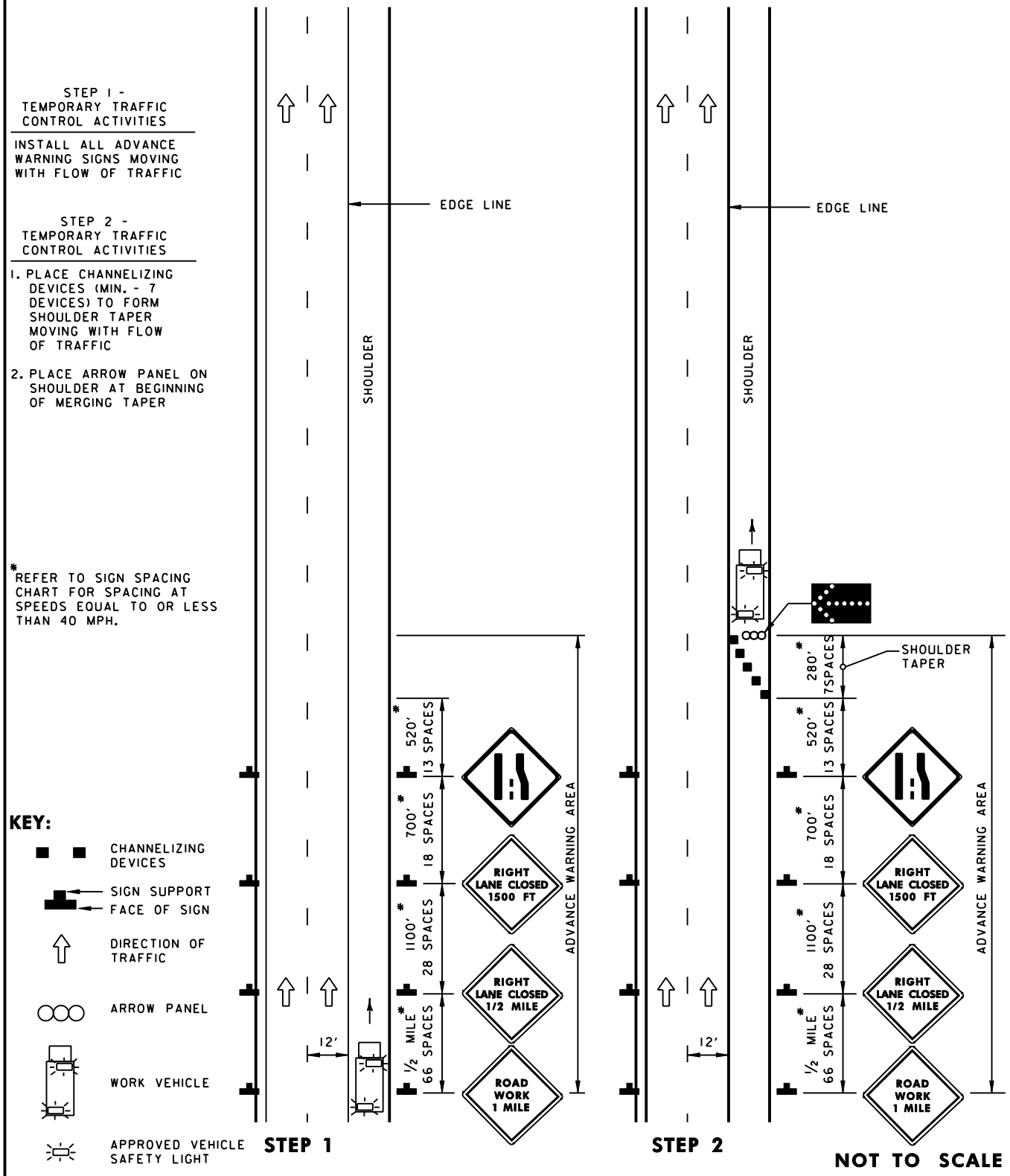
For lane closure removal, the work vehicle shall remove devices per MSHA Std No. MD 104.06-24 using the arrow panel in caution mode.

During the time period when devices are removed from everything except the first lane closure taper, the protection vehicle with arrow panel in flashing arrow mode and TMA shall remain 100 ft in advance of the work vehicle. **See Figure 3.**

When the first lane closure taper is being removed, the protection vehicle with arrow panel in flashing arrow mode and TMA should be positioned stationary in the lane that was closed within the shoulder closure taper. **See Figure 2.**

When the shoulder closure taper and advance warning signs are being removed, the protection vehicle with arrow panel in flashing arrow mode and TMA should be positioned stationary on the shoulder. **See Figure 1.**

TEMPORARY TRAFFIC CONTROL TYPICAL APPLICATION



SPECIFICATION	CATEGORY CODE ITEMS

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APPROVAL • SHA REVISIONS		APPROVAL • FEDERAL HIGHWAY ADMINISTRATION	
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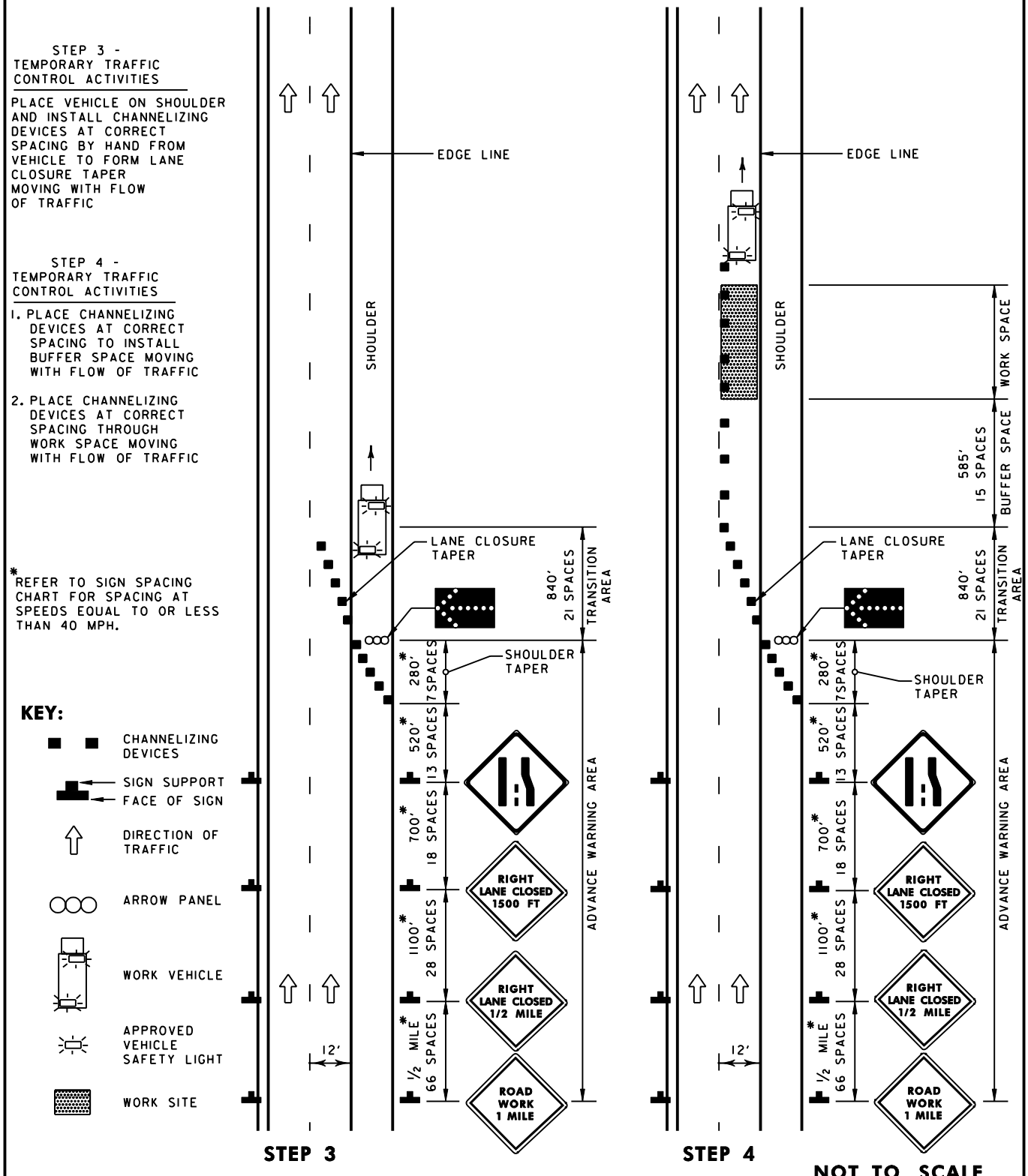
SHA State Highway Administration

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

INSTALLING LANE CLOSURE STEPS 1 AND 2

STANDARD NO. MD 104.06-21

TEMPORARY TRAFFIC CONTROL TYPICAL APPLICATION



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SHA State Highway Administration

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

INSTALLING LANE CLOSURE STEPS 3 AND 4

STANDARD NO. MD 104.06-22

TEMPORARY TRAFFIC CONTROL TYPICAL APPLICATION

STEP 5 - TEMPORARY TRAFFIC CONTROL ACTIVITIES

1. PLACE CHANNELIZING DEVICES AT CORRECT SPACING TO FORM TERMINATION TAPER MOVING WITH THE FLOW OF TRAFFIC
2. INSTALL "END ROAD WORK" SIGN APPROXIMATELY 500' FROM LAST DEVICE IN LANE CLOSURE MOVING WITH THE FLOW OF TRAFFIC

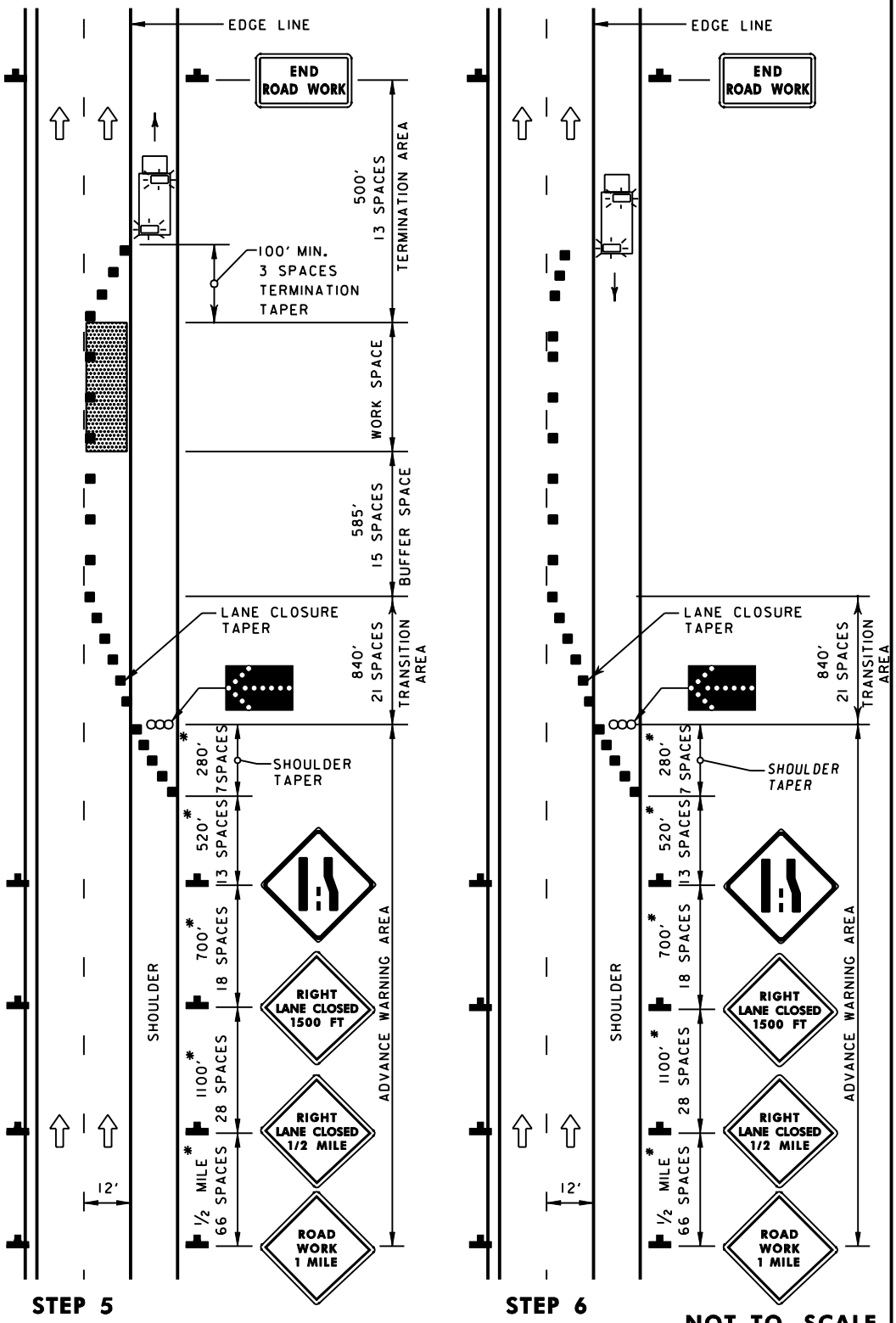
STEP 6 - TEMPORARY TRAFFIC CONTROL ACTIVITIES

1. CLEANUP WORK SPACE REMOVING ALL DEBRIS, VEHICLES, ETC.
2. REMOVE CHANNELIZING DEVICES FROM END OF CLOSURE BACK TO WIDEST PART OF LANE CLOSURE TAPER AGAINST THE FLOW OF TRAFFIC

*REFER TO SIGN SPACING CHART FOR SPACING AT SPEEDS EQUAL TO OR LESS THAN 40 MPH.

KEY:

- CHANNELIZING DEVICES
- SIGN SUPPORT / FACE OF SIGN
- DIRECTION OF TRAFFIC
- ARROW PANEL
- WORK VEHICLE
- APPROVED VEHICLE SAFETY LIGHT
- WORK SITE



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

INSTALLING LANE CLOSURE – STEP 5
REMOVING LANE CLOSURE – STEP 6

STANDARD NO. MD 104.06-23

TEMPORARY TRAFFIC CONTROL TYPICAL APPLICATION

STEP 7 - TEMPORARY TRAFFIC CONTROL ACTIVITIES

1. PLACE REMOVAL VEHICLE ON SHOULDER AND REMOVE CHANNELIZING DEVICES FROM LANE CLOSURE TAPER BY HAND ONTO BACKING VEHICLE
2. REMOVE ARROW PANEL AFTER ENSURING ROADWAY IS CLEAR
3. REMOVE CHANNELIZING DEVICES FROM SHOULDER TAPER

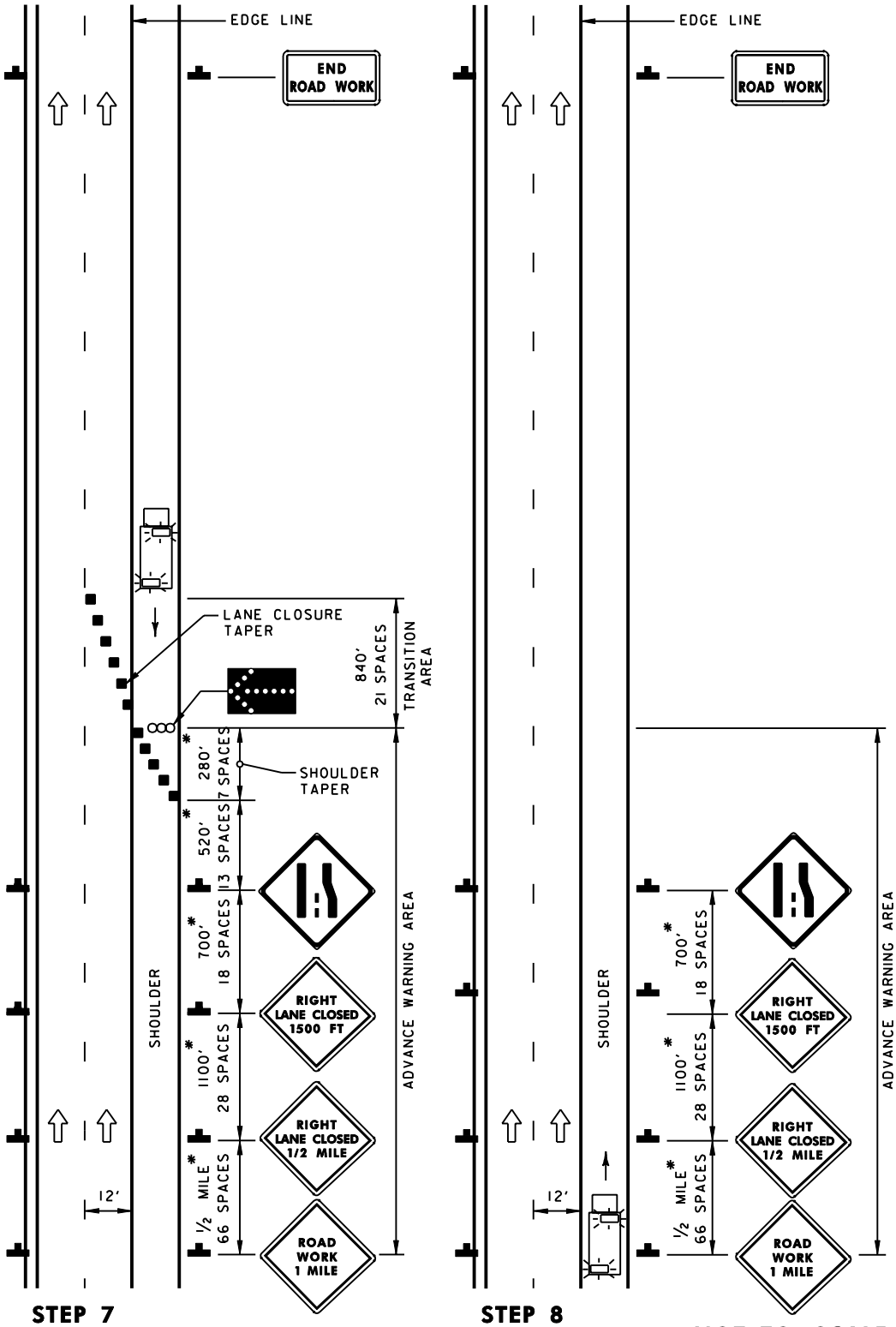
STEP 8 - TEMPORARY TRAFFIC CONTROL ACTIVITIES

1. REMOVE ADVANCE WARNING SIGNS MOVING WITH THE FLOW OF TRAFFIC
2. REMOVE "END ROAD WORK" SIGN MOVING WITH THE FLOW OF TRAFFIC
3. PREFERABLY, TWO WORKERS WALK BACK AND TURN SIGNS AWAY FROM TRAFFIC UNTIL VEHICLE PICKS UP SIGNS.

* REFER TO SIGN SPACING CHART FOR SPACING AT SPEEDS EQUAL TO OR LESS THAN 40 MPH.

KEY:

- CHANNELIZING DEVICES
- SIGN SUPPORT / FACE OF SIGN
- DIRECTION OF TRAFFIC
- ARROW PANEL
- WORK VEHICLE
- APPROVED VEHICLE SAFETY LIGHT



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SHA State Highway Administration

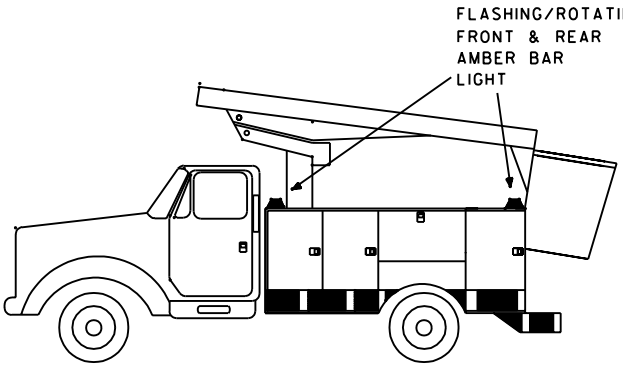
Maryland Department of Transportation
STATE HIGHWAY ADMINISTRATION
STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES

REMOVING LANE CLOSURE STEPS 7 AND 8

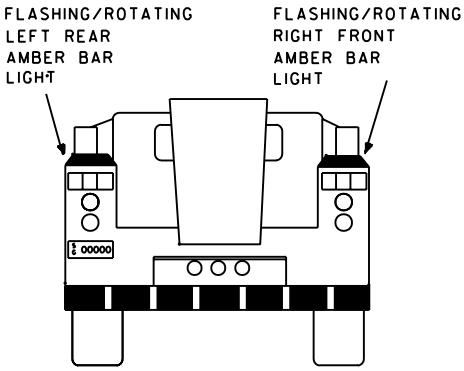
STANDARD NO. MD 104.06-24

TEMPORARY TRAFFIC CONTROL TYPICAL APPLICATION

VEHICLE CONSPICUITY



SIDE VIEW



BACK VIEW

RED/WHITE SIDE STRIPE IS OPTIONAL FOR UTILITY COMPANY VEHICLES HAVING COMPANY SIDE REFLECTIVE STRIPE MARKINGS MADE FROM MATERIAL SHEETING SPECIFIED BELOW.

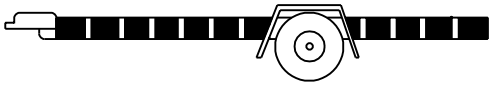
BAR LIGHTS MAY BE REPLACED WITH TWO DOME LIGHTS (ONE AMBER FLASHING STROBE AND ONE AMBER FLASHING ROTATING LIGHT SEPARATED BY 36 INCHES MINIMUM).

NOTES:

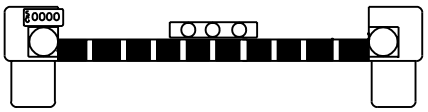
- VEHICLE SHALL, ALSO, DISPLAY FLASHING HAZARD/PARKING LIGHTS IN FRONT AND REAR.
- THESE VEHICLE CONSPICUITY REQUIREMENTS SHALL BE MET WHEN VEHICLE STOPS ARE 15 MINUTES MAXIMUM OR LESS, AND AT LOCATIONS WHERE THE LINE OF SIGHT (*) TO VEHICLE WORK ACTIVITY IS ADEQUATE. ALSO, NO ADVANCE SIGNING IS TYPICALLY NEEDED FOR 15 MINUTES OPERATIONS, WHEN THESE VEHICLE CONSPICUITY REQUIREMENTS ARE MET.

* SEE GENERAL NOTES DEFINITION.

MOBILE OPERATION VEHICLE CONSPICUITY STRIPING/LIGHTING



SIDE VIEW



BACK VIEW

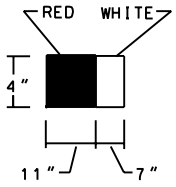
PORTABLE TRAILER VEHICLE CONSPICUITY STRIPING

MATERIAL:

- HIGH PERFORMANCE WIDE ANGLE RETROREFLECTIVE SHEETING-VEHICLE MARKING TAPE

  STRIPE WIDTH - 4 INCH MINIMUM

- BAR AND DOME LIGHTS AS APPROVED BY OOT&S



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

VEHICLE CONSPICUITY

STANDARD NO. MD 104.01-18

USE OF POLICE TRAFFIC SERVICES IN WORK ZONES

A. INTRODUCTION

The use of police traffic services in construction and maintenance work zones has proven to be effective in enhancing the safety of road workers and motorists. The primary reasons to utilize police services in work zones are:

(a) **Speed Control**. Vast research has shown that the presence of a marked police car is simply the most effective speed control measure in work zones.

(b) **Enforcement**. Police enforcement increases motorists' compliance with work zone regulations and discourages aggressive or careless driving.

(c) **Traffic Incident/Accident Management**. Work zone officers can immediately respond to any incident/accident, quickly restoring traffic flow and enhancing the safe operation of the work zone.

(d) **Traffic Control**. A police officer commands respect and authority. Thus, his presence facilitates the safe and efficient movement of traffic through the work zone (e.g., detour/diversion situations).

(e) **Increased Visibility**. The presence of a marked police vehicle in the work zone area is an effective measure to capture the attention of passing motorists causing greater motorist alertness.

B. USE OF POLICE AS A SPEED CONTROL MEASURE IN STATIONARY WORK ZONES

B.1. INTRODUCTION

When police are used as a speed control measure in stationary work zones, the service is usually implemented in one of the three following forms: (1) *Stationary Police Vehicle with Lights and Radar On*, this technique involves a police officer sitting inside a marked police car stationed at the site with its roof-mounted lights and radar in operation; (2) *Police Traffic Controller*, this technique consists of a uniformed officer standing at the side of the road near a speed limit sign, who manually motions for traffic to slow down; and (3) *Cruising Police Vehicle*, a marked police car regularly cruises the work zone area. The most effective of these techniques is the stationary police car with lights and radar on. For that reason, the deployment guidelines contained in this section are intended for this particular technique only.

B.2. OBJECTIVE

- Reduce the speed of vehicles traveling through a work zone.
- Encourage speed limit compliance.
- Increase safety in construction and maintenance work zones.
- Encourage greater motorist alertness to the surroundings.

B.3. LITERATURE REVIEW SUMMARY

B.3.1. ADVANTAGES

- Police presence/enforcement is a very effective measure of speed control in work zones.

- Average speeds in the work zone are reduced by 6 to 22 percent (2 to 13 mph, see *14, 18, 19, 24, 27 and 28).*
- The percentage of vehicles traveling at excessive speeds through the work zone is reduced by 14 to 32 percent (see *19*).
- The percentage of traffic merging in advance of a lane closure location is increased.
- Effectiveness of police presence/enforcement is sustained over time.
- This speed control measure is relatively easy to implement and remove.
- Police presence/enforcement with a stationary police cruiser with lights and radar on can be especially effective at night.
- Driver attention is higher and behavior more cautious when police are present.
- Increased police presence/enforcement at work zones appears to significantly reduce the frequency of work zone crashes.

B.3.2. DISADVANTAGES

- Though police presence/enforcement is very effective in reducing speeds, it is hampered by the limited availability of police officers and patrol cars, and the safety concerns for police officers.
- Police presence/enforcement is costly, particularly for long-term applications.
- Cooperation and creating a partnership between law enforcement, the contractor, and the Department of Transportation is a key component for a successful deployment.
- When on-duty police officers are assigned to the work zone, they may sometimes be called off the job to attend to higher priority police work.
- Speeds increase or go back to previous levels after the enforcement vehicle leaves the area.
- Lack of space for maneuvering and apprehending speeders is a drawback of law enforcement usage in work zones.

B.3.3. OTHER RELEVANT ISSUES

- Research studies have revealed that speed reductions are observed upstream from the stationary police car and at the location of the police car, with the greatest reductions occurring at the location of the police car. Immediately after the vehicles pass the police car, speeds tend to increase or go back to their original level.
- Though mean speeds decrease dramatically near the patrol car, the effect does not continue downstream.
- A police officer controlling traffic is less effective than a stationary police vehicle with light-bar and radar on (i.e., the police officer standing at the side of the road is perceived by passing drivers as less of a threat compared to a stationary patrol car capable of starting a pursuit and issuing a speeding ticket at any moment).
- Numerous studies have shown that mean traffic speeds are more likely to be reduced when a stationary police vehicle is present than when the police vehicle is cruising the area.
- A circulating police car may have a higher impact on individual vehicles than a stationary police car; nonetheless, the circulating vehicle is seen by fewer drivers and thus, its effect on the traffic stream as a whole is smaller compared to the stationary police vehicle.
- In spite of police presence/enforcement, mean speeds show some degree of variation throughout the work zone area.
- Speed enforcement is difficult in urban multi-lane facilities.

B.3.4. GUIDELINES

In addition to the guidelines described herein, SHA and construction personnel must refer to SHA's Standard Operating Procedures for the Use of Maryland State Police in Work Zones and SHA's Criteria for Use Form (see enclosed SHA Construction Memorandum 7210.100.30).

- **Motorists approaching stationary work zones should be able to see the marked police car three to five seconds in advance of its location.**

- **The police officer should be capable of starting a pursuit and issuing a speeding ticket at any moment.**
- **The marked police car should have its roof-mounted flashing lights and radar unit operating at all times. This will allow for the police car to be as conspicuous and noticeable as possible.**
- If traffic is expected to be free flowing through the work zone with little or no back-ups, the marked police car should be positioned in advance of the work zone location (e.g. workers and equipment very near the traffic stream).
- During traffic backups, the marked police car should be placed approximately ¼ mile in advance of the traffic backup. The police car should move with the backup as it lengthens or shortens.
- The marked police vehicle should be located in a position that provides maximum safety for the officer, as far from the traveled lane as possible.
- For the most part the marked police car should remain in place; however, to avoid the perception that there is no enforcement in the work zone, approximately 15 percent of the police officer's time should be used for active enforcement (this is particularly true for long-term work zone applications on which traffic citations should be periodically issued).
- Aggressive enforcement should be used during the opening days of the project and following major changes in work zone conditions.
- Enforcement pullout areas should be spaced throughout long work zones. The pullout areas need to be approximately 0.25 mile long to safely accommodate the use by police personnel. In long work zones, the pullout areas should be spaced approximately every 3 miles to adequately support the enforcement efforts (see *32*).
- The stationary police car technique should be used in those construction projects where slow-moving or stopped traffic backups are anticipated.
- The stationary police car technique may be used on all types of highways and in both short- and long-term work zones.
- Long work zones (e.g., one mile or longer) may require additional police officers and police car units.

- A second police car unit located downstream of the work zone may be occasionally used to ticket speeding drivers as they exit the work zone.
- It is believed that drivers are less attentive and travel at higher speeds at night, also, more impaired drivers are reported to be involved in crashes at night. In view of this information, the use of police officers to enforce speed limits and otherwise show their presence in nighttime work zones is highly recommended.

C. USE OF POLICE SERVICES IN MOBILE WORK ZONE OPERATIONS

C.1. INTRODUCTION

Marked police vehicles are utilized to enhance the visibility and safety of mobile work zone operations.

C.2. GUIDELINES

- The marked police car should be highly visible to approaching traffic, having its roof-mounted flashing lights and radar unit activated at all times. Drone radar use by work zone crews is a particularly effective device for mobile work zone operations (see drone radar section). Therefore the police officers should have the radar activated when escorting a mobile operation.
- The marked policed vehicle should not block an open lane unless protected by a shadow vehicle with a Truck Mounted Attenuator (TMA).
- The marked police car should be placed at least 600 ft ahead of the shadow vehicle with TMA (see *3*). Note: The distance between the vehicles may be increased or decreased depending on the type of work, terrain, local area and other factors.

D. USE OF POLICE ROLLING ROADBLOCKS FOR WORK ZONE OPERATIONS

D.1. INTRODUCTION

The police rolling roadblock technique (also referred as controlled delay) is used by some transportation agencies for work zone situations requiring intermittent short-duration full road closures (e.g. closures for bridge girder placement and utility crossing work) and/or slowing of traffic (e.g. abrupt lane shifts and hazardous conditions requiring reduced speed).

D.2. OBJECTIVE

- To momentarily suspend the entire traffic flow through a specific roadway segment where short-duration roadwork (i.e., 10- to 12-minutes) is taking place.
- To slow traffic through a work zone.

D.3. LITERATURE REVIEW

D.3.1 ADVANTAGES

- The rolling roadblock technique is a means of:
    1. short-term temporary closure of all travel or
    2. slowing traffic.
- Rolling roadblocks allow traffic to remain in motion; thus, faster traffic flow recoveries are possible compared to what occurs when traffic is brought to a complete stop.

D.3.2. DISADVANTAGES

- Rolling roadblocks have the potential to create significant traffic congestion.
- Performing rolling roadblocks generally requires additional manpower.

D.4. GUIDELINES FOR POLICE ROLLING ROADBLOCKS

Both Temporary Road Closures and Slowing of Traffic Conditions

- The rolling roadblock technique should be used only on expressways and freeways.
- Both types of rolling roadblocks need to be carefully planned and require coordination between SHA, Maryland State Police, and the contractor.
- Portable changeable message signs should be placed in advance of each point where pilot cars enter the highway to alert motorists of the rolling roadblock.
- Radio communications shall be established and maintained at all times among the traffic control vehicles and construction crew.
- A successive rolling roadblock should not be started until traffic from the preceding rolling roadblock has been cleared.
- Written notification should be provided to all affected emergency services, with a minimum of 14 calendar days when possible, prior to any road closure using the rolling roadblock technique.
- Given the potential to create congestion, rolling roadblocks should preferably be implemented during nighttime only.

Temporary Road Closures

- Marked police cars (i.e., “pilot cars”) should lead the rolling roadblock and protection vehicles should be positioned in front of each travel lane and on both shoulders (if the shoulder width is greater than 8 feet) to control the flow of traffic on the highway. The pilot cars shall enter the roadway, form the rolling roadblock, and slow traffic to create a gap far in advance of the work activity area without completely stopping traffic. If necessary, the crews may stop traffic but the stop in traffic shall not exceed 15 minutes.
- The upstream location where the pilot cars should start forming the blockade and the speed at which the blockade should travel will be determined based on the time needed to complete the work in the activity area.
- Marked “chase vehicles” should be used to follow the last free-flowing vehicles ahead of the rolling roadblock to notify construction staff that the blockage has begun.

- All ramps between the start of the blockade and the work zone shall be temporarily closed until the blockade has passed.
- The contractor may begin work immediately after the chase vehicle has passed the work zone.
- Radio communications should be used to adjust the speed of the rolling roadblock as necessary.
- If the work in the activity area is not completed when the rolling roadblock reaches it or the maximum time limit has been reached, all work should be immediately ceased except what is necessary to clear the roadway and reopen it to traffic.

Slowing of Traffic

- Marked police cars (i.e., "pilot cars") should be positioned in front of each travel laneto control the flow of traffic on the highway. The pilot cars shall enter the roadway, form the rolling roadblock, and slow traffic to create a gap far in advance of the work activity area without completely stopping traffic.
- Police personnel should maintain a set speed through the work zone as determined by the Engineer. The speed should be set so that vehicles can safely travel through the work zone.

E. POLICE ASSISTANCE IN WORK ZONE'S CRASH REPORTING

Due to the complex nature of work zones, an enhanced crash report form has been developed by SHA for reporting of work zone accidents. This form should be used by the SHA Project Engineer to report any work zone incident/accident (see next page).

Maryland SHA Work Zone Accident/Incident Report

A. Accident Report ☐

Incident Report: ☐

(An event that results in damage to traffic control devices or barrier, crash cushion, pavement, etc. {ex.: tire marks on barrier, skid marks on pavement, broken headlights/taillights, etc.})

☐☐☐☐☐☐☐☐ MAARS Report Number (Preprinted on Police Report)

_____ Acct/Incid Date

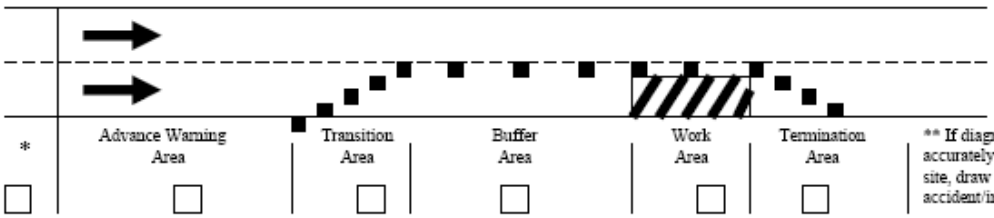
☐☐☐☐☐☐☐☐☐☐☐☐ Contract Number

B. _____ County _____ Route _____ Location (Intersecting Road etc.)

Acct/Incid Time _____ ☐ Non Work Hours _____ Weather

C. Accident/Incident Severity ☐ Fatal ☐ Injury ☐ Property Damage ☐ Unknown

D. Location of Accident/Incident Check all that apply: ☐ Non-Intersection ☐ Intersection ☐ Accel/Decel Lane ☐ Ramp



** If diagram does not accurately depict the accident site, draw a detail of accident/incident on back.

E. Traffic Control in Use
- ☐ Right Lane Closure
- ☐ Left Lane Closure
- ☐ Center Lane Closure
- ☐ Shoulder Work/Closure
- ☐ Lane or Roadway Shift
- ☐ Lanes Divide
- ☐ Flagging Operation
  - ☐ Intersection
- ☐ Detour/Road Closure
- ☐ Exit/Entrance Ramp
- ☐ Traffic Markings in Use
  - ☐ Lane Lines ☐ Edge Lines
  - ☐ Centerline
- ☐ Mobile
  - ☐ Less than 15 min/slow
  - ☐ Moving normal
  - ☐ Mowing
  - ☐ Marking
- ☐ Other _____

F. Type of Accident/Incident
- ☐ Rear End
- ☐ Sideswipe
- ☐ Turning
- ☐ Head-on
- ☐ Run-off-Road/Drop-off
- ☐ Fixed Object
  - ☐ Barrier Tangent
  - ☐ Barrier Flare
  - ☐ Barrier End Treatment (crash cushion)
  - ☐ Channelizing Devices
  - ☐ Sign/Sign Support
  - ☐ Arrow Panel/VMS
  - ☐ Work Vehicle/Equipment
- ☐ Other _____

G. Road Geometrics
- ☐ Straight & Level
- ☐ Horizontal Curve
- ☐ Vertical Curve
- ☐ Combination of Above Curves

H. Speed Limit MPH
- ___ Prior to Work
- ___ During Work

Mail to:
1) Office of Traffic & Safety
TDSD RM 150
Hanover Complex
2) Asst. District Engineer-Traffic

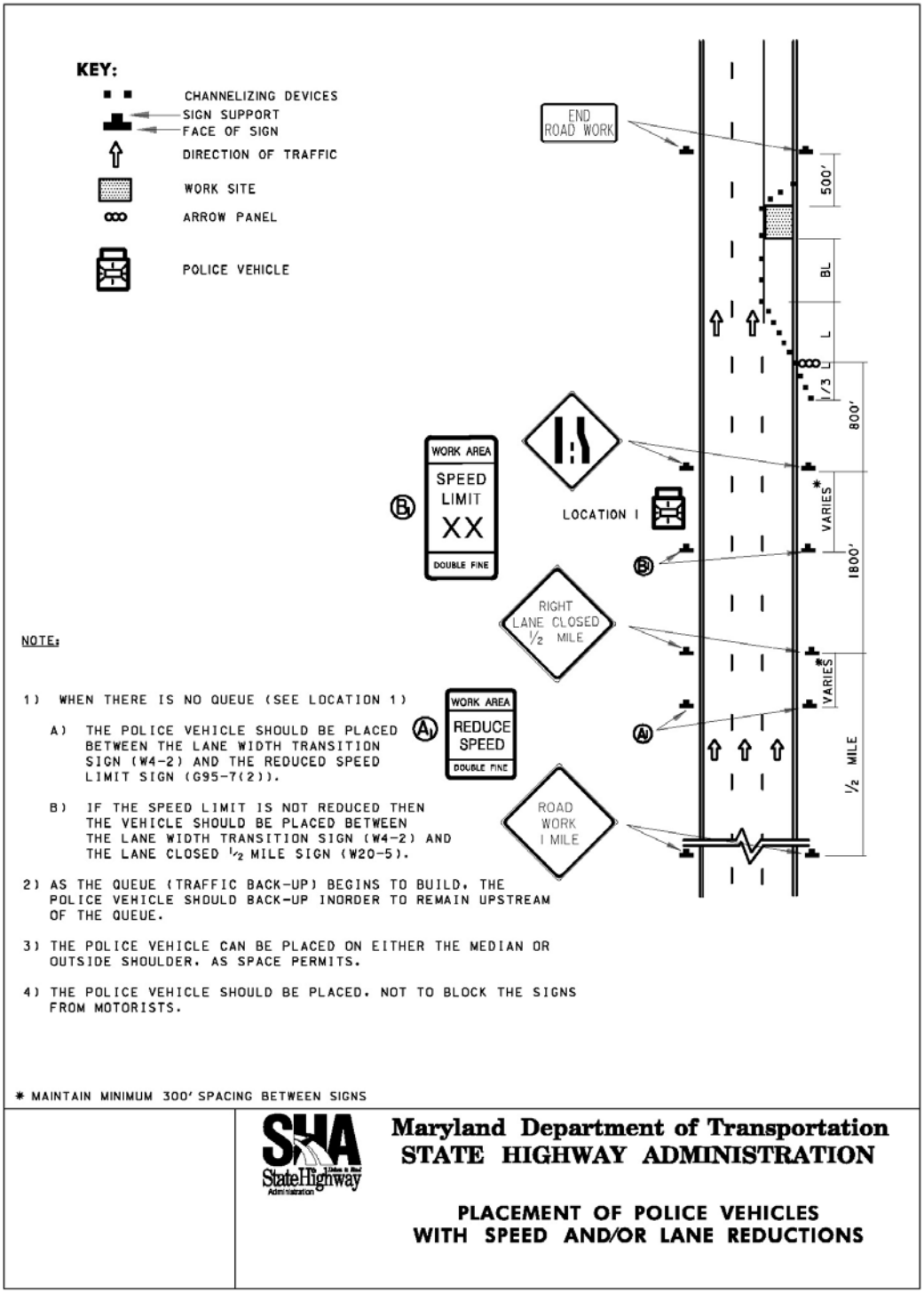
* An accident/incident which may occur **before** the advance warning area should be noted.

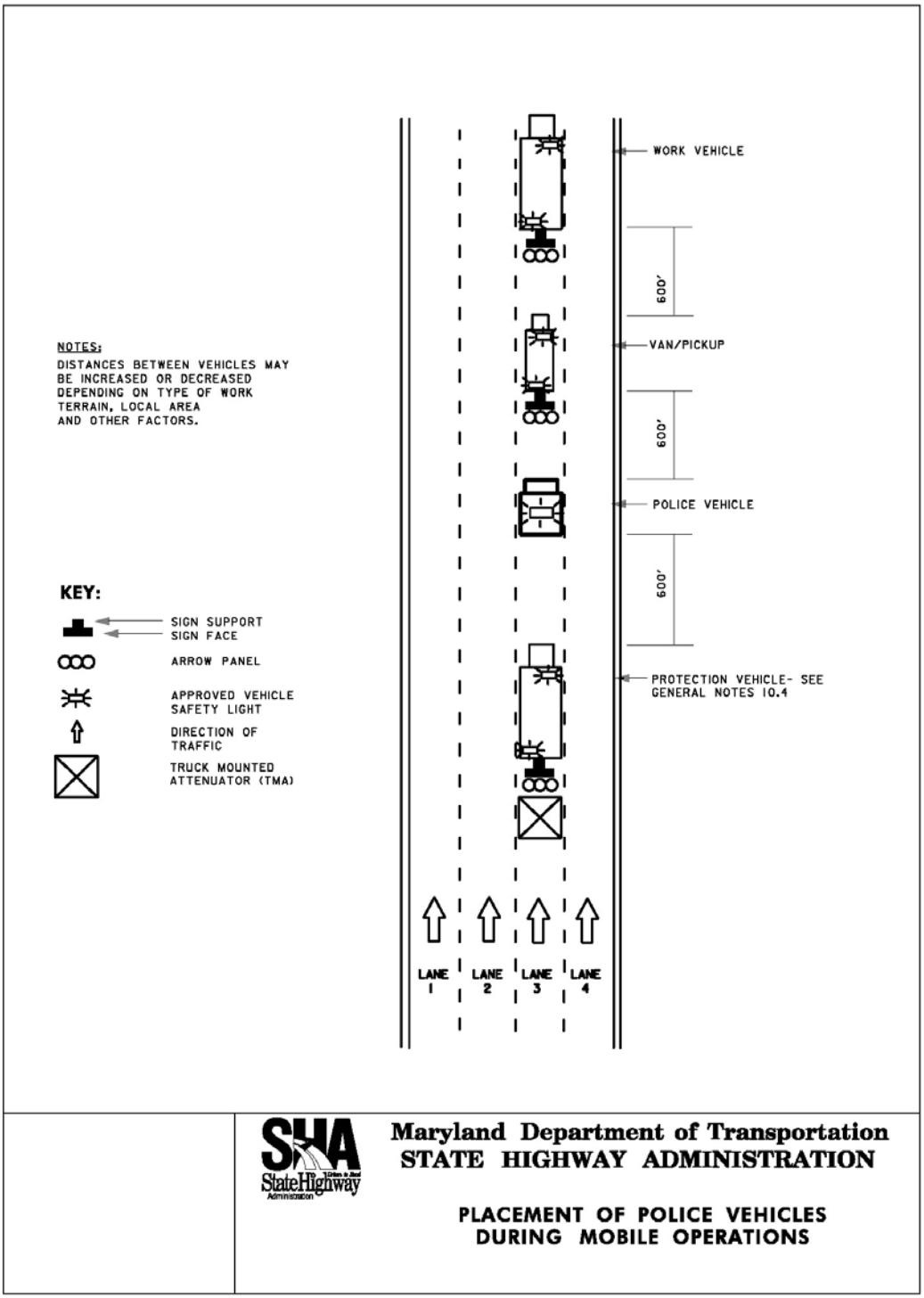
_____ _____
Name (Person Completing Report) Date

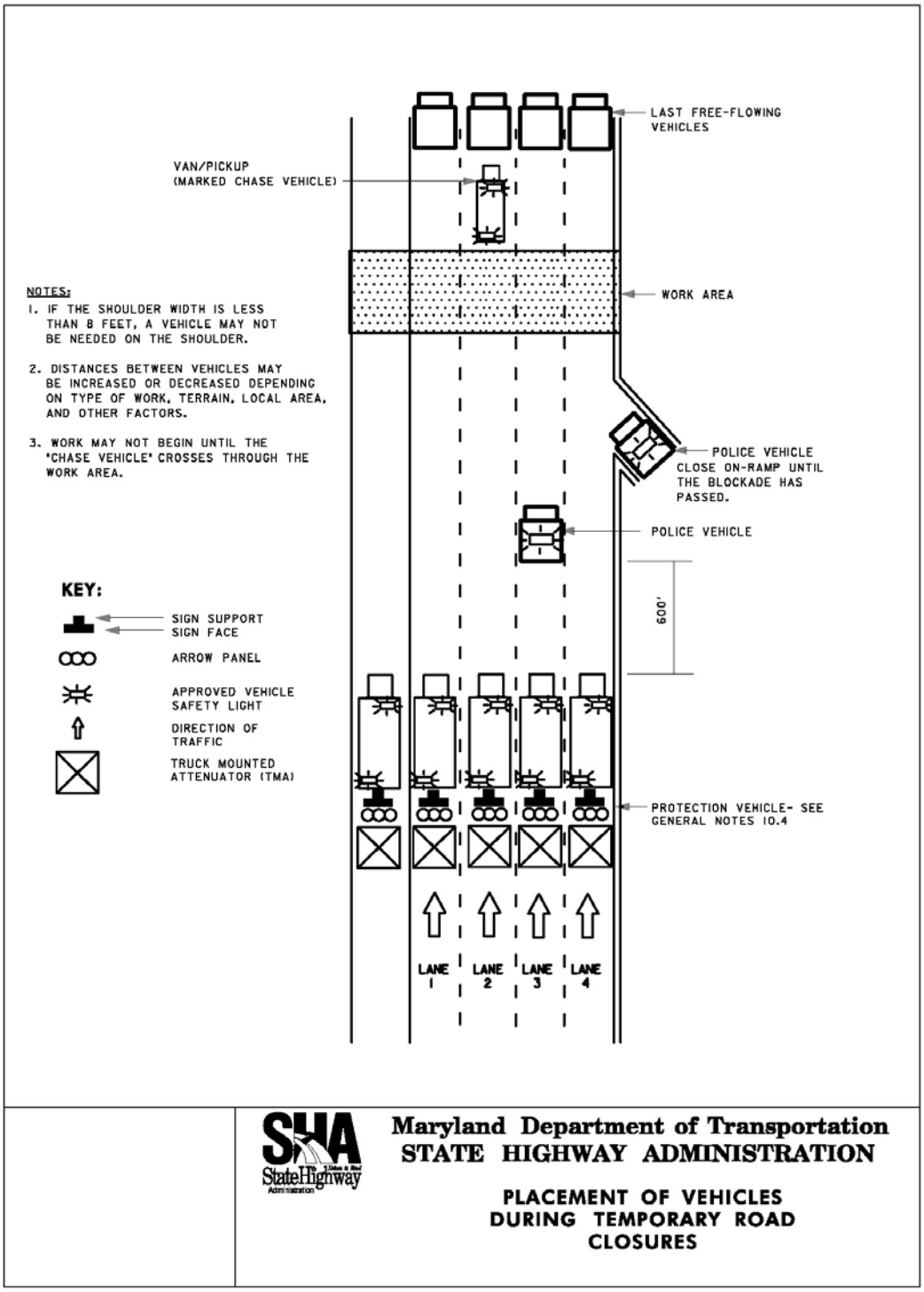
_____ _____
Title Phone Number

SHA 52.4 Revised 9/29/99

F. FIGURES FOR POLICE DEPLOYMENT




NOTES:
DISTANCES BETWEEN VEHICLES MAY BE INCREASED OR DECREASED DEPENDING ON TYPE OF WORK TERRAIN, LOCAL AREA AND OTHER FACTORS.
KEY:
SIGN SUPPORT
SIGN FACE
ARROW PANEL
APPROVED VEHICLE SAFETY LIGHT
DIRECTION OF TRAFFIC
TRUCK MOUNTED ATTENUATOR (TMA)
WORK VEHICLE
600'
VAN/PICKUP
600'
POLICE VEHICLE
600'
PROTECTION VEHICLE- SEE GENERAL NOTES 10.4
LANE 1
LANE 2
LANE 3
LANE 4
Maryland Department of Transportation
STATE HIGHWAY ADMINISTRATION
PLACEMENT OF POLICE VEHICLES
DURING MOBILE OPERATIONS


LAST FREE-FLOWING VEHICLES
VAN/PICKUP (MARKED CHASE VEHICLE)
WORK AREA
NOTES:
1. IF THE SHOULDER WIDTH IS LESS THAN 8 FEET, A VEHICLE MAY NOT BE NEEDED ON THE SHOULDER.
2. DISTANCES BETWEEN VEHICLES MAY BE INCREASED OR DECREASED DEPENDING ON TYPE OF WORK, TERRAIN, LOCAL AREA, AND OTHER FACTORS.
3. WORK MAY NOT BEGIN UNTIL THE "CHASE VEHICLE" CROSSES THROUGH THE WORK AREA.
POLICE VEHICLE CLOSE ON-RAMP UNTIL THE BLOCKADE HAS PASSED.
POLICE VEHICLE
600'
KEY:
SIGN SUPPORT
SIGN FACE
ARROW PANEL
APPROVED VEHICLE SAFETY LIGHT
DIRECTION OF TRAFFIC
TRUCK MOUNTED ATTENUATOR (TMA)
PROTECTION VEHICLE- SEE GENERAL NOTES 10.4
LANE 1
LANE 2
LANE 3
LANE 4
Maryland Department of Transportation
STATE HIGHWAY ADMINISTRATION
PLACEMENT OF VEHICLES DURING TEMPORARY ROAD CLOSURES

Disclaimer

The information provided in this section of the Maryland State Highway Administration's Work Zone Safety Tool Box is only to provide guidance. The Work Zone Safety Tool Box supplements current practices and standards provided in the current edition of the following documents:

1) The Manual on Uniform Traffic Control Devices (MUTCD)
2) The Maryland Supplement to the Manual on Uniform Traffic Control Devices
3) Maryland State Highway Administration Standard Sign Book
4) Maryland State Highway Administration Book of Standards for Highway and Incidental Structures
5) Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials

G. BIBLIOGRAPHY

1. LDOTD (2004). Louisiana State Police Procedural Order: Work Zone Safety. Louisiana Department of Transportation and Development, Baton Rouge, LA.
2. ODOT (2004). Unique Specifications: Unique 00220 - Controlled Delay. Oregon Department of Transportation, Salem, OR.
3. PennDOT (2003). New Memorandum of Understanding for State Police Supplemental Safety Effort. Pennsylvania Department of Transportation, Harrisburg, PA.
4. VDOT (2003). Guidelines for Use of Virginia State Police in Construction/Maintenance Work Zones. Virginia Department of Transportation, Charlottesville, VA.
5. US Department of Transportation FHWA (2003). Full Road Closures for Work Zone Operations: A Cross-Cutting Study. Federal Highway Administration, Work Zone Program, Washington, D.C.
6. De la Riva, M. (2003). Safety and Operational Effects of Highway Emergency Flares. Master of Science Thesis. The Pennsylvania State University, State College, PA.
7. Schrock, S.D., Ullman, G., and N. Trout (2002). Survey of State Law Enforcement Personnel on Work Zone Enforcement Practices. In Transportation Research Record 1818, TRB, National Research Council, Washington, D.C., pp. 7-11.
8. PennDOT (2002). Construction Work Zones Emphasis Areas for 2002. Internal memorandum 470-02-06. Pennsylvania Department of Transportation, Harrisburg, PA.
9. Adams, C (2002). Work Zones Traffic Control for Law Enforcement Personnel. Louisiana Department of Transportation and Development, Baton Rouge, LA.
10. US Department of Transportation FHWA (2001). A Study on the Use of Uniformed Officers on Federal-Aid Highway Construction Projects. FHWA Docket No. FHWA-1999-5387. Federal Highway Administration, Washington, D.C.
11. Maze, T.; Kamyab, A.; Schrock, S. (2000). Evaluation of Work Zone Speed Reduction Measures. CTRE Management Project 99-44. Center for Transportation Research and Education, Iowa State University. Ames, IA.

12. Federal Highway Administration (2000). Work Zone Operations Best Practices Guidebook. Publication No. FHWA-OP-00-010. Washington, D.C.

13. Sisiopiku, V.P. and Patel, H. (1999). Study of the Impact of Police Enforcement on Motorists Speeds. Transportation Research Record 1693, Washington, D.C., pp. 31-36.

14. MnDOT (1999). Effectiveness of Law Enforcement in Reducing Vehicle Speeds in Work Zones. Minnesota Department of Transportation, Office of Construction, Construction Programs Section. [www.atssa.com/mndot.htm]

15. PennDOT (1998). Memorandum of Agreement PennDOT/MSP. Pennsylvania Department of Transportation, Harrisburg, PA.

16. PennDOT (1997). Memorandum of Understanding PennDOT/PSP. Pennsylvania Department of Transportation, Harrisburg, PA.

17. Graham-Migletz Enterprises, Inc. (1996). Procedure for Determining Work Zone Speed Limits. NCHRP Research Results Digest, 192. Transportation Research Board, National Research Council.

18. McCoy, P.T., and J.A. Bonneson (1993). Work Zone Safety Device Evaluation. Report SD-92-10F. Center for Infrastructure Research, Lincoln, NE.

19. Benekohal, R.F., P.T.V. Resende, and R.L. Orloski (1992). Effects of Police Presence on Speed in a Highway Work Zone: Circulating Marked Police Car Experiment. Report No. FHWA-IL/UI-240. University of Illinois, Urbana, IL.

20. Benekohal, R.F., L.M. Kastel, and M. Suhale (1992). Evaluation and Summary of Studies in Speed Control Methods in Work Zones. Report No. FHWA-IL/UI-237. University of Illinois, Urbana, IL.

21. Ullman, G. L., Riesland, D. R. (1990). Catalog of Work Zone Speed Control Methods. Report No. FHWA/TX-90/1161-2, Texas Transportation Institute, Texas A&M University, College Station, TX.

22. McGee, H.W., Joost, D.B., and E.C. Noel (1988). Speed Control at Work Zones. ITE Journal, Vol. 58, pp. 17-19.

23. Noel, E., Dudek, C., Pendleton, O., McGee, H., and Sabra, Z. (1987). Speed Control Through Work Zones: Techniques Evaluation and Implementation Guidelines. Report No. FHWA-IP-87-4. Washington, D.C.: Federal Highway Administration.

24. Richards, S. H., Dudek, C. L. (1986). Implementation of Work Zone Speed Control Measures. In Transportation Research Record 1086, pp. 36-42, Transportation Research Board, Washington, D.C.

25. Dudek, C.L., Richards, S.H., and Wunderlich, R.C. (1986). Handling Traffic in Work Zones. Research Report 292-6F. Project No. 292. Texas Transportation Institute, College Station, TX.

26. Shinar, D.; Stiebel, J. (1986). The effectiveness of Stationary versus Moving Police Vehicles on Compliance with Speed Limit. Human Factors, Vol. 28, No. 3, June 1986, pp. 365-371.

27. Richards, S. H., Wunderlich, R. C., Dudek, C. L. (1985). Field Evaluation of Work Zone Speed Control Techniques. In Transportation Research Record 1035, pp. 66-78, Transportation Research Board, Washington, D.C.

28. Richards, S.H., R.C.Wunderlich, and C.L. Dudek (1984). Controlling Speeds in Highway Work Zones. Texas Transportation Institute, College Station, TX.

29. E. Hauer, & F .J. Ahlin, J. S. Bowser (1982). Speed Enforcement and Speed Choice. Accident Analysis and Prevention Vol.14, No. 4.

30. Dart, O.K. and Hunter, W.W. (1976). Evaluation of the Halo Effect in Speed Detection and Enforcement. In Transportation Research Record 609, Transportation Research Board, Washington, D.C., pp. 31-33.

31. LDOTD. Policy on the Use of Police Officers in Construction/Maintenance Work Zones. Louisiana Department of Transportation and Development, Baton Rouge, LA.

32. Schrock, S. and Ullman, G. (2003). Spacing of Law Enforcement Pullout Areas in Highway Work Zones. Paper prepared for the 82nd Annual Meeting of the Transportation Research Board. Washington, D.C.