# Roadway Traffic Control and Communications Manual


**MARCH 2015**

**THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY**

The Roadway Traffic Control and Communications Manual dated March 2015 replaces the previous version dated March 2014.

**Major Highlight Revisions**

- Section 1.0 Abbreviations & Acronyms
  - Added MWDS Acronym
- Article 5.2.2 Tapers
  - Revised the shifting taper
- Article 6.4.7 Barriers
  - Added transition from an anchored bolt system to a free-standing system
  - Referenced AASHTO RDG regarding flare rate for TCB
- Article 9.2.3 Replaced NID with MWDS
- Article 9.2.7 Replaced Queue / Count with Ramp Queue Detection System

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# SECTION 1.0 ABBREVIATIONS & ACRONYMS

| | |
|---|---|
| AASHTO | American Association of State Highway and Transportation Officials |
| AASHTO RDG | AASHTO Roadside Design Guide |
| ANSI | American National Standards Institute |
| AVL | Automatic Vehicle Locator |
| CCC | Construction Communications Coordinator |
| CFR | Code of Federal Regulations |
| CM | Construction Manager |
| CCM | Corridor Construction Manager |
| CCTV | Closed Circuit Television |
| DCM | Design Corridor Manager |
| DMS | Dynamic Message Sign |
| DSE | Design Section Engineer |
| DPM | Deputy Program Manager |
| FHWA | Federal Highway Administration |
| FMPCMS | Full Matrix Portable Changeable Message Sign |
| GPS | Global Positioning System |
| IDOT | Illinois Department of Transportation |
| IPO | I-PASS Only |
| ISP | Illinois State Police |
| IT | Information Technology |
| ITS | Intelligent Transportation System |
| MOT | Maintenance of Traffic |
| MASH | Manual for Assessing Safety Hardware |
| MOT MANUAL | Roadway Traffic Control and Communications Manual for the Illinois Tollway |
| MOVE ILLINOIS | Move Illinois: The Illinois Tollway Driving the Future |
| MUTCD | Manual on Uniform Traffic Control Devices for Streets and Highways |
| MVDS | Microwave Vehicle Detection System |
| NCHRP | National Cooperative Highway Research Program |
| NPDES | National Pollutant Discharge Elimination System |
| NTCIP | National Transportation Communication Infrastructure Protocol |
| ORT | Open Road Tolling |
| PCL | Project Communication Liaison |
| PCMS | Portable Changeable Message Sign |
| PM | Project Manager |
| PMO | Program Manager Office |
| RF | Radio Frequency |
| RQDS | Ramp Queue Detection System |
| RWIS | Roadway Weather Information System |
| SWZ | Smart Work Zone |
| TBG | Traffic Barrier Guidelines |
| TIMS | Traffic Information Management System, also TOC |
| TMA | Truck Mounted Attenuator |
| TOC | Traffic Operations Center, also TIMS |
| WIM | Weigh In Motion |

# SECTION 2.0 DEFINITIONS

**Activity Area**. The Activity Area is that portion of the roadway which contains the Buffer Space and Work Area from which traffic is excluded and the portion of the roadway used to carry traffic adjacent to the Work Area. It is located downstream from the Advance Warning Area and the Transition Area (if one exists). The typical devices located in this area are channelizing devices and appropriate signage..

**Advanced Warning Area**. The Advanced Warning Area of a Work Zone is the area located upstream of the Transition Area in the direction of traffic within which signs informing drivers of what to expect are placed. It starts at the beginning of the Work Zone and extends to the point where the first channelizing device is placed. Typically, the only traffic control devices located in this area are signs.

**Barrier Clearance Distance**. The Barrier Clearance Distance is the area behind the barrier, equal to or greater than the Lateral Deflection that must be free of storage items (material, equipment, etc.) that may hinder the barrier's crashworthiness.

**Barrier Warrant.** A Barrier Warrant consists of criterion that identifies an area of concern which should be shielded by a traffic barrier, if judged to be practical. The warrant shall be based on Tollway/AASHTO RDG guideline.

**Buffer Space**. The Buffer Space is a space within the Activity Area with a minimum length of 200 feet for shoulders and 500 feet for mainline pavement which is located immediately upstream (in advance) of the Work Area. It should be kept clear of workers and materials in order to provide additional recovery space for an errant vehicle that may penetrate the taper in the Transition Area.

**Clear Zone.** The Clear Zone is the distance beyond the edge of traveled way that should be clear of any non-traversable obstacles or fixed objects. A traversable and unobstructed roadside area.

**Closure**. A Closure involves the taking of some portion of the roadway (including lanes and/or improved shoulders) for the exclusive use of workers, equipment operations or material storage during a work operation. At an accident scene, a Closure may be created for the storage of disabled vehicles, emergency responders, or police vehicles.

**Counter-Flow Lane.** A Counter-Flow Lane is a lane operating in a direction opposite to the normal flow of traffic. Counter-Flow Lanes are separated from the opposite direction lanes by temporary concrete barrier or permanent barrier wall.

**Daily**. Daily is typically the range of time to perform work during the day or night; lasting less than 24 hours.

**Designer.** The person (or consultant team) responsible for performing a design task for a Tollway project. Although this is typically the Design Section Engineer (DSE), it can also include a person (or consultant team) hired by a Contractor to perform design as part of a Value Engineering Proposal or part of a Performance Based Design. This document will use the term "Designer" which covers anyone performing design and will only use the term "DSE" when discussing tasks specific to the DSE.

**Guideline.** A Guideline is an official recommendation indicating how something should be done or what sort of action should be taken in a particular circumstance.

**Fast Moving Mobile Operations**. Fast Moving Mobile Operations are those that move at speeds between five and thirty miles per hour.

**Impact Attenuator.** A protective device used to shield a rigid fixed object, such as a concrete barrier, a median barrier, or a bridge pier, by gradually decelerating the vehicle to a safe stop or by redirecting the vehicle away from the fixed object.

**Intelligent Transportation System.** Intelligent Transportation System applies advanced technologies of electronics, communications, computers, control and sensing and detecting in all kinds of transportation systems in order to improve safety, efficiency and service, and traffic situation through transmitting real-time information.

**Intermediate Term Stationary Work**. Intermediate-Term Stationary Work is work that occupies a location for more than 1 daylight period up to 3 days, or nighttime work lasting more than 1 hour.

**Intermittent Stop Mobile Operations**. Intermittent Stop Mobile Operations are those which are constantly being relocated along the highway.

**Lateral Deflection.** Lateral Deflection is the distance that the barrier travels laterally based on either NCHRP 350 or MASH Test Level 3 crash test.

**Long Term Stationary Work**. Long-Term Stationary Work is work that occupies a location for more than 3 days.

**Maintenance of Traffic.** Maintenance of Traffic is a plan developed to provide for safe and efficient motorists travel during staged construction.

**Major/Long-Term Project**. A Major/Long-Term Project is a project which has a duration greater than 1 month and length greater than 5 miles.

**Minor/ Medium-Term Project**. A Minor/Medium Project is a project which has a duration greater than 1 month and length less than 5 miles.

**Managed Work Area.** A process to systematically assess the work zone impacts of projects, implementing strategies related in establishing the safest and most efficient speed limit for work zone based on roadway conditions.

**Manual on Uniform Traffic Control Devices** (**MUTCD).** FHWA National Manual on Uniform Traffic Control Devices For Streets and Highways and as amended by the State of Illinois Department of Transportation supplement to the MUCTD. Publication which defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public traffic. The MUTCD is published by the Federal Highway Administration (FHWA) under 23 Code of Federal Regulations (CFR), Part 655, Subpart F.

**Policy.** A Policy is a defined course of action established by a set of principles which shall be followed.

**Roadway**. A Roadway consists of all lanes, auxiliary lanes and shoulders in one direction of travel.

**Short Duration.** Short Duration is typically the range of time required to perform short-duration work which is less than one hour.

**Short-Term Project**. Short-Term Project is a project which has a duration less than 1 month.

**Short Term Stationary Work**. Short-Term Stationary Work is daytime work that occupies a location for more than 1 hour within a single daylight period.

**Shy Distance.** Shy Distance is the measured distance between the edge of traveled way lane marking to edge of the traffic control device.

**Slow Moving Mobile Operations.** Slow Moving Mobile Operations are those that proceed down the roadway at less than five miles per hour.

**Stage.** A Stage is a component of work that has been defined by the Design Section Engineer which allows construction for a section of the project while maintaining the same traffic flow.

**Stakeholders.** Stakeholders are customers directly affected by the project which include Contractor, CM, CCM, DSE, Tollway Divisions, Local Municipalities and Local Emergency Responders.

**Strip-Map.** A Strip-Map is a seamless plan view of proposed stage change depicting, but not limited to, construction zone with location of all MOT devices such as: temporary concrete barrier, striping, channelizers, impact attenuators, changeable message signs, ground mounted and overhead signs with text.

**Termination Area.** The Termination Area is that last portion of the work zone located immediately downstream of the Work Area. It provides an opportunity for traffic to clear the closure and to return to normal traffic lanes. A downstream taper may be located in this area.

**Traffic Control Devices.** Traffic Control Devices are all signs, lights, signals, markings, channelizing devices and barriers placed on or adjacent to the roadway used to regulate, warn or guide motorists.

**Transition Area.** A Transition Area is employed as part of a Work Zone when some form of closure is involved. It is the area in which traffic is moved from one path to another and in which merging, or weaving, must be accomplished. For lane closing situations, the area is defined as that in which the channelizing taper is contained. The typical devices located in this area are channelizing devices, signs and arrow boards.

**Work Area.** The Work Area is a section within the Work Zone-Activity Area that is set apart for exclusive use by workers and equipment where maintenance, construction or utility operation activities are taking place from which vehicular traffic is prohibited.
The terms “work space” and “work site” shall not be used.

**Work Zone.** The Work Zone is the entire area of roadway that encompasses all traffic control devices and signing that are placed in conjunction with a work activity. It typically starts with the first warning sign such as ROAD WORK AHEAD or ROAD CONSTRUCTION AHEAD and ends with the last sign such as END WORK ZONE SPEED LIMIT.

**Work Zone Clear Zone.** The Clear Zone as defined in Chapter 3 of the AASHTO RDG based on the Work Zone Speed Limit.

**Worker.** A Worker is any person engaged in or used for a task of some kind which is present within the work zone.

# SECTION 3.0 INTRODUCTION

## 3.1 Purpose and Scope

The ROADWAY TRAFFIC CONTROL AND COMMUNICATIONS MANUAL for the ILLINOIS TOLLWAY (hereinafter referred to as 'MOT MANUAL') is designed to provide policies, procedures and guidelines to be used in identifying work zone issues along with developing comprehensive work zone strategies and plans for the establishment of work zone traffic control on the Illinois Tollway which address the project's overall safety, mobility and constructability issues.

This MOT MANUAL provides a written account of how certain activities are performed and is designed to guide and assist various personnel in performing their functions. When appropriate, there may be deviations from these written procedures due to the specific projects conditions.

This manual is to be followed by the Designer, CM, Tollway personnel and contract forces for all construction, maintenance and utility operations performed on the Illinois Tollway. Everyone involved in a project's development and delivery including field operations must be committed to providing safety and mobility for all activities. Addressing these safety and mobility issues requires considerations that start early in the project development and continue through the project completion.

Tollway projects are planned, designed, and constructed through a phased project management process as described in Section 4 of the Tollway's Design Section Engineer's Manual. All work zones, individual work areas and operational requirements for construction need to be identified and addressed during the project's development, design phases and environmental review. Work zone activities, along with their impacts, mitigation, and costs should be evaluated at the same time as, and in conjunction with, other design factors. A systematic approach in evaluation of work zone issues is essential in the ability to identify and address the potential resultant work zone consequences.

The Maintenance of Traffic (MOT) plan must consider existing, temporary and proposed elements that are typically within the roadside, project costs, productivity, along with promoting motorist and worker safety. Elements within or in close proximity to the work area clear zone should be further evaluated utilizing the procedures and principals outlined in the Tollway Traffic Barrier Guidelines.

This manual contains measures of FHWA Subpart K to 23 Code of Federal Regulations (CFR), Part 630, to decrease the likelihood of highway work zone fatalities and injuries to workers and road users. These measures establish requirements and provide guidance for the use of positive protection devices between the work area and motorized traffic, installation and maintenance of temporary traffic control devices, and use of uniformed law enforcement officers during construction, utility, and maintenance operations.

The fundamental purpose of assessing and managing the work zone impacts of road construction, utility and maintenance projects lies in:

- Safety – Maximizing the safety of road users and highway workers.
- Mobility – Maximizing mobility and accessibility on roadways.
- Constructability – Planning, designing, and building projects as effectively and efficiently as possible. Constructability is the ease with which a design can be implemented on the construction site. Constructability reviews are to be performed as described in Section 7, Quality Assurance of the Tollway's Design Section Engineer's Manual.

The traffic control procedures defined in the MOT Plates contained in this MOT MANUAL as well as the Tollway Standards were developed to meet the dual objectives of providing a high level of safety for Tollway users and protection for workers.

## 3.2 Tollway Traffic Operations and Safety Committee

The Tollway's Traffic Operations and Safety Committee is utilized to review and approve policy, processes, procedures, and/or guidance for the systematic consideration and management of work zone impacts and related issues, traffic engineering standards and guidelines related to temporary traffic controls, which include the consideration and management of road user and worker safety. The diverse makeup of the members of this committee provides a varied perspective in considering proposals to be implemented:

- Executive
- Communications
- Risk Management
- Safety & Training
- Toll Services
- Legal
- Engineering
- Business Systems
- Illinois State Police
- General Engineering Consultant
- Traffic Engineering Consultant
- Program Management Office

These policies, processes, procedures, and/or guidance are based on consideration of standards and/or guidance contained in the Manual on Uniform Traffic Control Devices (MUTCD) and the AASHTO Roadside Design Guide (AASHTO RDG). The strategies and devices to be used may be determined by either an engineering study, or from Tollway guidelines that define strategies and approaches to be used based on project and highway characteristics and factors.

## 3.3 Relationship to other Manuals/Guidelines

The MOT MANUAL is designed to follow the principles and practices set forth in the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS (MUTCD). The procedures established in the MOT MANUAL are tailored to the specific characteristics of the Tollway and the typical work operations that are performed thereon.

In those instances where traffic control situations or device specifications are not covered in the MOT MANUAL, the provisions of the MUTCD shall apply. For example, the MOT MANUAL addresses only work areas on the Tollway itself. Where work zones must be established on other highways, such as would be required to make repairs to the underside of a Tollway bridge over a state highway, the MUTCD defines the procedures to be followed.

When projects involve other agencies, their jurisdiction, policies and procedures must be followed. The MOT plan shall be reviewed and accepted by the involved agencies. When the jurisdictional authority does not have established policies, IDOT procedures and guidelines shall be followed.

The Illinois Tollway system connects with Interstate Highways serving three adjacent states. To provide consistent traffic control procedures readily recognizable to both in-state and out-of-state motorists, the MUTCD was used as a resource in the preparation of this document.

This MOT MANUAL supersedes the previous "Traffic Control Manual" published by the Illinois Tollway in 1979 and “Roadway Traffic Control And Communications Guidelines” in 2010.

Reference the Tollway Homepage: Doing Business: Construction and Engineering: Manuals;

## 3.4 Concepts

When project specific MOT plans are not included in the project, MOT Plates included in this MOT MANUAL were created to cover the range of activities commonly performed by Tollway maintenance and contract forces. In addition, Plates are included which address emergency lane closures.

The intent of the Plates contained herein is to provide a practical balance between the motorist's need for information and the logistical requirements for establishing the work zone while providing both a high level of safety for Tollway users and protection for workers. This MOT MANUAL recognizes the need for flexibility by Tollway maintenance crews and contract forces. Tollway maintenance crews should balance the need for MOT with the need to complete maintenance work. As a result, deviations from this MOT MANUAL may be allowed only with Tollway Chief Engineer or his/her designee approval.

Most construction projects are of such duration and magnitude that specific MOT plans will be developed for each project. The principles set forth herein serve as a starting point for this design process. Recognizing the increased exposure to work zone elements for long-term activities, warrants may exist for more complex types of traffic control.

The MOT Plates for emergency situations take into account the lack of advance notice in establishing the work zones and the short duration typically encountered. To provide a practical plan, the number of devices is minimized, but the target value of those devices that are called for is enhanced through the use of flares, or other devices.

As a fee based transportation system, it is important that extra effort be given to maintaining as free a traffic flow as safety guidelines will allow. It is important also that work zone signing be succinct and concise, and be clear and consistent across the system.

## 3.5 Application

The traffic control procedures set forth in this MOT MANUAL are intended to address typical situations anticipated on the Tollway. In application, adjustments may be required to fit actual field conditions. If due to space limitations or visibility constraints or other factors it is necessary to use device sizes or spacings that fall below the recommended minimums, then other features should be added to the work zone so that the overall level of safety is maintained.

In those instances where deviations are needed to accommodate field conditions or where operations are to be performed that are not adequately covered by the MOT MANUAL, the traffic control procedure should be discussed with the proper Tollway personnel prior to undertaking the work.

## 3.6 Project Communications

### 3.6.1 Information to Report

Information on start of construction, traffic shifts, stage changes, variances, or any other activity that will impact traffic on the Tollway and/or local roads, as well as nearby communities, must be reported in advance by the Project Communication Liaison (PCL) to the Construction Communications Coordinator (CCC) and the Traffic/Permit Technician at laneclosures@getipass.com. Information about lane closures shall be reported using the guidelines set forth in Article 11.1.4. In addition to lane closure information, any other activity or issues that may impact Tollway customers should be communicated to the CCC as soon as possible.

Reference Appendix A for further information regarding Construction Communications Roles and Responsibilities.

Reference Appendix B for Traffic MOT Forms.

### 3.6.2 Emergency Communication Plan

An approved Emergency Communications Plan shall be established for implementation and to ensure accurate and timely communications of all incidents, MOT related and non-MOT related issues that occur.

Referenced Document: Illinois Tollway Construction Managers Manual, Section 5.7; Communication

## 3.6.3 Maintenance of Traffic Advance Coordination Meeting (Mandatory)

### 3.6.3.1 Responsibility and Authority

This procedure applies to all personnel preparing, submitting and reviewing Maintenance of Traffic (MOT) stage changes for the Illinois Tollway Projects.

The Chief Engineer is responsible for approving this procedure. The Deputy Chief Program Implementation, has the primary responsibility and authority for implementing and maintaining this Procedure.

### 3.6.3.2 21 Day Advance Coordination Meeting

The Project Manager (PM) schedules a 21 Day Advance Coordination Meeting to be held at the Tollway and invites all project stakeholders. List of attendees shall include, but is not limited to, the following:

- PM
- Contractor
- CM
- CCM (if applicable)
- ISP District #15
- Tollway Maintenance
- Tollway Communications
- DSE (if applicable)
- Business Systems (if applicable)
- Toll Services (if applicable)
- Plaza Supervisor (If applicable)
- Local Municipalities (if applicable)
- Local Fire & Rescue (if applicable)

The PM obtains from the Construction Manager (CM) a strip-map depicting the current stage of traffic, current signing and striping configurations, where traffic will be in the proposed stage change and the proposed changes to signing and striping.

The strip-map will be presented to the project stakeholders. Comments and changes made by the project stakeholders shall be recorded on the strip-map and incorporated into both a revised strip-map and updated MOT plan drawings for final review at the 2 Day Advance Coordination Meeting.

The Contractor is to make and implement any changes directed by the Tollway at this meeting in order to meet the scheduled stage change date.

Signs which are to be supplied by the Tollway will be coordinated by the PM with both the CM and Tollway Maintenance so that preparations can be made to meet the scheduled stage change date.

**3.6.3.3 2 Day Advance Coordination Meeting**

The PM obtains a revised strip-map from the CM incorporating all of the comments and changes made at the 21 Day Advance Coordination Meeting for final review.

The Contractor, CM and Tollway Maintenance and Engineering verify that all preparations and changes have been made which meet the intent of the final strip-map plan.

If there is agreement on the revisions, at the conclusion of this meeting the MOT Stage Change Approval Form, which can be obtained from the Web-based Program Management System, is to be signed and the CM develops both the final strip-map and updated MOT plan drawings incorporating all of the approved comments from the project stakeholders.

If not in agreement, the PM shall coordinate the resolution of all outstanding issues and reschedule a follow-up meeting with the appropriate stakeholders so that final approval can be issued.

Post Stage Change Evaluation
After the stage change has been implemented, the CM shall inspect and fill out the Traffic Control Inspection Report (Form A-1C) daily; per the guidelines established in the CM Manual Article 5.8.4. The CM makes a statement in the Comments field that all of the MOT devices have been implemented and placed per the approved plan.

The CM uses both the updated MOT plan drawings and the Work Zone Safety Inspection Checklist in Appendix D to verify, in the field, that the approved MOT plan has been successfully executed.

If there are deficiencies noted, a corrective action plan with a timeline for completion is to be submitted by the CM to the PM within 24 hours. The CM is to notify the PM when all corrective actions have been implemented.

The PM will verify that the 21 Day Advance Coordination meeting minutes and 2 Day Advanced Coordination Meeting minutes have been posted by the CM in the Web-based Program Management System.

## 3.6.4 Closure Requests

### 3.6.4.1 10 Day Notice

The PM is to notify the Tollway Communications Department ten (10) days prior to major disruption of traffic, especially for medium or long term duration, start of new construction, major traffic shift, stage change, closing ramps or whenever construction activity will have a new and significant impact to traffic movements and flow, so that public notification can be disseminated.
Reference: Tollway - Lane Closure Reference Guide

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### 3.6.4.2 24-48 Hour Notice

(a) When is this required?

- Daily maintenance closures, other limited duration disruptions with minimal impact on traffic

  - Traffic shifts require minimum 48 hour advance notice to CCC and the Tollway Traffic Center (should send or notify as soon as the need is known), along with a "Standard Lane/Shoulder Closure Request" form according to the following notifications deadlines:

    Wednesday work is due Monday **BEFORE 9:00 AM**

    Thursday work is due Tuesday **BEFORE 9:00 AM**

    Friday work is due Wednesday **BEFORE 9:00 AM**

    Saturday work is due Thursday **BEFORE 9:00 AM**

    Sunday, Monday & Tuesday work is due Friday **BEFORE 9:00 AM**

  - Overnight full closures require 48 hours advance notice.

  - Other lane closure requests require notice before 9 A.M. on the working day preceding the requested closure per Tollway Traffic Center according to the Tollway – Lane Closure Reference Guide.

(b) Deadline for Contractor submittals.

The deadlines for the submittal of forms to the Tollway are those as described above. However, additional time should be factored to allow for the processing of procedure coordination from the Contractor to the CM and CCM (if applicable) to the PCL. It is recommended the Contractor submit requests a minimum of 2 hours prior to noted deadlines.

## 3.6.5 Cancellations and Changes

### 3.6.5.1 Cancellation of Lane Closure Request

Cancellations of planned lane closures shall be in accordance with procedures of the Tollway-Lane Closure Reference Guide.

#### 3.6.5.2 Lane Closure Change Procedures

Revisions to lane closure requests shall be in accordance with procedures of the Tollway-Lane Closure Reference Guide.

### 3.6.6 Reporting Lane Closure Status Procedure

The Construction Manager (CM) shall contact the Tollway Traffic Center in accordance with the procedures of the Tollway –Lane Closure Reference Guide.

### 3.6.7 Minimizing Traffic Impacts- Avoiding Conflicts

The Engineering Department shall analyze all projects activities for traffic impacts, the most typical of which are provided below.

- Program Management Projects
- Maintenance Projects
- Design/Maintenance Activities
- Utility installation/relocation
- Right of Way Disturbance Permits

Traffic impact analysis include:

- Project/Activity Type and the associated traffic impacts, including safety issues.
- Project/Activity Duration
- Area Tollway/Non-Tollway projects/activities
- Need and justification for lane closures or other activities impacting traffic
- Seasonal/Hourly traffic volumes
- Potential travel time delays
- Reliability/historical performance of Contractor
- Weather

(a) Project/activities shall be coordinated using a master plan MOT process. Advance project/activity planning and coordination must proceed on a strategic level and must be considered as far in advance as possible. The Management of Traffic planning/permitting levels for projects/activities are as follows:

- Strategic – this involves future year advance planning. Major project conflicts and coordination opportunities are generally identified. Project design and construction details are generally not known. However, projects can be planned and designed to avoid or minimize major disruptions, and project/activity/utility project collaboration can be enabled to maximize cost effectiveness by all involved entities.

- Concept – this involves the project implementation/construction phase. In this case, the project/activity has been designed and the general detail of lane closures/traffic impact activities is known. The actual dates of lane closures are generally known with good accuracy. This means that the Contractor will have a schedule of closures by month at the start of the project/activity.

- Detail – Contractors and workers are required to provide a detailed closure/messaging plan ten (10) days in advance of the lane closure to allow for review and approval, sign fabrication, advance notice and messaging for the general public. The closure/traffic impact plan is specific and accurate to within the hour. Twenty-four (24) hour advance notice is required after the ten (10) day plan/notice is approved. Advance signage and communication should have taken place prior to considering the twenty-four (24) hour notice for the lane closure/activity.

(b) Lane closures are a last resort. The Maintenance & Traffic Division shall make a judgment based on a traffic impact analysis process.

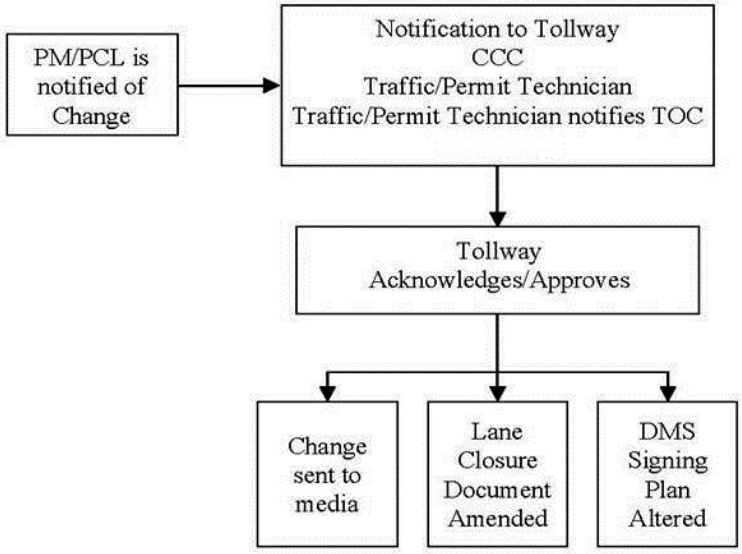
- Nighttime closures shall be required in all cases unless specifically authorized otherwise. Exceptions will be considered on a case by case basis. The overriding factor will be minimizing traffic delay as determined by the Tollway Lane Closure Reference Guide or the Maintenance & Traffic Division.

- Alternate means/methods should be considered in order to avoid or minimize the proposed lane closure.

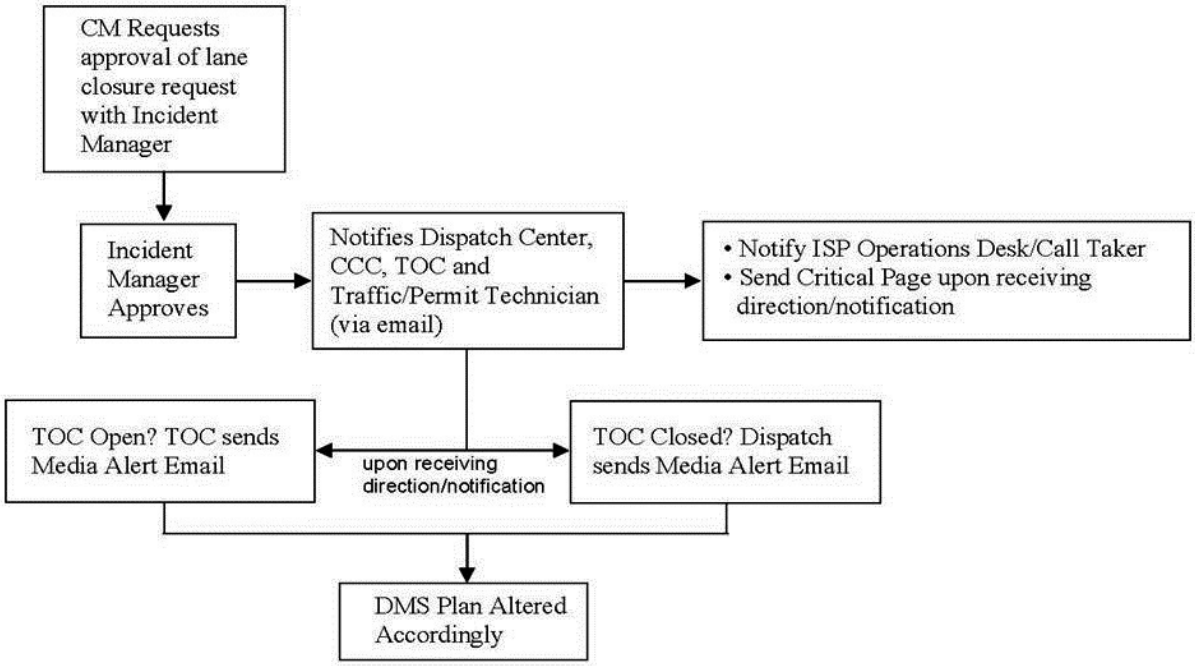
- If a lane closure is authorized, Contractors shall be prepared to mobilize and initiate work immediately when the lane closure is implemented. Work should be planned such that it can be completed ahead of schedule to allow for an early removal of the lane closure/traffic impact.

- The Lane closure/traffic impact schedule should be as compressed as possible with an allowance for an additional time contingency if needed. Weather conditions, accidents, and traffic can sometimes delay the planned completion of a work activity and removal of the lane closure. If the confidence level is not sufficiently high to complete the work within the compressed schedule, then additional time shall be included in the signage/communications/messaging to account for this possibility. The motoring public will tolerate delays if they are warned days in advance. Schedules and travel routes and times can be planned for accordingly. Unplanned delays cause significant losses to commerce and personal time.

**REGULAR BUSINESS HOURS Monday-Friday, 7 AM to 3 PM**




**AFTER HOURS + Weekends, Holidays, or 3 PM to 7 AM Monday/Friday**




*Lane Closure Hours Diagram*

# SECTION 4.0 PROJECT INFORMATIONAL SIGNAGE

## 4.1 Objectives

To provide signing improving customer awareness (service/experience) through increased communications about roadway conditions, with particular focus on informing motorists about construction projects while motorists are on the roadway and experiencing the inconveniences associated with a project.

Providing accurate information to motorists encourages improved driver attention to conditions.

Typical location of information signs is shown on the Tollway MOT Standards.

Care must be taken to place project informational signage at locations that do not conflict with construction signage, particularly lane closure or lane shift signage. Changes in construction signage during a project must be coordinated with the Maintenance & Traffic Division to analyze project/activity and special event conflicts for potential conflicts, including conflicting messaging or closure impacts.

## 4.2 Sign Content

The ground mounted static signs or series of signs should contain the following information:

(a) Project benefits

- i.e. I-PASS improvement, drainage, re-surfacing
- Reduce delay
- Improve Ride

(b) Duration

- Duration of project: Approximate schedule by month or season if end date is uncertain so as not to over promise

(c) Length

- Length of project, i.e. Next 5 Miles

(d) Effort to minimize disruption

- i.e. Work being done overnight for your convenience, etc.

(e) How to get more info and/or provide feedback

- Comments? Call 1-800-TOLL-FYI

(f) Safety

- Please drive safely
- Please use caution
- Watch for workers
- Other messages related to specific project

(g) Thank you

- All messages will state “Thanks for your Patience”

## 4.3 Number (in each direction) and type of signs

The number of signs that will be deployed and the type of signs will be dependent on the type of project, length and expected duration as discussed below.

### 4.3.1 Major/Long-term Project

Duration greater than 1 month and length greater than 5 miles

(a) Dynamic Message Signs within influence area

(b) Static shoulder-mounted

- Three (3) at the beginning (Less than three (3) must be approved )
  - Project Benefit/Length
  - Duration
  - Working Smart/Thanks
- One (1) in the Middle
  - Summary – Project benefit, Duration, Safety and Effort to minimize disruption
- One (1) at the end
  - Thanks and Comments

(c) Signs should be updated with relevant changes and/or to show progress.

(d) Portable Changeable Message Signs (Supplementary)

- Used to guide motorists through work zone
- Provide information that will change frequently

### 4.3.2 Minor/ Medium-term Project

Duration greater than 1 month and length less than 5 miles.

(a) Dynamic Message Signs if in area and available

(b) Static, shoulder mounted

- Two (2) at beginning (if there is room)
    - Project Benefit/Length
    - Duration/Safety
- One (1) at end
    - Thanks and Comments

(c) Signs should be updated with relevant changes and/or to show progress.

(d) Portable Changeable Message Signs (Supplementary)

- Used to guide motorists through work zone
- Provide info that will change frequently

### 4.3.3 Short-term Project

Duration less than 1 month.

(a) Dynamic Message Signs if in area and available

(b) Shoulder mounted Static Signs

- One (1) at beginning
- Project Benefit/Duration, safety

(c) Signs should be updated with relevant changes and/or to show progress.

(d) Portable Changeable Message Signs (Supplementary)

- Used to guide motorists through work zone
- Provide info that will change frequently

### 4.3.4 Daily Construction or Lane Closures

Day or night; less than 24 hours.

(a) Dynamic Message Signs if in area and available

(b) Portable Changeable Message Signs

- Guide motorists through work zone
- Provide Special information

### 4.3.5 Project Informational Signs

(a) The size, type and message of the sign shall be determined by the Communications Department.

## 4.4 Timing of sign (or series of signs) installations

The Project Information Signs should be erected prior to the beginning of construction activity, but no earlier than two (2) weeks before the start of construction. Portable Changeable Message Signs shall be placed prior to the beginning of construction activity, but no earlier than one (1) week before the start of construction. Dynamic Message Signing, if available, should be utilized to alert customers of project status.

## 4.5 Responsibilities

(a) The Engineering Department Maintenance & Traffic Division is responsible for overall management and maintenance of the Tollway system. All activities must be REVIEWED and APPROVED by the Maintenance & Traffic Division. This requirement applies to internal Tollway Departments and external entities.

(b) The Engineering Department shall regularly plan and coordinate with the Communications Department to ensure that the motoring public is adequately informed of planned or on-going traffic impact activities. Regular updates should be provided on all active projects/activities, including projects to be advertised for bid/contracts awarded by the Board. Coordination activities include:

- Upcoming potential lane closures as soon as they are being considered.
- Scheduled lane closure activities that impact traffic.

(c) The Engineering Department is responsible for establishing the traffic maintenance plan, signage, and messaging. Working drawings of signage/messaging shall be drafted by the Engineering Department or their representatives. A collaborative review and approval process with the Communications Department shall be used to finalize wording and messaging. Dynamic messaging shall be provided with PCMS and stationary DMS. These signs are managed and maintained by the Engineering Department.

(d) The Communications Department is responsible for communications with the general public and most specifically the Illinois Tollway patrons. It is imperative that accurate, up to date, and consistent information is provided to the Communications Department and most importantly the general public. All project signage/messaging text must be approved by the Communications Department.

(e) The CM, CCM and Maintenance & Traffic Division shall keep the Communications Department continuously updated on projects and traffic impact activities.

(f) The CM and the CCM shall communicate and coordinate all planned and on-going projects with the Maintenance & Traffic Division to minimize traffic impacts and ensure proper communication with the Communications Department and the general public.

# SECTION 5.0 PRINCIPLES OF TRAFFIC CONTROL

## 5.1 Objectives

The principles of traffic control to be employed on the Tollway are for the safe and efficient movement of traffic through both maintenance and construction work zones and for the safety of the work force performing these operations.

Motorists have come to expect a high level of service on the Tollway. The objective is to maintain the highest level of service while taking into account the safety of motorists and workers alike while providing for the protection of materials, equipment and Tollway facilities.

Exposure control measures should be considered to avoid or minimize worker exposure to motorized traffic and exposure of road users to work activities, while also providing adequate consideration to the potential impacts on mobility.

Proper traffic control and delineation is critical to achieving safety in work zones. Maintenance of traffic strategies, devices, and contracting/construction techniques and coordination are used to facilitate traffic flow safely through and around work zones. However, the work zone traffic control devices themselves may pose a safety hazard to vehicle occupants or work crews when impacted by errant vehicles. Thus, the FHWA and the MUTCD require that the crashworthiness of work zone traffic control devices be demonstrated before they are implemented.

Temporary signs, changeable message signs, arrow boards, channelizing devices and lighting devices are all utilized as temporary traffic control devices. Their placement and positioning must be such as to not present a hazard to traffic and/or impact any existing traffic barrier device.

Temporary installation does not negate the consideration of clear zone, length of need, safety, etc. during the work zone construction duration.

## 5.2 Definition of Terms

### 5.2.1 Elements of a Work Zone

To make full and effective use of this MOT MANUAL, one must clearly understand the terms that are used. Many technical words have various meanings in common usage. In this section the definitions given for key terms apply to their specific use in this document. Reference Section 2 of this MOT MANUAL for definitions of terms for Elements of a Work Zone.

It is convenient to subdivide the work zone into a series of "areas," each of which can be addressed separately during the traffic control design process. Exhibit 1 shows a typical work zone and illustrates the various elements which compose it:

- Advanced Warning Area
- Transition Area
- Activity Area
- Buffer Space
- Work Area
- Termination Area

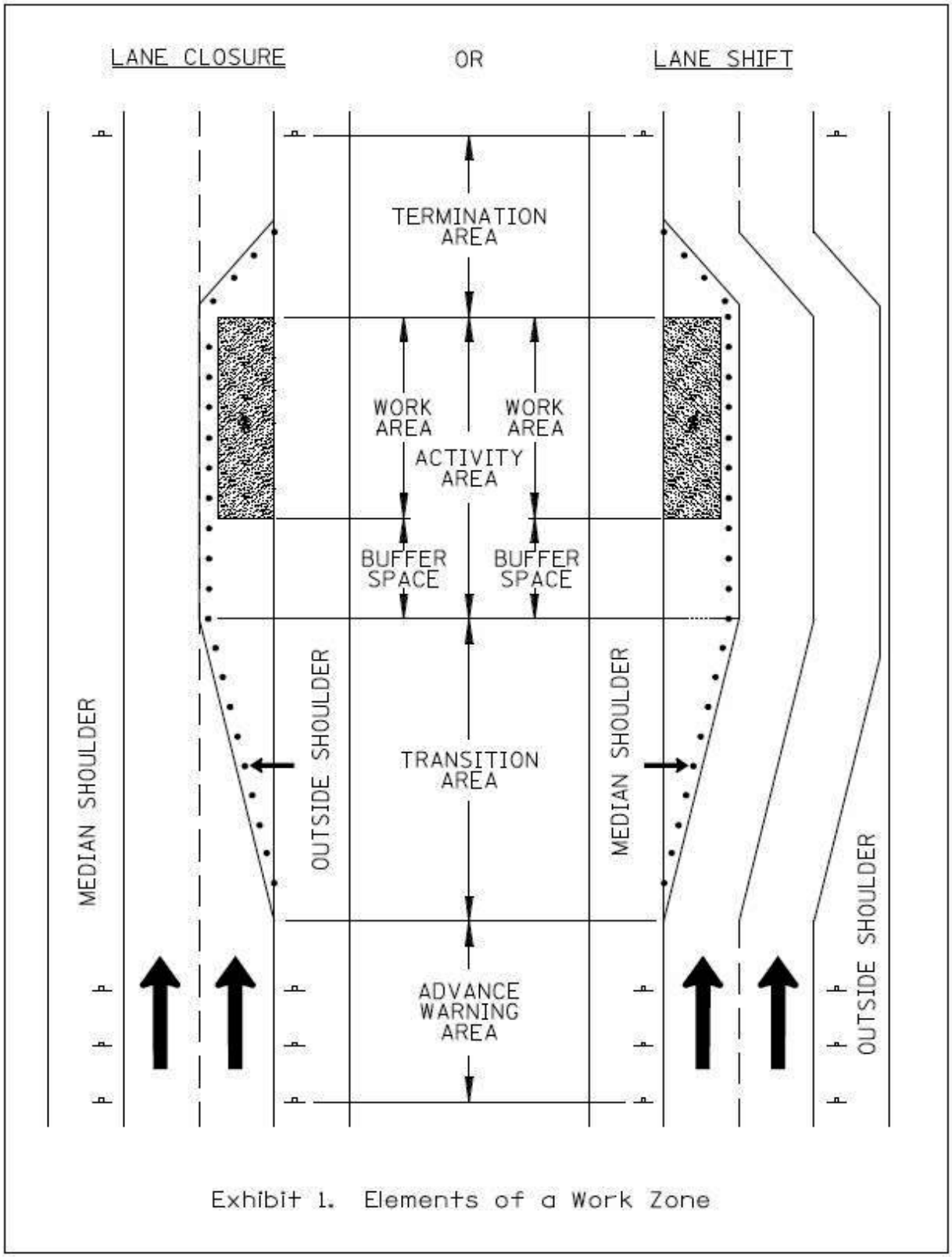



Exhibit 1. Elements of a Work Zone

R:\CTE-TOLLWAY\Working_Files\PROJECTS\boilerplate\V8\controlzone.dgn

### 5.2.2 Tapers

Tapers are used to move traffic laterally from one path to another. Tapers are typically formed by using an array of channelizing devices. The following are different types of tapers which may be used in work zones.

(a) Merging Taper - A merging taper is used on multilane roadways when the number of traffic lanes are reduced. Merging tapers require longer distances to enable traffic to adjust their speed and to find a gap to merge into a single lane before the end of the transition.

(b) Shifting Taper - A shifting taper is used for a lateral shift and not merging. The shift can be accomplished using relatively flat tapers of 65:1 for approaches and departures.

(c) Shoulder Taper - When a shoulder is closed on a high-speed facility, it should be treated as a closure of a portion of the roadway, and the work area on the shoulder should be preceded by a shoulder taper. Shoulder tapers may be needed when the shoulder is unavailable for use.

(d) Downstream Taper - A downstream taper is an optional feature which may be placed in the termination area immediately downstream of the work area. It is used to direct traffic back into a lane which has been closed in the work area. Because such tapers do not force traffic to shift laterally, they may be relatively short, a minimum of 100 feet.

Downstream tapers are particularly useful where there are ramps located in close proximity just beyond the work area. They may be undesirable where trucks need to back into the work area or need to accelerate up to merging speeds upon leaving the work area.

(e) Two-Way Traffic Taper - The two-way traffic taper is a special taper which is used in advance of a work area that occupies part of a two-way roadway. The remainder of the road is used alternately by traffic in either direction. Such tapers are not used on the Tollway mainline roadway, but may be used on service drives and access roads or on highways which the Tollway crosses over/under.

The function of this taper is not to force traffic to merge, but rather to resolve the potential head-on conflict. A short taper is used to cause traffic to slow down by presenting the appearance of a restricted alignment. Flaggers are used to assign right-of-way in such situations. When implementing such tapers on cross-roads, the appropriate Illinois Department of Transportation (IDOT) or jurisdictional agency standards should be used.

(f) Reverse Curve- A single or multilane traffic flow operation in which traffic is shifted laterally right to left or left to right through two successive curves. Commonly used to redirect through lanes at median crossovers, this measure shall only be used within a work area.
Reference Document (Current Edition): Tollway Standard Drawing E4

## 5.3 Considerations

To meet the stated objectives, the sometimes competing needs of motorists and workers must be balanced and consideration must be given to constraints due to time, costs, field conditions, etc. Effective traffic control design is an optimization process.

There are considerations that when applied mitigate the effects of compromise and constraint which enhance the attainment of the traffic control objectives. Among the principles to be employed are uniformity, adaptation, compensation and redundancy.

### 5.3.1 Work Zone Safety and Mobility

#### 5.3.1.1 Work Zone Safety

Equally as important as the safety of road users traveling through the work zone is the safety of the workers. Work zones present temporary and constantly changing conditions that are unexpected by the road user. This creates a high degree of vulnerability for workers on or near the roadway.

The following are some of the important elements of worker safety and work zone management that should be considered to improve safety:

- Worker Training
- Maintenance of Traffic Plans
- Compliance with Standards
- Use of Positive Protection, Reference: Section 7 of this MOT MANUAL.
- Work Zone Speed Limit
- Enforcement
- Activity Area
- Flaggers
- Access to Work Zone

#### 5.3.1.2 Work Zone Mobility

Work zone mobility refers to the movement of road users efficiently through a work zone with minimum delay compared to travel when no work zone is present while not compromising the safety of highway workers or road users. The commonly used performance measures for the assessment of mobility include delay, speed, travel time and queue lengths.

MOT strategies must include a plan to notify road users, mitigate and manage the congestion as much as possible. Traffic capacity mitigation measures are important since many projects cannot effectively eliminate all work zone impacts. A capacity analysis helps determine whether a work zone strategy is feasible. Mitigation measures that provide the correct combination of public information, advance signing and notification as well as innovations such as strategic closures, accelerated construction schedules can be effective in reducing mobility impacts.

## 5.3.2 Work Zone Speed Limit

### 5.3.2.1 Managing Speeds in Work Zones

Traffic speed in highway work zones is an important factor affecting the safety for both the traveling public and for the workers during construction or maintenance activities. Determining the safest and most efficient speed limit within work zones based on roadway conditions should provide for a consistent and efficient traffic flow. Proper and consistent application of the work zone speed limit should improve the safety of the highway worker and the traveling public, allow for better enforcement, minimize traffic congestion and incidents, all of which will contribute to a safer work zone.

An enhanced understanding of the relationship between factors used to justify reduced work zone speed limits and motorist perceptions of the need to reduce their speed should improve the speed limit selection process and compliance of speed limits within the work zone. The document “Guidelines on Managing Speeds in Work Zones” developed by the Roadway Safety Consortium summarizes available guidance on setting speed limits and managing speeds in work zones.
Website path to this publication: http://www.workzonesafety.org/research/record/10852

AASHTO members and other highway construction industry experts identified the need for guidance on managing speeds in work zones. A fundamental principle of temporary traffic control is that road user movement should be inhibited as little as practical. The MUTCD states that reduced speed limits should be used only in the specific portion of the work zone where conditions or restrictive features are present. These guidelines have been developed to provide the Designer with typical factors to consider and evaluate in determining a work zone speed limit.

Speed is often regarded as an indicator or measure of two different transportation performance characteristics, mobility and safety. Higher speeds generally translate to shorter travel times, an indication of good mobility. The relationship between speed and safety is complicated and indistinct. One of the many complicating factors is that high-speed highways have low crash rates. However, since interstate highways also have distinguishing design features (e.g., limited access control and wide clear zones), it is difficult to separate the effects of speed from other characteristics. Therefore conflicts can develop between the mobility and safety objectives.

The Tollway operates as a high speed facility. Slower speeds in work zones may reduce the roadway capacity and cause localized congestion, which, in turn, can increase the potential for rear-end crashes and other conflicts, such as vehicles maneuvering out of their travel lane. While the speed of traffic can affect crash frequency and severity, speed variance is also an important factor. ***Traffic moving along at a uniform pace, albeit somewhat faster, may be***

***safer than traffic moving at slower, non-uniform speeds, which increases the potential for conflicts between vehicles[1].***

Drivers are informed that they need to slow down in work zones through the use of signing, lane striping, reduced speed limits and other techniques. Regulatory speed limit signs are used to inform drivers of the legal speed limit in a work zone. When normal operating speeds on the roadway are high, voluntary speed reductions may not produce the desired speeds through the work zone. Simply posting lower speed limits does not necessarily reduce speeds. Numerous studies have shown that posting a reduced speed limit sign by itself does not slow drivers down. Drivers reduce their speeds through the work zone only when they perceive a need to do so, based on conditions in the work zone or the perception of enforcement activities. Typically, drivers slow down when large equipment and workers are located close to moving traffic, when roadway restrictions such as temporary crossovers or narrowed lanes are in place or when temporary traffic barriers are near the edge of the lane. ***It is the situation they see, and not the reduced speed limit sign itself, that causes drivers to reduce their speeds[2].***

The following is a list of referenced publications in which variable speed limit system in a work zone has been studied.

- A Field Test and Evaluation of Variable Speed Limits in Work Zones; U. S. Department of Transportation Federal Highway Administration
- Safe Speeds in Work Zones; FHWA Publication No: FHWA-RC-BAL-04-0015
- Field Test of Variable Speed Limits in Work Zones (Michigan), Final Report RC-1467, U. S. Department of Transportation Federal Highway Administration
- Variable Speed Limit Signs Effects on Speed and Speed Variation in Work Zones; Utah Department of Transportation
- Work Zone Variable Speed Limit Systems: Effectiveness and System Design Issues; Virginia Transportation Research Council
- Evaluation of Work Zone Speed Limits: An Objective and Subjective Analysis of Work Zones in Missouri; Missouri University of Science and Technology
- Exploring the Effectiveness of Variable Speed Limit Controls on Highway Work-Zone Operations; University of Maryland
- A Framework to Evaluate the Impact of Variable Speed Limit Systems on Work Zone Traffic Operation Using VISSIM; DKS Associates

#### 5.3.2.2 Determination of Work Zone Speed Limits

Establishing work zone speed limits is based on sound engineering judgment being applied while examining various aspects of the project. Many varying factors include considering scope of work, maintenance of traffic, geometrics, construction access/egress, project length and duration, along with traffic volume… etc. are to be taken into account in determining the appropriate WZSL. It is important to understand that overuse of speed limits, especially speed limits that are unrealistically low, will have little effect in reducing speed in the work area. As a negative consequence, it will create driver disrespect for work zone speed limits in general, and will thus adversely affect speeds at other sites where speed limits are posted realistically.

[1] Guidelines on Managing Speeds in Work Zones.
[2] Ibid

The Illinois Vehicle Code under Sections 11-605.1, give to the Tollway the authority to alter maximum posted speed limits on its system for establishing a construction or maintenance speed zone.

| Normal Posted Speed | | |
|---|---|---|
| 70 MPH | Maximum WZSL: | 65 MPH |
| ≤ 65 MPH | Maximum WZSL: | Posted Speed |
| ALL | Minimum WZSL: | 45MPH |

Condition based speed limits are to be used to manage work zone speed limits. These are determined on the varying work zone conditions. Some work zone conditions to evaluate are:

- Managed Work Area
- Stage Changes
- Access to Work Area
- Use of Shoulder
- Construction Work Equipment
- Pull-Out Area
- Type of Traffic Control Device
- Duration of Work
- Restricted Work Hours

The applicable work zone speed limit reflects some of the same factors a prudent driver also considers. Improving the consistency between a responsible driver's speed selection and the speed limit may help to restore work zone speed limit credibility and improve safety.

Reduced speed limits should remain in place only when work zone conditions present a controlling concern. Failure to adjust these signs when they are not needed leads to reduced credibility of speed limits, decreased compliance with speed control and other temporary traffic control devices in the work zone, greater variation in vehicle speeds and negative public opinion of work zones. In order to maintain the credibility of work zone speed limits, signs used to reduce speeds should be adjusted as conditions warrant.

Condition based speed limits are not common to most Tollway projects. However, there are projects whereby this strategy can be utilized.

- Example 1: Pavement Markings. The work zone speed limit is kept at posted during the daytime, and reduced at nighttime during construction operations.

- Example 2: Intermittent Patching. The work zone speed limit is kept at posted during the daytime, and reduced at nighttime during construction operations.

- Example 3: Long work zones. The work zone speed limit is kept at posted until construction operations have been scheduled for a specific roadway segment.

Work zone speed limit signs shall be placed according to Tollway Standards and beyond the entrance ramps associated with each interchange and at the approximate midway point within the work zone length. Work zone speed limit sign spacing is not to exceed 5 miles.

The Tollway has developed work zone speed limit flow charts for some of the more common work zone situations encountered, considering maintenance of traffic, type of traffic control

devices, shoulder refuge, along with managed work areas. These charts cannot cover every situation that may be encountered in construction and maintenance work zones and should serve as a baseline or starting point. There are many factors that can come into play that are not covered in these guidelines which may justify the use of a recommended WZSL. The work zone speed limit flow charts are to provide decision tools to assist Designers with managing speeds in work zones. Engineering judgment, as well as state laws and practices, should be used to determine the appropriate speed limit, speed limit management strategies and speed reduction strategies for each work zone. For several situations, the desired WSZL will offer a range in speed limits for consideration.

Reference Appendix F-Flow Charts for Consideration of Work Zone Speed Limits.

The starting point in determining the work zone speed limit is to consider the following:
Posted Speed 65 MPH or Greater: Desired WZSL 55 MPH
Posted Speed 55 MPH: Desired WZSL 50 MPH

Shoulder Closure Posted Speed: Any Desired WZSL 55 MPH

Reduced speed limits should be used only in the work zone where conditions or restrictive features are present. Frequent changes in the speed limit are not permitted. A desirable MOT plan should be designed so that vehicles can travel through the work zone with a minimal speed limit reduction. An explanation is required for establishing a work zone speed limit less than the desirable. Where restrictive features justify a speed reduction of more than 10 mph, additional driver notification should be provided. The speed limit should be stepped down in advance of the location requiring the lowest speed, and MOT warning devices should be used in accordance with Tollway Standards.

Use of Flowcharts
1. Select Roadway Configuration
2. Determine Maintenance of Traffic Type
3. Duration of Work
4. Traffic Control Device Used
5. Is there a shoulder available for vehicle refuge?
6. Has the work zone been managed for safest and most efficient speed limit?
7. Select (or) propose alternate work zone speed limit
8. Complete Work Zone Speed Limit Form

MOT Modified is the condition when traffic is in lanes not using a shoulder.

#### 5.3.2.3 Work Zone Considerations

Work zone considerations are those factors which establish the basic framework in establishing condition based work zone speed limits.

The design and physical factors of the roadway place a definite limitation on the safe operating speed of vehicles. These factors along with type of construction and the maintenance of traffic features are to be taken into consideration in the establishing work zone speed limits.

Actual project conditions used to establish the work zone speed limit are numerous and highly variable. Speed limit strategies are justified for certain conditions, and optional for others, based on a careful engineering analysis of project-specific criteria.

The Tollway has incorporated into the MOT Standards-Section E adjustments to accommodate various work zone speed limits. However, the designer needs to evaluate whether unique work zone features to a specific project would require a plan detail.

**5.3.2.3a Segmented Work Zone**

In some cases, it may be desirable to establish different speed zones within an individual project. Though this is uncommon, dependent on the type of construction activities, long work zones with staged construction activities can incorporate shorter lengths of lane closures thus increasing mobility. Whenever possible, the use a short segmented work zones is desirable.

The maximum length of lane closures should be 5 miles with at least 3 miles between adjacent work areas unless documentation shows that a longer length minimizes road user costs, or substantially shortens the overall duration of a lane closure.

**5.3.2.3b MOT Complexity**

In the design of a project, the MOT plan is an essential element in determining a method for maintaining a safe flow of traffic through a construction work zone. The different types of traffic patterns required to allow for the construction activity will have an impact on the recommended work zone speed limit. Likewise the selected work zone speed limit may impact the features of the MOT. Higher speeds require differences in taper rates for traffic shifts. Tollway Standard E4 provides tables for MOT reverse curve layout based on WZSL. With higher speeds there was a need to extend the buffer space which is located immediately upstream (in advance) of the Work Area to provide additional recovery space for an errant vehicle that may penetrate the taper in the Transition Area. All Tollway lane closure details have been modified to provide a minimum buffer space of 650’.

The work zone presents a dynamic work environment with changing conditions. Each MOT stage may introduce a new construction activity, duration, traffic pattern, or traffic control device. The work zone speed limit needs to be evaluated for each MOT stage for the proposed work zone design layout. These varying conditions may result in changes to the WZSL.

**5.3.2.3c Refuge Area**

An important feature to consider is the available space provided for a disabled vehicle. When the shoulder area becomes < 8’ in width there is insufficient area for a vehicle to find refuge.

Pull-Out Areas are discussed in Article 5.3.7.

**5.3.2.3d Potential Roadside Obstacles**

The clear zone is the unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery of errant vehicles. Within the work zone, traffic may be shifted onto the shoulder reducing the clear zone distance to an existing obstacle. Also, the contract may introduce temporary obstacles (i.e. temporary lighting) requiring the clear zone distance to be evaluated.

The AASHTO Roadside Design Guide provides guidance and Table 3-1 provides suggested Clear Zone Distances based on traffic volumes, speeds, and roadside geometry. As stated in

the Tollway Traffic Barrier Guidelines, the highest value within the range from Table 3-1 shall be used. Based on the selected WZSL, temporary roadside barrier may be required to shield an obstacle.

Reference Document: AASHTO Roadside Design Guide

**5.3.2.3e Construction Access/Egress**

Contractor access to work area locations are proposed by the Contractor and submitted to the Construction Manager (CM) for acceptance prior to any placement. Construction vehicles entering or exiting the work area can create significant speed differentials between themselves and traffic using the facility. The Tollway has developed Standard Drawing (E6) for the required features of this access point which has been detailed for a range of WZSL. When higher speed limits are utilized, additional opening length may be required to accommodate the deceleration and acceleration of vehicles exiting and merging with through traffic. For site specific locations there may not be adequate room for this placement. It is essential that the Designer take into consideration the construction phases, staging, number of anticipated access points, and work area restrictions which may impact the flow of construction vehicles, equipment, and workers operating in the work zone.

Construction Access/Egress is discussed in Article 5.3.5.

**5.3.2.3f Roadway Capacity-Volume**

The Tollway system operates on two, three and four lane roadway segments. An important feature to evaluate in developing the work zone speed limits within an MOT plan is the effect on roadway capacity and number of lanes impacted by the type of construction or maintenance operation.

The Tollway Lane Closure Guide provides lane closure sheets to the Designer with the hours of the day and days of the week when the traffic impacts of a lane closure are expected to be within acceptable limits. The numbers of lanes available at that time on all sections are provided. Thus the presented volumes are an estimate of actual demand on available lanes, which is the most relevant information for assessing potential lane closures.

Typically during nighttime hours the traffic volumes are significantly reduced on the Tollway systems. Additional lanes are available to be taken out of service without impacting roadway capacity. Also with reduced traffic volumes during various time periods, the work zone speed limit may accommodate a speed above 45 MPH.

Reference Document: Tollway Lane Closure Guide; Tollway Website

**5.3.2.3g Roadway Geometry**

Horizontal and vertical alignments establish the general character of a highway, perhaps more than any other design consideration. The configuration of line and grade can affect a recommended work zone speed limit and sight distances. The roadway geometry along with the work zone MOT can be controlling elements in the selection of a work zone speed limit. Other criteria require that judgments be made by Designers in consideration of site specific work zone conditions and activities.

### 5.3.2.3h Sight Distance

To maintain vehicle paths and avoid conflicts, drivers need visibility of road and traffic conditions. Visibility needs are related to the operating environment and vehicle speeds. The AASHTO "Green Book" identifies several types of sight distance and establishes minimum design values. Sight distance requirements also depend on the vertical alignment (or profile) of the roadway.

### 5.3.2.3i Interchanges

The number and location of interchanges, exit-entrance ramp locations within the construction work zone may have an influence on the recommended work zone speed limit for a given segment within the work zone. The volume of vehicles either entering or exiting the roadway may be impacted by the MOT configuration. Consideration of the length of entrance-ramp acceleration lanes, exit-ramp deceleration lanes and taper rates need to be considered. A design objective is to minimize the speed disparity between mainline and entering/exiting traffic streams.

Reference: Chapter 10 of AASHTO's A Policy on Geometric Design for Highways and Streets.

### 5.3.2.3j Shoulder Closure

When a shoulder closure is required to perform construction or maintenance work, the roadway configuration plays a significant role in establishing the work zone speed limit. The roadway configuration for a two lane roadway differs significantly from three and four lane configurations in the dimension of the shoulder widths. A two lane roadway's median shoulder is 4' wide.

When closing a shoulder, closure lengths exceeding 1000' no longer provides a refuge area. Therefore, the WZSL should be evaluated depending on type of traffic control device utilized.

Shoulders provide a number of important functions. Safety and efficient traffic operations can be adversely affected if any of the following functions are compromised:

- Shoulders provide space for emergency storage of disabled vehicles.
- Shoulders provide space for enforcement activities.
- Shoulders provide an area for drivers to maneuver to avoid crashes.
- Shoulders increase safety by providing a stable, clear recovery area for drivers who have left the travel lane.
- Shoulders improve stopping sight distance at horizontal curves by providing an offset to objects such as barrier and bridge piers.
- On roadways with gutter and enclosed drainage systems, shoulders store and carry water during storms, preventing water from spreading onto the travel lanes.
- On high-speed roadways, shoulders improve capacity by increasing driver comfort.

#### 5.3.2.3k Work Area

The length and location of the work area is to be considered in establishing a WZSL. Work areas requiring a lane closure or traffic shift differ from when a shoulder is closed. Each MOT configuration along with the type of traffic control device utilized can influence the work zone speed limit selected.

#### 5.3.2.3l Active Work Zone

The condition of a work area when construction operations are actively in progress, where workers present may become a factor for a recommended WZSL. However, the presence of workers alone is not a controlling event.

#### 5.3.2.3m Adjacent Projects

Coordination with adjacent project(s) is very important. The work zone speed limit established on an ongoing project may impact and influence the recommended value for use on the one being designed. It is important to establish a safe and effective work zone speed limit for the efficient movement of traffic along the entire affected roadway segment.

#### 5.3.2.3n Work Zone Speed Limit Responsibilities

**Designer Responsibilities**
The designer must submit the Tollway's Work Zone Speed Limit Form for each project.
The submittal should be early in the design process so that the necessary details can be incorporate into the plans. A separate work zone speed limit form is to be submitted for each MOT stage. MOT plan configurations should also be included.

- Tollway WZSL Form-WBPM, Folder-Traffic MOT

WZSL Form submittal process:

- o DSE prepares/submits to DCM
- o DCM to PM
- o PM to WZSL Committee
- o WZSL Committee may request meeting with DSE concerning any questions/issues.

Reference Documents:

- Appendix F-Tollway Work Zone Speed Limit Flow Chart

**Design Corridor Manager Corridor / Construction Corridor Manager**
For corridor projects, both design and construction corridor managers need to review, evaluate and coordinate work zone speed limits to be utilized during the construction stages between individual projects.

**WZSL Committee**
The WZSL committee will review the WZSL Form, supporting documentation, and proposed WZSL. When there is not a unanimous agreement for the proposed work zone speed limit for a particular project, a separate meeting will be conducted to discuss the MOT and develop consensus

.
WZSL Committee Members

- Tollway- Incident Manager
- Tollway- Roadway Maintenance Manager
- Tollway- Traffic Operation Manager
- Tollway- Geometrics Engineer
- Illinois State Police
- Tollway GEC-Committee Point Person

**Contractor Responsibilities**
When the Contractor proposes changes to the contract plans, the MOT and work zone speed limit needs to be reviewed. The Contractor shall submit the proposed revisions to the WZSL Committee for review.
Reference Article 1.8; Designer Responsibilities for additional guidance.

**5.3.2.4m Ramps- Work Zone Speed Limit**

**Service Interchange**
**Diamond/Outer/Loops**
The Tollway does not post regulatory speed limits on ramps. The Tollway may post an Advisory Speed (W13-1P) plaque to supplement a warning sign to indicate an advisory speed based on the ramp design speed.

However, when work is being performed on a ramp, the Designer may consider posting an Advisory Speed (W13-1P) plaque to supplement a warning sign to indicate an advisory speed for a specific construction condition.

**Directional Ramps**
**Collector-Distributor (CD) Roadway**
**Service Interchange-Directional**
Ramps with a design speed of 50 MPH or greater may consider establishing a work zone speed limit when its length exceeds ½ mile.
The Designer shall submit the work zone speed limit form to the WZSL Committee for review.

## 5.3.3 Work Zone Trooper Assistance

A comprehensive work zone speed enforcement operational plan has been developed between the Tollway and the Illinois State Police. For any work zone on the Tollway system, the Contractor may request additional trooper assistance. In these cases, a supplemental operational plan is developed for each individual project with input from the Tollway, Contractor and the ISP. In these cases, Tollway Finance will make payments directly to the ISP which are deducted from the construction contract.

## 5.3.4 Work Zone Clear Zone

Chapter 3 of the AASHTO RDG defines a clear zone as the total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. In accordance with Chapter 9 of the AASHTO RDG, “the forgiving roadside concept should be applied to all work zones as appropriate for the type of work being done and to the extent existing roadside conditions allow.”

In determining and establishing clear zone for a project's work zone, the designer must consider several factors that together contribute to the selection of clear zone for the work zone.

This section of the MOT MANUAL should be considered in coordination with the Manual on Uniform Traffic Control Devices, AASHTO RDG, and other sections of this document particularly the Tollway's Longitudinal Drop-off Policy and Use of Positive Protection Devices. The information included herein is meant to provide the designer with information and topics for consideration when evaluating the clear zone.

Engineering judgment using the guidelines set forth herein, the MUTCD and the AASHTO RDG must be employed for the clear zone determination due to the number of variables associated with each work zone. Those work operations or objects that are actively in progress and delineated by approved traffic control measures are not generally subject to the clear zone requirements for work zones.

Factors that must be considered when establishing a clear zone for a work zone may include:

- Duration of the construction activity(ies)
- Traffic volumes
- Nature of the potential obstacle
- Longitudinal edge drop-offs
- Use of positive protection
- Design speed through the work zone and anticipated running speeds
- Length of the potential obstacle
- Proximity between traffic and construction workers
- Proximity between traffic and construction equipment and temporary structures (scaffolding, bracing, piling, etc.)
- Geometry of the roadway
- Transition areas through the work zone
- Lane closures or lane transitions
- Type and location of equipment and material storage

When potential roadside obstacles are determined to be located within or in close proximity to the clear zone, they should be further evaluated utilizing the procedures and principles outlined in the Tollway's Traffic Barrier Guidelines (TBG). This process should be documented by the Designer and implemented into the contract documents, including but not limited to the MOT plans and specifications.

### 5.3.5 Contractor Access to Work Area

Contractor access to work area locations, as needed, are to be proposed by the Contractor and submitted to the CM for acceptance prior to any placement. Flaggers are to be positioned to alert through traffic of construction equipment and vehicles entering and/or exiting the work area and to minimize impacts on through traffic in the work zone. Minimum distance must be maintained from crossovers, exit and entrance points, and ramps to allow for safe and efficient traffic movement.

Contractor Access to Work Area shall be spaced no closer than 2,600 feet between areas, except for bridge work where two access locations may be provided, one on each side of the structure. However, at bridges only one access area at a time will be allowed to be opened for use. The locations for Contractor Access to Work Area shall meet minimum stopping sight distance requirement in accordance with AASHTO Green Book (current edition).

Reference Document (Current Edition): Tollway Standard Drawing E6.

### 5.3.6 Stabilized Construction Entrance

A stabilized construction entrance, as needed, is to be installed at the point of entrance/exit to a construction work area which utilizes a pad of aggregate underlain with a geotextile material. The purpose of this installation is to reduce the tracking of mud and dirt onto the Tollway and public roads by construction vehicles. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains or surface waters and production of airborne dust.

NPDES permits require that appropriate measures be implemented to prevent the tracking of sediments onto paved roadways.

Reference Document (Current Edition): Tollway Standard Drawing K1.

### 5.3.7 Pull Out Areas

Roadway cross-sectional width is often reapportioned in work zones, resulting in the reduction or elimination of shoulders and travel lanes. Since shoulders are the traditional refuge for disabled vehicles, operators of disabled vehicles may be faced with unfamiliar conditions and undesirable choices. The provision of emergency pull-out areas mitigates cross-sectional reductions. The provision of enforcement pull-out areas offer additional means of facilitating work zone enforcement.

Emergency and enforcement pull-out area locations, as needed, are to be proposed by Designer and shown on the contract MOT Plans. Emergency pull-out areas shall be spaced approximately ½ mile between locations. Enforcement pull-out areas shall be spaced approximately 3 miles between locations.

The locations for emergency and enforcement pull-out areas shall meet minimum stopping sight distance requirement in accordance with AASHTO Green Book (current edition). Sight distance is an important consideration in pull-out location selection and design. Extended sight distance aids driver performance in resolving potential conflicts between traffic in the through lanes and

traffic that is entering or exiting an emergency pull-out area. Pull-out areas shall be on relatively flat, tangent sections of the roadway to maximize available sight distance.

Emergency pull-out areas should be located on the right side of the travel lanes. Left-side pullout areas violate driver expectancy and should only be used where the right side is not available. When counter flow lanes are implemented, it may become necessary to have emergency pull-outs located on the left side of traveled lanes. Enforcement pull-out areas should only be located on the right side of the travel lanes.

Advance construction guide signing improves the use and safety of pull-out areas. By knowing the distance to a refuge, drivers experiencing emergencies can make informed decisions on the approach and exiting maneuvers. Signing also provides other drivers with notice of potential exiting and merging traffic.

Reference Document (Current Edition): Tollway Standard Drawing E7.

### 5.3.8 Lane Closure

Lane closure is a construction work zone mitigation strategy wherein one or more travel lanes and any adjacent shoulders are closed to traffic. Typically lanes are not permanently closed on the Tollway, the existing lane capacity is maintained with the use of a lane shift.

Condition: When no positive protection is provided and workers or equipment are present in the work area and encroach within 2 feet or less from the edge of traveled way, the lane open to traffic shall be temporarily closed during work activities.

Guidance: This mitigation may require nighttime work depending on system location. Also, dependent on the scope of work, constructability and duration, the use of positive protection devices should be assessed as a possible alternate to lane closure.

Lane closures/traffic impact activities shall be immediately discontinued if the Engineering Department determines that unacceptable and/or unplanned traffic impacts have resulted. Lane closures should be removed immediately if there is no appreciable work activity being accomplished. The motoring public is intolerable of lane closures/traffic impact activities if there is no visible sign of progress. The Maintenance & Traffic Division has the authority to approve and remove lane closures/traffic impact activities at its discretion. The Deputy Program Manager and each Project Engineer/Manager has a responsibility to proactively manage their projects to ensure proper procedures are followed and that the goals/intent of this MOT MANUAL are achieved.

Traffic conditions, accidents, rain, snow, fog, and other unforeseen emergency conditions may require the CM to restrict, modify, or remove lane closures or channelizations shown in the plans.

### 5.3.9 Interior Lane Closure

Interior lane closure which creates a split traffic pattern is discouraged from use on the Tollway, however this work zone mitigation strategy may be necessary in a certain set of circumstances. Prior approval from the Tollway is required for this traffic pattern. A project specific MOT traffic plan must be developed for implementation.

Reference Section 11, Exhibit 2. Interior Lane Closure Installation Procedure

### 5.3.10 Tapers

Reference Article 5.2.2 of this MOT MANUAL.

### 5.3.11 Counter-Flow Lane

Counter-flow is a construction work zone mitigation strategy to establish two way traffic on a normally divided roadway facility. This strategy allows for the construction of a larger segment of the one-way roadway with reduced conflict between roadway traffic and equipment, workers, or onsite material movement.

In this strategy:

- The number of lanes in each direction are to remain the same as existing.
- At both ends, one or more traffic lanes in one direction is routed across the median to the opposite-direction pavement or roadway. At some locations median barrier wall is removed or a temporary crossover is constructed for this purpose.
- No truck traffic is permitted to use the counter flow lane, when only one lane is moved to the opposite side.
- Evaluation of traffic volumes to determine if cross-overs between counter-flow lanes and local lanes are needed to optimize traffic flow.

Crossover locations shall be selected which maintain existing access points. Additionally, substantial grade differences between the one-way roadways or within median topography can influence the feasibility and cost of a temporary crossover roadway. The design must address horizontal geometry along with vertical profile and cross slopes when selecting locations.

Counter-flow lane use imposes more constraints on drivers. There is usually only a single one-way lane, which limits driver lane and speed choice. Additionally, cross-sectional arrangements often involve operation near barriers and provide reduced refuge opportunity for disabled vehicles requiring the placement of emergency pull-out areas.

### 5.3.12 Use of Shoulder

Use of shoulder is a construction work zone mitigation strategy involving the use of an outside or median shoulder as all or part of a temporary traffic lane. This strategy compensates for the removal of permanent travel lanes from service. Employing this strategy may require constructing or upgrading shoulder pavement structures to adequately support traffic loads and maintain minimum lane width requirements. Typically the shoulder rumble strip should be removed. When the shoulder is used to carry traffic, the roadside obstacles on that side will be closer. The existence, proximity, and nature of roadside features should be considered in assessing this strategy. The shoulder is not intended for truck use.

Emergency turnarounds exist within the median concrete barrier. The ends of the concrete barrier in each direction are shielded by energy attenuators. Their opening length between

median barrier wall vary. Where traffic is to be routed onto the median shoulders this opening should be closed to shield vehicles from crossing into lanes in the opposing direction of travel. However, since the Tollway Maintenance and Local Emergency Responders use these turnarounds, the Tollway will review the work zone location and determine which are to be temporarily closed. Where a temporary barrier is not placed to close these openings, flexible post delineators shall be installed. These devices present a visual barrier within the opening yet provide access to emergency vehicles.

### 5.3.13 Reduced Lane Width

The minimum lane width for mainline MOT shall be 11 feet measured between pavement lane markings (11'- 4" measured between the centers of pavement lane marking stripes) with a 2 foot desirable and 1 foot minimum shy distance to a traffic control device.

The desirable lane width for ramp MOT shall be 14 feet (11 feet minimum) measured between pavement lane markings. Consideration of roadway geometry and type of work to be performed is necessary in establishing this lane width. A wider lane width is required for the tracking of larger vehicles when on sharp horizontal curves. Evaluate the need for an alternative wide-load detour route. Ensure the wide-load detour is adequately marked in advance of the construction work zone.

### 5.3.14 MOT Modifications

When the Contractor proposes changes to the design MOT plans, an evaluation for potential roadside obstacles shall be performed as well as identifying impacts to the projects' work zone issues along with schedule and costs.

When an alternate traffic pattern is proposed within the contract, the Contractor shall submit a maintenance of traffic deviation plan, 21 days prior to the changes for acceptance by the Tollway. In addition, The Contractor is required to attend a maintenance of traffic meeting arranged by the Tollway Construction Manager with representatives of the Tollway to review the proposed changes in the maintenance of traffic 2 days prior to the implementation of the new maintenance of traffic stage changes.

### 5.3.15 Temporary Stoppage of Traffic

Temporary stoppage of traffic is a construction work zone mitigation strategy wherein traffic in one or both directions is stopped for a relatively short period to allow restricted construction operations. It is employed during specific operations (e.g. setting bridge beams) for which project personnel can select a beginning point and reasonably predict the duration. This strategy temporarily removes the traffic from all or part of the work area for a short period of time, usually during the non-peak traffic times. Prior approval from the Tollway and coordination with the Illinois State Police is required. The maximum duration permitted for this strategy is not to exceed 15 minutes.

### 5.3.16 Night Work

High traffic volumes on the Tollway make it difficult to perform various work zone operations in or near travel lanes during much of the day because of the disruption in traffic flow and the risk this introduces for the workers and the traveling public. As a result of these concerns, all types

of highway work are increasingly scheduled for off-peak periods, particularly at night, to alleviate the problems associated with working in traffic.

On many sections of the Tollway, night work is the only time where lane closures are allowed. Night construction allows for conducting construction operations during reduced traffic demand. Night traffic volumes are generally significantly lower than daytime volumes. The advantages of night work are associated with lower traffic volumes and lower traffic impacts. The disadvantages are higher agency costs, decreased visibility and noise restrictions.

### 5.3.17 Mainline Open Road Tolling (ORT) Work

The following guidelines and procedures are to be followed for mainline ORT work.

- No full or partial lane shifts are permitted. Traffic must be kept in established lanes due to lane loops in the roadway pavement used for electronic tolling.

- Positive protection (e.g. temp concrete barriers) and equipment placement requires coordination with Business Systems to avoid conflicts with lane loops in the pavement used for electronic tolling.

- When shoulder use is necessary, coordination with Business Systems is required for Force Account involvement.

- ORT lane closure is to be coordinated with Toll Services and Plaza Supervisors for assessing staffing requirements.

- Counter-flow lanes through the ORT zone are permitted. Coordination with Business Systems is required for scope of work and Force Account involvement.

- Lane Closure Reference Guide is to be followed. 21-Day Notification must include Toll Services and Business Systems when IPO lane is affected.

- Temporary full ORT closure is permitted for restricted night work. Coordination with Business Systems required for scope of work and Force Account involvement.

  Reference Documents: Section 15 of this MOT MANUAL.

  PLATE 13-PLAZA MAINTENANCE FULL ORT CLOSURE-TWO LANES

  PLATE 14-PLAZA MAINTENANCE FULL ORT CLOSURE-THREE LANES

  PLATE 15-PLAZA MAINTENANCE FULL ORT CLOSURE-FOUR LANES

### 5.3.18 Mainline Plaza Work (Non-ORT)

Each toll plaza presents unique features; traffic volume, number of cash lanes, ramp entrance-exits, etc. which must be assessed. The following guidelines and procedures are to be followed for mainline plaza work.

- Temporary closure to the IPO lane is permitted.

- Business Systems coordination for Force account involvement is required with IPO lane closures.
- Plaza Supervisor coordination is required for assessing staffing requirements.
- Long term closure of IPO lane requires a lane conversion from manual to IPO.
- Lane closure request form must be completed; provided from the Tollway PM.
- The far lane on the right side of mainline plazas accommodates 12 feet wide, permit vehicles. Closure of this lane requires special coordination for permit pick-up, vehicle routing, etc.
- Lane conversion tasks;
    - Contractor work: Installation of conduits, loops, pavement, etc.
    - Force Account Work: Installation of electronic tolling system connections.
    - Access to ORT cabinets must be maintained.

### 5.3.19 Ramp Plaza Work

The following guidelines and procedures are to be followed for ramp plaza work.

- Temporary lane closure is permitted; 9AM – 3PM daily.
- Multiple lane configurations: When IPO lane is closed the Cash lane must remain open.
- When cash lane is closed, the following shall be performed:
    - The IPO lane shall be converted to accept cash
    - The placement of a temporary collection box (< 1 day).
- Coordination with Business Systems is required to establish Force Account Work and necessary Contractor work involvement.
- Single lane ramp work is a special condition; requiring the ramp to be closed overnight or for a specific period of time with a detour route.
- When any lane at a ramp plaza is to be closed special coordination is required for permit vehicles. Permit pick-up, vehicle routing etc. is required.

### 5.3.20 Interchange Ramp Work

Maintaining existing access points is desirable for established traffic patterns. When a complete interchange ramp closure is necessary, prior authorization of the Tollway will be required. A detour route must be established with coordination and approval from agencies impacted by the rerouting of traffic onto other roadways.

A temporary single-lane interchange ramp should have a desired travel lane width of 14 feet with a 1 foot minimum shy distance on each the right shoulder and left shoulder. Ramp geometry and design vehicle may require additional lane width.

The MUTCD provides considerable guidance and illustrated examples of MOT provisions and schematic geometry for accommodating interchange ramps within work zones.

### 5.3.21 Use of Positive Protection Devices

Reference: Section 7 of this MOT MANUAL.

### 5.3.22 Longitudinal Drop-Off Policy

Reference: Section 8 of this MOT MANUAL.

### 5.3.23 Detour Routes

The Designer shall present to the Tollway Detour Committee any project that has contemplated a detour route as part of its MOT. The Designer shall state reasons why a detour will be required. A detour should be a last resort after exhausting all other options. No coordination with local agencies should be conducted until directed by this Committee.

## 5.4 Application of Principles

### 5.4.1 Uniformity

The principle of uniformity calls for always handling a given situation in a similar manner using standard devices and procedures that are familiar to motorists. Uniformity reinforces expectations of drivers and increases the likelihood that they will take proper and timely actions as they negotiate the work zone.

The primary action to achieve uniformity is to follow this MOT MANUAL whenever possible. When special procedures must be employed to handle unusual conditions, the goal is to provide information and guidance in a way that is familiar to drivers.

Refer to Appendix C for Procedures for Placing Traffic Control Signage and Appendix D for the Work Zone Safety Inspection Checklist.

### 5.4.2 Adaptation

The traffic control procedure employed must be adapted to field conditions as they exist in the vicinity of the work zone. The MOT plans, MOT Plates, and the Tollway MOT Standard Drawings form the starting point in this adaptation process. The devices selected must be appropriate to the situation, taking into account the degree of hazard involved and the potential for corrective action by the motorist before encountering such hazards.

### 5.4.3 Compensation

Compensation comes into play when it is not possible to install the plan or device in the location or manner called for in the MOT plans, the Tollway MOT Standard Drawings or typical MOT

Plates. Such constraints can be caused by space limitations, sight distance problems, mobile operations, etc. The principle to employ is to compensate for a substandard feature by providing more than the minimum called for in another area. Through this process such limitations can be overcome and an equivalent level of safety can be achieved.

Typical methods of compensating are to employ more devices or ones that are larger or more visible.

### 5.4.4 Redundancy

Redundancy is a means of providing the motorist with additional opportunities to obtain requisite information, take proper action, and make corrective adjustments, if required. The warning sign series defined in the Plates provide for repeating messages. They are designed to deliver logical and increasingly explicit information on the situation ahead and actions that are required. The sign series provides essential information even though some signs may not be observed.

In the typical lane closing situation the advance warning signs are only the first information offered. The second form of the message is usually provided by channelizing devices placed on a taper. For long-term projects, pavement markings may also show required movements and will continue to function even if the channelization is displaced; if a motorist is inattentive, he may even penetrate the taper area before he recognizes the situation. The long tapers prescribed provide space and opportunity for a driver to regain control of his vehicle within the transition area. An empty buffer space provided at the upstream end of the work area provides additional recovery space.

## 5.5 Duration

Selection of the proper traffic control procedure is in part determined by the duration of the activity that is to be performed. To illustrate this principle five categories are defined below. Under each category the critical features affecting changes in traffic control procedures are described.

### 5.5.1 Short Duration

Short-duration activities are defined as those for which the erection of a standard work zone and the removal of that zone represent a greater effort and/or involve a greater hazard than the performance of the work itself. Typically the range of time required to perform such short-duration work is less than one hour.

In recognition of the hazards involved in installing and removing devices and the limited amount of exposure involved, some reduction in the number of devices used may be warranted. When this approach is used, the principle of compensation is applicable.

A maintenance truck may be placed in the lane upstream from the crew with an arrow board to warn the motorist. A highly visible combination of vehicle and flashing or rotating lights may compensate for the absence of some of the full set of standard warning signs and channelizing devices.

In such instances, proper timing of the activity is important. If the extent of the work zone is to be reduced, the work should be performed when hazards are minimized, such as midday when lower traffic volumes may prevail, and under good sight distance and weather conditions.

Any questions concerning the reduction in the number of devices shown in the Plates covering typical application should be discussed with the proper Tollway personnel prior to undertaking the work.

### 5.5.2 Short Term Stationary

Short-term stationary work is daytime work that occupies a location for more than 1 hour within a single daylight period.

### 5.5.3 Intermediate Term Stationary

Intermediate-term stationary work is work that occupies a location more than 1 daylight period up to 3 days, or nighttime work lasting more than 1 hour. Once night-time closures are involved, additional procedures must be employed to warn motorists of the greater potential hazards due to restricted visibility and to enhance the target value of certain devices.

However, because intermediate-term work lasts only a few days, it may not be practical to undertake the placement of features which may be required for major longer-term projects. For example, the removal of temporarily inapplicable pavement marking and the subsequent reinstallation of same may require more time and/or effort than is warranted. Likewise, the construction of crossover points or the erection of temporary barriers may not be practical for intermediate-term activities.

When such costly features as temporary roadways and barriers are not specified due to the relatively short project duration, other devices and features shall be employed which provide a high level of safety for motorists and workers.

### 5.5.4 Long Term Stationary

Long-term stationary work is work that occupies a location more than 3 days. For these projects the exposure is high in terms of the total number of vehicles passing through the work zone and the number of crew days of work. More elaborate and extensive forms of traffic control may be warranted. Signs are typically mounted using the same standards as employed for permanent mountings.

The traffic control procedures defined in this MOT MANUAL may warrant expansion and upgrading for long-term activities. For example, where high hazard conditions exist, barriers and appurtenant features should be considered instead of channelizing devices for minimizing vehicles from entering hazardous areas.

### 5.5.5 Mobile Operations

Mobile operations pose special problems as compared with standard stationary activities. As devices must be relocated periodically or continuously, the approach generally selected is to employ fewer but larger and more-visible traffic control devices.

(a) Intermittent Stop – Intermittent stop operations are those which are constantly being relocated along the highway. If several minutes are required at a work area, then the treatment to be employed is essentially the same as that used for short-duration

activities. If frequent stops are to be made for a few minutes or less then the traffic control procedure to use is that described below for fast moving operations.

An example of an intermittent stop activity is debris pickup.

(b) Slow Moving – Slow moving operations are defined as those that proceed down the roadway at less than five miles per hour. For such operations, stationary advanced warning signs and channelizing tapers are used. A standard work zone is established as defined in the applicable Plate with the work area having sufficient length to accommodate the moving activity within it.

There are procedures which may be used to avoid having long lane closures for the entire work period. For example, once the stationary advance warning area and transition area are established, the work area may be lengthened as the work proceeds in the direction of traffic. This procedure provides an expanding work zone.

An alternative is to set out a closure that contains the entire length of contemplated work and to work upstream towards the stationary transition area. A diminishing work zone is created when this procedure is used.

Another method is to employ two sets of traffic control devices and use a leapfrog procedure. These techniques all make use of stationary devices, which are periodically moved as work progresses.

An example of a slow-moving activity is crack sealing.

(c) Fast Moving – Fast moving operations are those that move at speeds between five and thirty miles per hour. At these speeds, traffic control devices that are ordinarily placed upstream of the work area must be moved continuously as the work progresses. The speed of travel is too great to place them and, periodically retrieve them; also the spacing criteria between the signs and the actual work area must be maintained.

Plates 9 and 10 cover fast-moving operations for a single lane closure and for a two-lane closure. In both instances, moving vehicles are used as arrow board supports and to create a channelizing taper.

An example of a fast-moving operation is pavement marking.

If a moving operation is performed at speeds greater than thirty miles per hour, the hazard is reduced as the work vehicle is moving essentially with traffic. In such instances, the traffic control requirements may be reduced as compared with those shown in the plate. Frequently, the vehicles are equipped with appropriate devices such as rotating/flashing beacons, signs or special lighting.

# SECTION 6.0 DEVICE REQUIREMENTS

## 6.1 Safety Hardware Testing

The National Cooperative Highway Research Program (NCHRP) Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*, has been the accepted method for safety hardware device testing and acceptance since 1993. AASHTO Manual for Assessing Safety Hardware (MASH) is an update to and supersedes NCHRP Report 350, for the purposes of evaluating new safety hardware devices. Any new or revised highway safety hardware under development as of October 15, 2009, when the MASH was published, may continue to be tested using the criteria in NCHRP Report 350. However, FHWA will not accept or review requests for new or revised highway safety hardware tested using NCHRP 350 criteria which are received after January 1, 2011.

MASH does not supersede any guidelines for the design of roadside safety hardware, which are contained within the AASHTO Roadside Design Guide. An implementation plan for MASH that was adopted jointly by AASHTO and FHWA states that all highway safety hardware accepted prior to the adoption of MASH – using criteria contained in NCHRP Report 350 – may remain in place and may continue to be manufactured and installed. In addition, highway safety hardware accepted using NCHRP Report 350 criteria is not required to be retested using MASH criteria. However, new highway safety hardware not previously evaluated must utilize MASH for testing and evaluation.

MASH was developed through National Cooperative Highway Research Program (NCHRP) Project 22-14(02), "Improvement of Procedures for the Safety-Performance Evaluation of Roadside Features," and contains revised criteria for impact performance evaluation of virtually all highway safety features, based primarily on changes in the vehicle fleet.

## 6.2 General Requirements

In this section of the MOT MANUAL, the requirements for each of the various types of traffic control devices used at work zones are discussed in detail. Specifications are presented regarding the selection, size, application and placement of devices used on the Illinois Tollway. Where different practices are encountered for maintenance operations and construction activities, the needs of each are stated.

To reduce the inventory of devices used for maintenance operations, devices are specified which can be utilized for a wide range of traffic control situations. In some instances, special signs are defined which can readily be derived from standard signs by the addition of a supplemental plate to the sign face.

The intent of the specifications presented in this document is to limit the range of devices permitted by the Manual of Uniform Traffic Devices. Device types are selected which are most appropriate for the high-speed, high-volume, fully-controlled access characteristics of the Tollway. In general, the largest standard-sized device is specified. For more detailed specifications, reference should be made to the MUTCD. It must be recognized, however, that the MUTCD is continually being updated and modified. Where changes are made that cause this MOT MANUAL to be out of conformance with the MUTCD, the provisions of the MUTCD prevail.

For construction projects reference should be made to the Standard Drawings pertaining to the MOT furnished as part of the Contract Documents. This document serves as a guideline for the design of traffic control procedures for construction activities. However, the work zone specifications may require adaptation of this MOT MANUAL to adjust to specific conditions encountered during project phases.

Approval of the Tollway's Chief Engineer is required before any traffic control device not included in this MOT MANUAL is placed on any portion of the Tollway system.

## 6.3 Signs

All existing signs along the Tollway within the work zone are to be maintained. These shall include but not be limited to Toll Plaza signage, informational signs, guide signs, mile post signs, airport and oases signage.

All standard signs shall conform to the requirements of the contract documents and the MUTCD and its supporting manuals, and MOT MANUAL. In complying with these requirements, the Contractor and suppliers will furnish signs that are correct in size, shape, color and legend. Special signs, should they be required, are detailed in the plans. Section 1091, Table 1091-2, Type A of the Standard Specifications provides the requirements for reflectorization.

For signs to be used in work zones, all of the above shall be met to the satisfaction of the Tollway. In addition, Section 701 of the Tollway Supplemental Specifications regarding sign erection and sign installation dimensions shall be met. Sign positioning at the work zone may be minimally adjusted with CM approval based on site conditions.

### 6.3.1 Sign Usage

Signs are utilized at work zones to inform drivers as to changes in regulations, to provide advanced warning of potentially hazardous conditions and to present information to guide motorists on the proper use of the roadway. Various types of signs including regulatory, warning and guide signs may be used in a work zone. The majority of the signs specified in the MOT Plates and Standard Drawings, however, fall into the category of warning signs.

### 6.3.2 Sign Design

The design features of signs include such items as shape, color, corner radius, border width, letter size, legend placement and symbol dimensions. All such features shall conform first to the provisions of the IDOT and Tollway standards drawings. In the absence of these standards, all such features shall conform to the MUTCD. For information not provided in the MUTCD, refer to the publications entitled "Standard Highway Signs" and "Standard Alphabets for Highway Signs" published by the Federal Highway Administration.

All construction signs and all other signs which may be used shall have a reflectorized background.

### 6.3.3 Sign Sizes

Wherever the MUTCD defines more than one size, the largest size shown shall be used. The standard size for diamond-shaped warning signs shall be 48 inch X 48 inch. The standard size for regulatory signs, such as KEEP RIGHT (LEFT) and DO NOT PASS shall be 48 inch x 60 inch. Advisory speed plates shall be 24 inch x 24 inch, unless otherwise indicated. “Advisory” speed plates should only be used on ramps. Elsewhere, regulatory speed limit signs should be used as necessary.

For use on other than mainline roadways, smaller signs may be used in those instances where space limitations preclude the use of the largest sizes.

### 6.3.4 Sign Placement

(a) Longitudinal Position- Warning signs are typically placed in advance of the situation to which they apply to provide adequate time for drivers to recognize the situation and take appropriate action. There are two exceptions to this rule: the Large Arrow sign is placed at the point where the change in direction is required and the TWO WAY TRAFFIC sign is placed within the applicable area.

Regulatory signs are generally placed at the point where the regulation takes effect. Guide signs may be placed in advance or at the applicable point, or both. Regulatory and Warning signs should be repeated within the work zone, as necessary, to remind the motorist that the regulations are still in effect or to confirm warning information.

Longitudinal sign positions and spacing for typical applications are given in the Standard Drawings. For mainline roadways the first warning signs are generally placed 3 to 5 miles in advance of the transition or point of restriction. The minimum sign spacing on the mainline is 500 feet. When shifts and splits follow in close proximity, this spacing may be difficult to implement. In such locations, an occasional 250 to 300 feet spacing may be inevitable.

Where lower speeds are encountered, such as on ramps, within plazas and Oases, these spacings may be reduced; but in no instance should sign spacing be less than 200 feet.

In selecting a sign location, consideration must be given to visibility constraints due to the horizontal and vertical alignment of the roadway and the presence of obstacles to vision, such as light poles and bridge piers. Adjustments should be made, as needed, to provide good visibility toward the upstream travel lanes. Likewise, attention must be given to the location of other permanent signs. Work zone signs should be positioned at least 200 feet away from other existing signs, if possible. When such adjustments are substantial, the preferred approach is to increase distances beyond those shown.

(b) Lateral Position - The standard location for signs is on the right side of the traveled way. Where there are two or more travel lanes in the same direction, as is normally the case on the Tollway, the sign message should be repeated on the left side of the roadway. In segments with 3 or more lanes in one direction, smaller signs mounted on the median barrier or on the opposite median shoulder should be utilized.

All signs shall be erected approximately at right angles to and facing the traffic they are to serve and placed in positions where they will effectively convey their messages. Signs shall be located with a minimum clearance of 2 feet between the sign and the edge of the adjacent lane. Exception to this is the emergency pull-out signage which is to be attached to the temporary concrete barrier.

For short and intermediate-term activities, signs may be mounted on temporary supports placed on shoulders. They should be placed away from the adjacent lane, however, to enable the shoulder to be used for emergency purposes to the fullest extent possible.

For long-term projects shoulders should be kept open, if possible, and temporary signs should be post-mounted using the same placement criteria as for permanent signs. A spacing of 8 to 12 feet from the traveled way is desirable.

(c) Vertical Position - Post-mounted signs shall be placed with the bottom a minimum of 7 feet above the roadway. If a secondary sign is mounted below another sign on the Tollway, the major sign shall be installed with a minimum height of 8 feet and the secondary sign shall be installed with a minimum height of 5 feet, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement.

(d) Signs installed temporarily on overhead structures may need to be larger than the standard sizes in order to have sufficient target value. In instances where warning signs are added to overhead guide sign assemblies, specifically designed signs may be desirable to provide both warning and guidance messages within the space available.

### 6.3.5 Sign Mountings

Portable sign supports shall be designed or constructed to yield upon impact to minimize hazards to motorists, yet they shall be sturdy enough to stand under anticipated roadway conditions. Ballast shall be used as needed to provide stability.

Signs may be mounted on portable supports, posts, on the back of vehicles for mobile operations and upon existing overhead sign bridges and structures.

Post-mounted signs shall be mounted on wood posts no larger than 6 inch x 6 inch or on steel or aluminum supports of a size that do not constitute a hazard to motorists.

All sign supports shall meet the requirements of the National Cooperative Highway Research Program (NCHRP) Report 350 or MASH, Test Level 3.

### 6.3.6 Special Signs

Certain signs are used in the MOT Plates or Standard Drawings which are defined as "special" signs. These are used only in those instances where a standard sign is not available which can adequately meet the needs of the particular situation. Other special signs may be needed for unique traffic control situations which must be handled. The principle to be employed in the design of a special sign is that it should conform to the general specifications for shape, color and placement. Note that such signs are considered to be "special standard signs" as opposed to non-standard signs.

Special signs other than those defined in this manual shall be approved by the Tollway's Chief Engineer prior to their fabrication.

## 6.4 Channelizing Devices

### 6.4.1 General Characteristics

(a) Functions - Channelizing devices are placed in the roadway and adjacent to travel lanes to control the flow of traffic. They have the following three functions:

- To warn and alert drivers of hazards in or adjacent to the roadway
- Placed along a taper, to force the movement of traffic from one lane or path to another
- To delineate the desired travel path and guide drivers through the work area.

Channelizing devices and associated warning signs shall not be stored on the roadway or within the clear zone. Such devices must be removed from the road, or may be stored behind guardrail in accordance with Article 11.4.1, Work and Storage Locations, well outside the clear zone, or within permanent shoulder closures associated with the project.

It must be recognized that channelizing devices may constitute obstacles themselves; therefore, motorists shall be warned with appropriate signs about the work zone before they proceed into a roadway area in which channelizing devices have been placed.

Channelizing must be positioned so that all activity takes place within the work area behind the channelizing devices and causes no interference to traffic. If workers or equipment are required to work outside the work area, the channelization is inadequate.

(b) Types of Channelizing Devices - Channelizing devices fall into two categories. Devices in the first category provide visual guidance and alert drivers to hazardous areas. These devices are cones, drums, tubular markers, barricades, vertical panels and pavement markings. They should be fabricated to offer minimum physical impact and to minimize vehicle occupant space penetration when hit.

Barriers form the second category. Barriers are designed to function physically as well as visually and to provide positive protection for the barrier clearance distance from vehicular penetration. Barrier delineators are attached to the face of the barrier to alert the drivers to the presence of the barrier adjacent to the traffic lane.

Warning lights may be added to channelizing devices in areas with frequent fog, snow, severe roadway curvature or where visual distractions are present. Warning lights are required for all channelizing devices used overnight.

(c) Channelizing Device Spacing - Channelizing devices should be placed sufficiently close together to appear as a continuous line of devices at normal travel speeds. On tapers, the line of devices lies across a travel lane and the motorist tends to look through them. Therefore close spacing is used on tapers. Beyond the transition area a longer spacing may be used along the work area, as motorists are traveling parallel to the line of devices.

The basic device spacing specifications are given in the MOT Plates and Standard Drawings. For channelizing tapers a 50-foot maximum spacing shall be used.

After a channelizing taper, the devices along the buffer space shall be placed at a 50-foot maximum spacing. Additional devices in the work area shall be placed at a maximum spacing of 100 feet. The channelization shall be continued for at least 100 feet beyond the work area.

Along curves the device spacing may be reduced to provide the appearance of a continuous line. When the roadway curvature is less than a 1430-foot radius, the maximum device spacing shall be 50 feet within both the transition area and the work area. When curvature is less than a 715-foot radius, such as may occur on ramps, the maximum device spacing shall be 25 feet.

When traffic is shifted onto the shoulder, barricades or other channelizing devices shall be placed along the outer edge of shoulder at twice the spacing distance used on the work area side, unless adjacent to guardrail or other barriers.

(d) Use of Tapers - Standard taper lengths are given in the MOT Plates and Standard Drawings. These should be considered as minimum taper lengths unless physical constraints, such as ramp terminals, require shorter lengths to meet field conditions.

Channelizing tapers shall be placed in full view of the upstream roadway. Where horizontal alignment or crest vertical curvature creates reduced sight distances, the buffer space should be carried further upstream and the channelizing taper placed where good approach visibility exists.

The standard length for a lane-closing channelizing taper is 800 feet. When two lanes are closed, a transition distance 2000 feet long is placed between the two individual 800-foot tapers.

A taper used to close a shoulder shall be a minimum length of 200 feet.

Shorter tapers may be used in toll plazas and on non-mainline roadways where lower speeds occur. The applicable formula for channelizing tapers is $L=WS^2/60$; where L is the taper length in feet, W is the lateral shift or lane width, and S is the speed in miles per hour. The speed value to be used in this formula should be the greater of either the posted speed limit or the 85th percentile actual speed. If there are any questions concerning the application of this formula, the matter should be first resolved with Engineering Department personnel.

When a downstream taper is used, a short 100-foot taper consisting of four additional devices at a 25 foot spacing is appropriate.

### 6.4.2 Cones

(a) Specifications - Cones used to channelize traffic on the Tollway shall have a nominal height of 28 inches and shall have a broadened weighted base to provide stability in accordance to IDOT Standard 701901 (See Appendix F). The predominant color shall be fluorescent orange. When used for emergency nighttime applications, the cone height should be a nominal height of 36 inches, and two white retroreflective bands shall encircle the cone.

Cones shall be made of material able to withstand impact without damage to the cone or the vehicle. Cones shall meet the requirements of the NCHRP Report 350 or MASH under Category 1, and the cone manufacturer shall provide evidence of certification with this requirement.

(b) Application - Cones are intended for use on short-duration and short-term maintenance and utility operations. When a closure is expected to extend into the hours of darkness, Type II or vertical barricades with steady-burning Type C barricade lights shall be used instead of cones.

### 6.4.3 Drums

(a) Specifications - Drums used for channelizing shall be of a size commonly referred to as 55-gallon capacity with a height of approximately 36 inches and a minimum diameter of 18 inches in accordance to IDOT Standard 701901 (See Appendix F). Drums shall be nonmetallic and have alternating Type AA or Type AP fluorescent orange and reflectorized white, horizontal, circumferential stripes. The markings on drums shall be horizontal, circumferential, alternating orange and white reflectorized stripes four to eight inches wide, using a material that has a smooth, sealed outer surface which will display the same approximate size, shape and color day and night. There shall be a minimum of three orange and two white stripes on each drum. If there are any spaces between the horizontal orange and white stripes, they shall be no more than two inches wide. Drums shall be weighted in a manner approved by the manufacturer so they are not moved by wind or traffic.

### 6.4.4 Barricades

Several types of barricades are specified for use on the Tollway for maintenance and construction operations.

(a) Type I and Type II Barricades - Type I and Type II barricades are lightweight portable barricades 24 inches wide and 36 inches high excluding any warning lights in accordance to IDOT Standard 701901 (See Appendix F). Type I barricades shall have a single rail 8-12 inches high with reflectorized striping. Type II barricades are Type I with the addition of a lower reflective-striped rail.

Type I barricades are used exclusively as patching barricades, and are to be placed in front of any intermittent pavement openings inside a channelized work area.

Type II barricades are used for the following applications:

- Along the buffer space and work area portions of the work zone, as well as along the limits of a lane shift for construction projects, and for maintenance activities that extend into the hours of darkness.

- For the tapers and along the buffer space and work area portions of shoulder closure work zones.

(b) Type III Barricades - Type III barricades are a minimum of 48 inches wide and 60 inches high (excluding warning lights) and have three reflective-striped rails in accordance to IDOT Standard 701901 (See Appendix F). Three additional rails shall be added facing the opposite direction, if they can be seen by normal traffic movement from that direction.

Type III barricades shall be used where it is necessary to close a roadway. They are typically erected across the closed roadway at the point of closure. Flashing yellow lights may be placed upon the barricade, as needed. Signs may also be attached to the barricade when they are used on crossroads with the approval of the respective governing agency. When used to close a ramp, the Type III barricade(s) are placed across from the gore point, and behind a line of Type II barricades placed along the deceleration lane.

(c) Vertical Barricades – Vertical barricades are frame and rail supported, similar to Type I and II barricades. The vertical panel shall be 12 inches wide, with a minimum overall height of 36 inches, excluding the warning light in accordance with IDOT Standard 701901 (See Appendix F).

Vertical barricades may be used in lieu of Type II barricades.

(d) Direction Indicator Barricades – Direction indicator barricades are Type II barricades, except the top rail shall be sheeted totally in reflective orange, with a black indicator arrow 21 inches long, with a 9½-inch wide arrow barb and a 3½-inch long shaft in accordance with IDOT Standard 701901 (See Appendix F).

Direction indicator barricades shall be used exclusively in the merging taper portion of the lane closure, with the arrow pointing toward the open lane(s). Direction indicator barricades shall not be used in lane shifts, as it could give the impression of a lane reduction.

(e) Barricade Specifications - Barricades are composed of horizontal panels 8-12 inches wide containing alternating orange and white stripes sloping downward at an angle of 45 degrees toward the side to which traffic is to pass.

The entire area of orange and white shall be reflectorized with a material that has a smooth, sealed outer surface which will display the same approximate size, shape and color day and night. The predominant color for other barricade components shall be white. Barricades should be made of lightweight components to minimize the hazard to motorists, if hit; but must be made sturdy enough to stand under anticipated roadway conditions. All barricade framing shall meet the requirements of the NCHRP Report 350 or MASH under Category 3.

Barricade warning lights attached to Type II, Type III, Vertical or Direction Indicator barricades shall be placed above the top rail with the bottom of the lens 38 to 62 inches above the ground. The light shall be mounted close to the outboard end of the reflectorized rail on the side facing traffic. No portion of the light housing should obstruct the reflectorized rail in the predominant traffic direction.

### 6.4.5 Vertical Panels

(a) Specifications - Vertical panels used as channelizing devices shall be 8 to 12 inches wide and, at least 24 inches high, with the top positioned a minimum of 48 inches above the elevation of the roadway in accordance with IDOT Standard 701901 (See Appendix F). The entire face shall be colored and reflectorized following the same pattern and specifications given for barricade rails.

(b) Applications - The predominant use of vertical panels is to provide channelization and delineation where restricted lateral clearance precludes the use of barricades or drums. They may be used to delineate the edge of temporary roadways, such as crossovers and runarounds.

### 6.4.6 Tubular Markers

(a) Specifications - Tubular markers shall be predominantly orange, not less than 36 inches high and at least 2 inches wide facing traffic. They shall be made of a material that can be struck without damaging vehicles. For nighttime use, tubular markers shall be reflectorized.

(b) Application - Tubular markers have less visible area than other devices and should be used only where space restrictions do not allow for the use of other devices. Tubular markers shall not be used to separate opposite directions of traffic on Tollway facilities.

### 6.4.7 Barriers

(a) Applications - Barriers are devices designed to minimize penetration by a motor vehicle while redirecting an impacting vehicle in such a manner as to minimize damage to the vehicle and its occupants.

(b) Barrier Specifications - The standard type of temporary barrier to be used on the Tollway is the Temporary Concrete Barrier, per Section 704 of the Standard Specifications.

Barrier sections shall be precast in 12.5 feet sections. The ends of each section shall provide a key or connection which causes the barrier sections to act as a continuous chain when impacted. An additional provision may be made for fastening the units to an underlying pavement or bridge deck when allowable deflection is to be limited. Sections shall be designed to provide lifting points and sufficient reinforcing to withstand lifting stresses. Recesses shall be provided on the bottom sides which are of sufficient size to permit water to flow under the barrier without clogging.

Other forms of temporary barriers may be considered. The design for other barrier types or the proposed use of proprietary barriers however, must be submitted to the Tollway's Engineering Department for review and acceptance.

(c) Use of Barriers - Applications for when barriers may be warranted are discussed in Section 7, Use of Positive Protection Devices.

(d) Placement Considerations - Barriers shall not be used as channelizing tapers where merging is required. In such instances the lane should be closed using channelizing devices, such as barricades, to provide recovery space before the barrier is introduced.

Barriers have been found to be most effective up to impact angles of 15 degrees. They are to be placed essentially parallel to traffic flows and in no instances shall they be positioned such that impacts at angles greater than 15 degrees are anticipated.

The upstream end of barriers shall be treated in such a way as to preclude impact. This can be accomplished by flaring the barrier away from the travel path to a point well outside the clear zone. The preferred treatment is the use of a NCHRP 350 or MASH approved impact attenuators at the exposed end.

When a temporary barrier is placed such that it longitudinally abuts another barrier system, such as a guardrail or a bridge rail, a structural connection that meets NCHRP 350 or MASH Test Level 3, shall be provided to form a continuous barrier system with a smooth face in the direction of traffic flow.

(e) Barrier Installation

When installing a temporary concrete barrier, a certain amount of space must be provided behind the barrier. This space allows for lateral deflection of the barrier in the event of an impact from an errant vehicle. The amount of space needed behind the barrier depends on the design of the barrier being installed.

Construction strategy consideration shall be given to worker or equipment exposure when a particular construction activity will encroach within the barrier clearance distance. Providing concrete anchoring systems may be desirable based on the distance and time that workers or equipment are present within this zone along with the Longitudinal Drop-Off Policy discussed in Section 8.

Temporary concrete barrier is to be seated on bare, clean pavement or paved shoulder and pinned together in a smooth, continuous line. Temporary concrete barrier is not to be anchored on new bridge decks or bridge approach slabs , or where alternate anchoring details are shown on the plans. The barrier unit at each end of the installation shall be secured to the pavement or paved shoulder using six anchoring pins. This anchorage is necessary to establish the required tension in the barrier system. The end barrier unit facing oncoming traffic shall be shielded with a temporary impact attenuator, meeting the requirements of NCHRP 350 or MASH, Test Level 3.

Additional segment anchorage will be required for conditions where barrier clearance distance cannot be met. There are several anchoring systems for use to prevent overturning and lateral deflections greater than those obtained during the NCHRP 350 or MASH tests based on varying conditions.

Barriers located on bridge decks shall be restrained as shown in the plans. Anchor pins shall not be installed through new bridge decks or on bridge approach slabs.
Temporary Concrete Barrier has several critical components to perform properly:

1) Lateral Deflection. The distance that the barrier travels laterally, after an impact, under the guidance of NCHRP 350 or MASH.

2) Barrier Clearance Distance. The area behind the barrier, equal to or greater than the lateral deflection that must be free of obstacles (material, equipment, etc.) that may hinder the barrier's crashworthiness.

3) Minimum Deployment Length. Minimum assembly of 8 longitudinal concrete barrier segments (100 feet) excluding terminals or end anchorage devices, is required for any continuous run of TCB to perform as tested under NCHRP 350 or MASH criteria.

4) Shy Distance. A 1 foot minimum / 2 foot desirable offset from the travel lane to the temporary concrete barrier for mono-directional traffic.

5) Flare Rate. The flare rate for temporary precast concrete barriers shall be determined based upon the latest version of the AASHTO RDG. In no case on the Tollway shall the flare rate be steeper than 15:1 with respect to the edge of the marked traffic lane.

6) TCB Quality. Temporary concrete barrier shall conform to requirements in the Tollway's "Quality Standard for Work Zone Traffic Control Devices" current edition.

7) Barrier Anchorage. The anchorage of TCB to new pavement/slab other than the end units is not preferred.

(f) Temporary Concrete Barrier Anchoring Systems

1) Free-Standing System.

Free-standing TCB placement consists of the end barrier units being anchored into pavement or deck. The remaining units set atop pavement which are attached together by a constrained pin and loop type connection. The barrier clearance distance to be provided for this system is 3'-9".

2) Anchor Bolt System.

When overturning and lateral deflections cannot be tolerated, the temporary concrete barrier system must be anchored to the bridge deck or concrete pavement. Adequate barrier clearance distance from edge of unprotected deck or pavement drop-off shall be maintained for the type anchorage system provided. Each barrier segment anchorage shall be installed through holes on the lower portion of the traffic side face of the barrier to constrain deflection. The barrier unit at each end of the installation run shall be secured to the pavement, deck or paved shoulder using six anchoring pins. Barriers located on bridge decks shall be restrained as shown in the plans. Anchor pins shall not be installed through new bridge decks or on bridge approach slabs.

The Designer shall provide design details indicating the minimum edge distance placement, method of anchorage and barrier clearance distance.

3) HMA Pin-Down System.

On projects with HMA pavement material, epoxy bolt anchoring systems cannot be used because of the different mechanical properties of the bolts when placed in asphalt compared to concrete. On these projects, where barriers are needed closer to the hazard, the barriers are to be installed with an asphalt barrier pin assembly.

Each barrier segment anchorage shall be installed through holes on the lower portion of the traffic side face of the barrier to constrain deflection. When connected to free-standing temporary concrete barrier there exists a need for a transition in the relative stiffness and deflection of the systems. The free-standing temporary concrete barrier shall have an upstream and downstream transition anchoring the barrier segments into the pavement.

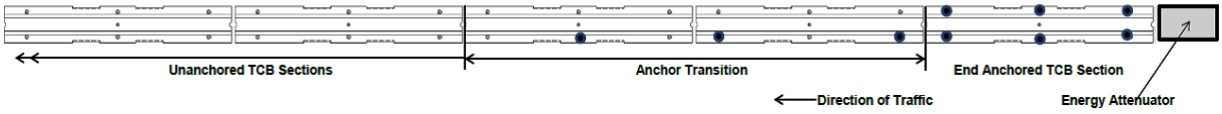
The Designer shall provide design details indicating the minimum edge distance placement, method of anchorage and barrier clearance distance.

4) Free-Standing to Rigid Temporary Concrete Barrier Transition.

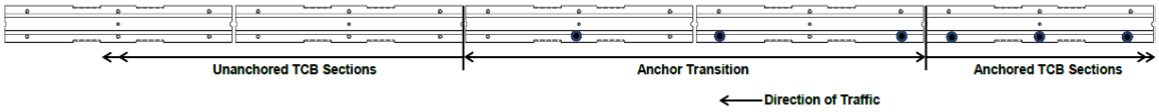
When a free-standing temporary concrete barrier system is connected to a rigid barrier, such as a concrete bridge rail or median barrier, there exists a need for a transition in the relative stiffness and deflection of the systems. The free-standing temporary concrete barrier shall have an upstream transition anchoring the barrier segments into the pavement. The end barrier in this transition section shall be connected to the pin down section with a structural connection that meets NCHRP 350 or MASH Test Level 3.
The Designer shall provide design details indicating the minimum edge distance placement, method of anchorage and barrier clearance distance.

5) Temporary Concrete Barrier Anchor Layout Transitions

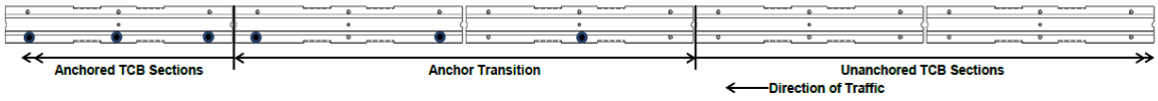
A transition shall be provided when anchored and free-standing TCB are connected. The transition from anchored to free-standing TCB shall consist of two anchor pins installed in the end holes on the traffic side of the first TCB beyond the anchored TCB section and one anchor pin installed in the middle hole on the traffic side of the second TCB beyond the anchored TCB section. The third TCB beyond the anchored TCB section shall then be free-standing (unanchored).



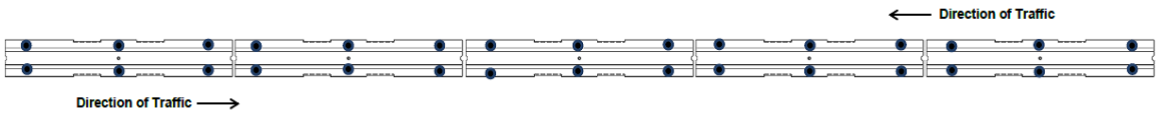

Condition 1: Freestanding Temporary Concrete Barrier
Anchor Layout




Condition 2: Anchored to Freestanding Temporary Concrete Barrier
Anchor layout




Condition 3: Freestanding to Anchored Temporary Concrete Barrier
Anchor layout




Condition 4: Counterflow Temporary Concrete Barrier
Anchor layout

(g) Proprietary Temporary Traffic Barrier (PTTB)

A proprietary temporary traffic barrier (PTTB) may be used for work zones or lane separation situations. The required barrier clearance distance shall be based upon the dynamic deflection exhibited in the manufacturer's crash testing results. When free-standing installations are used, the barrier clearance distance shall be required based on the NCHRP 350 or MASH TL-3 dynamic lateral deflection for roadway excavation edge drop-offs and equipment and material storage locations. NCHRP 350 or MASH TL-3 tested anchoring systems may be used to reduce the above barrier clearance distance, dependent on manufacturer's recommendation.

The Designer shall provide design details indicating the minimum edge distance placement, method of anchorage and barrier clearance distance.

(h) "Y" Shape -Temporary Concrete Barrier.

The "Y" shape concrete barrier is used to split one run of TCB into dual runs. This barrier attaches directly to IDOT's 32 inch TCB. At least one standard TCB segment shall be attached between the "Y" shape and an impact attenuator. This barrier shall not be used in an unanchored configuration. An Impact Attenuator, Temporary (Fully Redirective, Wide), TL-3 may be used as an alternate to the TCB "Y" connector segment, see Article 6.7.1.

Reference Document (Current Edition): Base Sheet M-MOT-700

(i) Temporary Guardrail

Temporary guardrail must meet current Tollway Standards for steel plate beam guardrail. Existing guardrail in satisfactory condition may be extended as long as the temporary guardrail matches in design the system to which it attaches to and a proper barrier warrant has been completed. Once the temporary guardrail system is no longer in use the entire guardrail system must be removed and replaced with a new guardrail installation which meets current Tollway Standards.

Existing guardrail system with steel block-outs may not be modified.

(j) Remove and Reinstall Existing Guardrail

The Tollway has allowed the temporary removal and reinstallation of a small section of existing guardrail when all of the following conditions have been met:

1) To provide temporary access for the Contractor to get equipment or materials to a work area.

2) Going around the guardrail is either impractical or very difficult.

3) The adjacent roadway rehabilitation or the existing guardrail upgrade is programmed within the next five years.
4) The existing run of guardrail is not the current Tollway standard.

5) The existing run of guardrail (including terminals) meets NCHRP 350 Test Level 3 criteria.

6) Full tension capability is reestablished to the guardrail system.

7) Opening location shall be shielded as described below in Condition 2.

Once a rail section(s) of guardrail is removed, the guardrail system no longer functions as designed. It is essential that the full tension capability is reestablished to the guardrail system. When this operation is being performed the following measures may be considered based on the configuration of traffic control devices utilized for the projects maintenance of traffic.

Condition 1.

Work that occupies this opening location shall require the use of temporary warning devices, such as drums for either of the following situations:

1) Short-Term Stationary Work which is daytime work that occupies a location for more than 1 hour within a single daylight period.

2) Stationary Work which is performed during either daytime or nighttime that occupies a location for more than 1 hour while workers are continuously present.

When lanes of traffic are open adjacent to the guardrail affected, the shoulder shall be closed using Tollway Standard E3. Temporary warning devices, such as drums or other devices, in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), Part 6, Temporary Traffic Control, shall be placed a minimum of 1500' in advance of the opening or along the entire length of the guardrail run whichever is shorter.

Upon completion of work, the temporary barrier terminal assemblies shall be removed, the standard section(s) of guardrail shall be reinstalled and the full tension capability shall be reestablished to the guardrail system.

Condition 2.

Work that occupies this opening location shall require the use of temporary concrete barrier with an appropriate end impact attenuator to shield the work area for the following situations:

1) Intermediate-Term Stationary Work is work that occupies a location for more than 1 daylight period up to 3 days.

2) Long-Term Stationary Work is work that occupies a location for more than 3 days.

The Designer shall provide details in the MOT Plans. The end guardrail posts at each side of the opening shall be replaced with a temporary traffic barrier terminal compatible with the system affected which allows for the restoration of the full tension capability to the remaining guardrail system.

Upon completion of work, the temporary barrier terminal assemblies shall be removed, the standard section(s) of guardrail shall be reinstalled and the full tension capability shall be reestablished to the guardrail system.

## 6.5 Pavement Markings

### 6.5.1 Background

It must be recognized that drivers gain a great deal of guidance information from "reading the pavement," and pavement markings are a highly effective means of indicating paths to be followed. They can provide a most useful backup form of information in instances where channelizing devices are knocked down. Pavement markings shall be installed so as not to be in conflict with other traffic control devices.

### 6.5.2 Requirements

(a) Long-term Projects - For long-term projects pavement markings shall be modified to provide safe and orderly traffic flow through the work zone. Conflicting pavement markings shall be removed, covered, or obliterated as soon as practical following any change in traffic lanes and appropriate pavement markings installed as needed.

(b) Other Activities - For intermediate-term projects and other short-term operations it may be impractical to modify pavement markings. In such instances sufficient traffic control devices shall be used to provide a clear indication of proper travel paths. One means of mitigating pavement marking conflicts is to reduce the spacing on channelizing devices to form a channelizing pattern that is very dominant.

### 6.5.3 Materials

Temporary pavement markings using standard permanent materials should be applied to surfaces to be removed in subsequent stages of a multi-stage project or especially long-term projects where weather may become a factor (snow removal).

Pavement Marking Tape, Type IV shall be used on the final wearing surface when the temporary pavement marking will conflict with the permanent pavement marking such as on tapers, crossovers and lane shifts.

For projects with scheduled pavement markings being applied during late season, after October 15th and before April 15th, Late Season Temporary Pavement Markings (epoxy or polyuria) shall be used.

### 6.5.4 Pavement Markings Removal

Pavement markings shall be removed, covered with temporary marking materials, or obliterated without unduly damaging the pavement surface. Care must be taken to avoid leaving scars that give the appearance of delineation. Over-painting is not an acceptable method for obliteration, unless that portion of pavement surface will be removed or overlaid in a subsequent stage of construction.

Pavement markings on east-west roadways need to be evaluated because of the visibility issues caused by the varying angle of light reflecting off the roadway surface from the sun. Under these conditions, covering of the existing pavement markings will not be the most effective measure in establishing the temporary lane configurations. Based on the projects length, duration and time of year, engineering judgment shall be used in determining what measures are appropriate.

## 6.6 Lighting Devices

### 6.6.1 General Applications

At nighttime and during periods such as fog or heavy rainfall , clarity and distance of vision are severely reduced. Reflectorization will only partially compensate for the reduced vision, because it is limited to the adequacy of approaching vehicles headlights and the condition of the reflecting surface. Independent light sources may be used to warn or guide traffic through the work zone during nighttime and periods of reduced vision. Warning lights, floodlights, rotating lights and beacons and supplemental sign lighting are included in the list of independent sources which may be used.

### 6.6.2 Warning Lights

(a) Specifications - There are three types of warning lights which may be used. All are defined as portable, lens-directed enclosed lights emitting a yellow color. Detailed specifications for warning lights shall be in accordance with the "Purchase Specifications for Equipment and Material Standards of Institute of Transportation Engineers", Publication No-ST-OI7A, latest edition.

Please Note: Article 701.01 (a) of the Tollway Supplemental Specifications requires, “During severe weather conditions, Contractor personnel shall maintain continuous surveillance”, and as in Article 701.03 (c) of the Tollway Supplemental Specifications, “repair or replacement within 12 hours of notification.” The Contractor is responsible for replacing lighting units which have become defective. The Contractor shall be responsible for replacing light batteries on a group basis at such time as may be specified by the CM.

Please Note: Article 701.03 (e) of the Tollway Supplemental Specifications requires, “Lights shall be visible from a distance of 1500 feet under normal atmospheric conditions. All lights shall meet approval of the CM.

(b) Applications - Type A warning lights are low-intensity flashing lights to be used from dusk to dawn. They may be mounted on channelizing devices or advance warning signs to warn motorists that they are approaching or proceeding in a potentially hazardous area.

Type B lights are high-intensity flashing lights which are effective 24 hours a day.

Flashing lights may be mounted to advance warning signs or on independent supports.

Type C lights are low-intensity steady-burn lights used from dusk to dawn. When warning lights are used on channelizing devices positioned in a series to provide path guidance, they shall be steady-burn lights. Type C lights should be mounted on channelizing devices, as needed.

For nighttime closures Type II or vertical barricades shall be used with one Type C light per unit for channelizing tapers and to separate travel lanes from the work area or other adjacent hazardous areas.

### 6.6.3 Nighttime Lighting

Nighttime lighting is used on construction and maintenance projects to enable workers to see during nighttime operations. To a more limited extent they may also enable the approaching motorist to see what is taking place, but are usually not essential to the safe movement of traffic past the work area.

For nighttime flagging, flaggers shall be illuminated by an overhead source providing a minimum vertical illuminance of 10 foot candles measured 1 foot out from the flagger's chest. The bottom of any luminaire shall be a minimum of 10 feet above the pavement. Luminaire(s) shall be shielded to minimize glare to approaching traffic and trespass light to adjoining properties. The glare requirements are contained below.

### 6.6.4 Specifications

Reference IDOT Standard Specifications for Road and Bridge Construction, Section 702, Nighttime Work Zone Lighting.

The lighting system shall be designed to meet the following.

(a) Lighting Levels. The lighting system shall provide a minimum of 5 foot candles throughout the work area. For mobile operations, the illuminated work area shall be defined as 25 feet in front of and behind moving equipment. For stationary operations, the work area shall be defined as the entire area where work is being performed.

Lighting levels will be measured with an illuminance meter. Readings will be taken in a horizontal plane 3 feet above the pavement or ground surface.

(b) Glare Control. The lighting system shall be designed and operated so as to avoid glare that interferes with traffic, workers, or inspection personnel. Lighting systems with flood, spot, or stadium type luminaires shall be aimed downward at the work and rotated outward no greater than 30 degrees from nadir (straight down). Balloon lights shall be positioned at least 12 feet above the roadway.

As a large component of glare, the headlights of construction vehicles and equipment shall not be operated within the work zone except as allowed for specific construction operations. Headlights shall never be used when facing oncoming traffic.

(c) Light Trespass. The lighting system shall be designed to effectively light the work area without spilling over to adjoining property. When, in the opinion of the CM, the lighting is disturbing adjoining property, the Contractor shall modify the lighting arrangement or add hardware to shield the light trespass.

The lighting design required above shall be provided at any location where construction equipment is operating or workers are present on foot. When multiple operations are being carried on simultaneously, lighting shall be provided at each separate work area.

The lighting requirements for specific construction operations shall be as follows.

(a) Installation or Removal of Work Zone Traffic Control. The required lighting level shall be provided at each truck and piece of equipment used during the installation or removal of work zone traffic control. Headlights may be operated in the work zone.

(b) Milling and Paving. The required lighting level shall be provided by mounting a minimum of one balloon light to each piece of mobile construction equipment used in the work zone. This would include milling machines, mechanical sweepers, material transfer devices, spreading and finishing machines, and rollers; but not include trucks used to transport materials and personnel or other vehicles that are continuously moving in and out of the work zone. The headlights of construction equipment shall not be operated within the work zone.

(c) Patching. The required lighting level shall be provided at each patching location where work is being performed.

(d) Pavement Marking and Raised Reflective Pavement Marker Removal/Installation. The striping truck and the attenuator/arrow board trucks may be operated by headlights alone; however, additional lighting may be necessary for the operator of the striping truck to perform the work.

For raised reflective pavement marker removal and installation and other pavement marking operations where workers are on foot, the required lighting level shall be provided at each truck and piece of equipment.

(e) Layout, Testing, and Inspection. The required lighting level shall be provided for each active area of construction layout, material testing, and inspection. The work area shall be defined as 15 feet in front and back of the individual(s) performing the tasks.

### 6.6.5 Beacons

Rotating or flashing high-intensity yellow beacons shall be mounted at a minimum height of 7 feet on maintenance, construction or utility vehicles and equipment that are operated as part of a moving operation or that are used as either stationary or moving shadow vehicles. Such lights need not be used, however, if the vehicle displays a functioning vehicle mounted arrow board.

## 6.6.6 Arrow Boards

An arrow board is defined as a special lighting unit which displays a set of yellow lamps which can flash and/or sequence arrow or pattern to provide highly visible warning messages.

### 6.6.6.1 Specifications

Arrow boards may be either vehicle or trailer-mounted. They shall be operated by a self-contained power source, either batteries or electric generator, or the vehicle's electrical system when heavy duty components are installed, which can adequately provide the required power.

For daytime use, the minimum trailer-mounted arrow board size shall be 30” x 60” with 13 lamps. For nighttime use the minimum size is 48” x 96” with 15 lamps. The larger size shall be used for all stationary applications on long-term projects. Truck mounted arrow boards that are 36” x 72” may be used for short term Maintenance closures. The minimum mounting height shall be 6 feet to the bottom of the panel for vehicle-mounted arrow boards and 7 feet for trailer-mounted boards.

### 6.6.6.2 Applications

The primary use of arrow boards is to supplement a channelizing taper for lane closures. They should be used, as available, for all such short-term maintenance applications. They shall be used for nighttime closures and on all intermediate and long-term construction projects.

Arrow boards are also used for mainline traffic splitting around a center lane work area, or at the beginning of a counter-flow lane. Arrow boards shall be used as specified in the MOT Plates for moving operations.

Arrow boards have particularly important application for mobile and short-duration projects and as part of the transitory traffic control that may be required during the installation, modification or removal of the work zone.

### 6.6.6.3 Position

The standard location for an arrow board used to supplement a lane closure is:

- Approximately 2100 feet in advance of the beginning of the lane closure taper.
- Near the center of the closed lane approximately one-third of the distance downstream within a channelizing taper.

In locating the panel, however, consideration must be given to both the horizontal and vertical alignment of the approach roadway and to the presence of any obstacles that may obstruct its view. The board should be placed in a position which will maximize its upstream visibility. On horizontal curves to the left it may be desirable to position the board further to the right, if feasible, to place it closer to the axis of vision of approaching traffic. The converse situation applies on curves to the right.

#### 6.6.6.4 Operation

For lane closures the preferred mode of operation is the flashing (on-off) arrow. For exterior lane closures the arrow heads shall point in the direction of the open lane(s). When an interior lane is closed and traffic may pass on both sides of the work area, the double-headed arrow shall be displayed in a flashing mode.

When an arrow board is used for a shoulder closure and no merging maneuver is required, the board should be operated using the caution mode. This pattern commonly consists of only the stem of the arrow or four corners.

The light intensity shall be reduced during nighttime use to avoid glare and returned to full intensity for daytime use. For boards in a stationary position used on long-term projects, this dimming shall be accomplished automatically through the use of photo-electric devices, or equivalent.

### 6.6.7 Portable Changeable Message Signs

Portable Changeable Message Signs (PCMS) have the flexibility to display a variety of messages. They are frequently used to provide advance warning and information for highway alignment, traffic or other pertinent information. Each construction contract will contain the following:

- Type of PCMS to be used
- Placement/location PCMS are to be used
- Payment schedule

#### 6.6.7.1 PCMS Specifications

There are three types of portable changeable message signs approved for use on the Illinois Tollway.

- Three line PCMS
- Full matrix non-TIMS compatible PCMS
- TIMS compatible full matrix FMPCMS

The three line and the full matrix - non -TIMS compatible portable changeable message signs must meet the following specifications:

- 3 line 8 characters per line (18 inch characters)
- Top of sign height when deployed to maximum height – 150 inch minimum
- Solar powered battery charging
- 10 day battery life with no solar assistance
- 70 MPH wind rated

- 30 Degree/1000 feet visible LED design
- Day/night auto brightness
- Waterproof lockable cabinet for controller
- Password protected software
- 200 message storage capacity
- Remote programmable using internet based system
- DOT approved trailer with 3 inch opening Lunette Eye
- Must meet the following:
    - MUTCD
    - NTCIP compliant
    - AASHTO (NTPEP) tested

The TIMS compatible full matrix FMPCMS must be one from the Tollway's Maintenance and Traffic Division's Fleet Unit approved list. Contact the Tollway's Fleet unit for the approved list of TIMS compatible PCMS.

When TIMS compatible full matrix FMPCMS are used the Contractor must:

- Provide internet access for TIMS to access the sign controller
- Provide Automated Vehicle Location tracking for TIMS
- Have all PCMS inspected and approved by the Tollway's Fleet unit before putting on a job site.

**6.6.7.2 Applications**

Portable Changeable Message Signs are required as part of the advance signage for all lane closures or lane shifts of an intermediate or long-term duration. PCMS are also used to supplement other traffic control devices in advising users of unexpected traffic and routing situations or information that may be helpful to the users. (See Project Informational Signage Article 2.2)

DSE's shall provide in the Contract, three (3) FMPCMS on the Tollway per approach to the construction area. DSE should also determine if additional FMPCMS are needed on the crossroads.

Some applications include:

- Substantial reduction in speed
- Significant delays

- Adverse weather conditions
- Changes in roadway (alignment, surface conditions, etc.)
- Advance notice of closures (This includes complete closures of intersecting roadways, when such is requested by the applicable jurisdiction.)
- Stopped Traffic Ahead

## 6.7 Other Devices

### 6.7.1 Attenuators

Temporary impact attenuators are protective systems that help aid an errant vehicle from impacting fixed objects or shadow vehicles by either gradually decelerating the vehicle to a stop when hit head-on or by redirecting it away from the feature when struck on the side. These barriers are used for rigid objects or other features that cannot be removed, relocated, or made breakaway. All temporary impact attenuator products shall have fully redirective properties and be tested under NCHRP Report 350 or MASH at test level TL-3. There are two types of attenuators, roadside and truck-mounted (TMA).

Temporary impact attenuators, non-redirective, such as water and sand filled barriers are not permitted for use in the work zone.

The following systems as classified are appropriate only in work zones or other temporary installations. All proprietary roadside hardware devices must receive FHWA acceptance letters as a crashworthy product. To be considered for use on the Tollway, a given device must be on the Illinois Department of Transportation, Bureau of Materials and Physical Research; APPROVED LIST OF IMPACT ATTENUATORS, TEMPORARY as described below:

- IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, NARROW).
  This category of impact attenuators is for locations where narrow hazards are present and errant vehicles must not encroach behind the device.
- IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, WIDE).
  This category of impact attenuators is for locations where wide hazards are present and where space does not allow development of width transitions from other impact attenuators.
- IMPACT ATTENUATORS, TEMPORARY (FULLY REDIRECTIVE, RESETTABLE).
  This category of impact attenuators includes those crash cushions that either suffer very little, if any damage, upon impact and are easily pulled back into their full operating condition, or they partially rebound after an impact and may only need an inspection to ensure that no parts have been damaged, misaligned, etc.
- IMPACT ATTENUATORS, TEMPORARY (SEVERE USE, NARROW).
  This category of impact attenuators is for locations where narrow hazards are present, and frequent impacts are expected and/or where access for repairs would create unacceptable traffic control or operational problems. These crash cushions should retain some residual capacity to absorb additional frontal impacts while awaiting repairs.

IMPACT ATTENUATORS, TEMPORARY (SEVERE USE, WIDE).

This category of impact attenuators is for locations where wide hazards are present, and frequent impacts are expected and/or where access for repairs would create unacceptable traffic control or operational problems. These crash cushions should retain some residual capacity to absorb additional frontal impacts while awaiting repairs.

Reference Documents (Current Edition):

- Illinois Department of Transportation, Approved List for Materials for products.
- Proprietary Manufacturer's Design Guide and Installation Manual.

### 6.7.2 Rumble Strips

Rumble strips consist of intermittent narrow, transverse areas of rough textured or slightly raised or depressed road surface that alert drivers to unusual traffic conditions.

### 6.7.3 Shoulder Rumble Strips

Shoulder rumble strips consist of equally spaced depressions cut in the shoulder and installed continuous longitudinally and 12 inches from the edge of pavement.

### 6.7.4 Lane Channelizers

Vertical panels used to separate and delineate approved lanes to or from Plaza lanes.

### 6.7.5 Flexible Delineator Posts

Flexible post-mounted delineators are typically ground-mounted plastic posts with reflective sheeting that are used to delineate roadsides, interchanges and other areas in which safety is a concern. Flexible delineator posts are designed to withstand multiple impacts, limit damage to the impact vehicle and alleviate the potential for injury to vehicle occupants.

### 6.7.6 Glare Screens

Glare screens are used to block the driver's view of activities, and or minimize head light and other light that could distract from the driving task. Vertical and horizontal alignment along with lane shifts during MOT shall be evaluated to determine the need during staging operations.

Reference Document (Current Edition):
Illinois Bureau of Design and Environmental Manual.

### 6.7.7 Barrier Delineators

Barrier delineators are to be installed on temporary concrete barriers, guardrails and parapets as described in the Tollway Supplemental Specifications to the Illinois Department of Transportation, Article 701.03 Devices.

# SECTION 7.0 USE OF POSITIVE PROTECTION DEVICES

Positive protection devices are defined by the Federal Highway Administration (FHWA) as devices that contain and/or redirect vehicles and meet the crashworthiness evaluation criteria contained in National Cooperative Highway Research Program (NCHRP) Report 350 or MASH, Recommended Procedures for the Safety Performance Evaluation of Highway Features, 1993, Transportation Research Board, National Research Council.

The use of positive protection devices is to minimize the intrusion of motorized traffic into the work area and other potential roadside obstacles in the work zone. All barriers except permanent rigid barriers will deflect when hit by an errant vehicle. The amount of deflection is primarily dependent on the stiffness of the system. However, vehicle speed, angle of impact, and weight also affect the amount of barrier deflection.

A free standing barrier, where the base of the interior barriers are placed on a paved surface without physical attachment to that surface is the desired choice for providing protection in a work area and work zone. While some situations allow for placing free-standing barriers, other more restrictive situations require that each barrier be restrained using techniques such as anchoring, pinning, or bolting to the bridge deck or pavement to further limit any lateral barrier movement.

When barriers are crash-tested, it is impossible to replicate the innumerable variations in actual highway conditions. Therefore, barriers are crash-tested under standardized controlled conditions. Barriers are not placed with the assumption that the system will contain or redirect all vehicles in all conditions. They are placed with the assumption that under normal conditions, they may offer an improved safety condition for most collisions.

Exposure control measures should be considered where appropriate to avoid or minimize worker exposure to motorized traffic and exposure of road users to work activities, while also providing adequate consideration to the potential impacts on mobility.

Positive protection techniques, when properly implemented, can help improve safety for workers and the motoring public. However, careful evaluation needs to be exercised before installing positive protection devices. The decision to use positive protection should be based on the best overall management of safety, mobility, constructability, cost, and overall project duration. These guidelines are meant to be coupled with engineering judgment in determining the use of positive protection.

## 7.1 Typical Positive Protection Devices

The performance level for all types of positive protection device designs are to be crash tested and approved at test level three (TL3) and are acceptable for use on higher speed roadways under NCHRP Report 350 or MASH Guidelines. The listing of devices shall include, but are not limited to, the following:

(a) **Temporary Concrete Barrier**. Temporary concrete barrier is a set of freestanding, precast, concrete segments 12’-6” in length with built-in connection devices. Their profiles follow the same contours as other permanent safety shaped concrete barriers, that being the “F” shape. Reference Article 6.4.7 of this MOT MANUAL for anchorage installation guidelines.

(b) **Moveable Concrete Barrier**. The movable concrete barrier system consists of approximately 3 feet long precast, concrete segments of barrier connected by steel pins to form a barrier wall that is moved laterally with a transport/transfer vehicle. Reference the individual manufacturer's details and specifications for installation requirements.

(c) **Steel Shaped Barrier.** The steel shaped barrier system consists of long steel sections which can be interlocked to form a barrier wall. The individual barriers or assembled sections can be raised onto wheels with a hand crank or optional compressed air in which the barrier links can be repositioned. Reference the individual manufacturer's details and specifications for installation requirements.

(d) **Temporary Impact Attenuators.** Temporary impact attenuators are protective devices that are specifically designed to control deceleration of an impacting vehicle at an acceptable rate. These systems shall have redirective and non-gating properties such that a vehicle impacting into the attenuator is redirected away from the barrier back towards the traveled way. Reference the individual manufacturer's details and specifications for installation requirements.

(e) **Temporary guardrail.** Temporary guardrail consists of a metal beam rail with block-outs and metal posts that are the same as those allowed by the Tollway for its permanent installations. Materials employed for temporary guardrail do not need to be new, although they must be in like-new condition. All temporary guardrail is to be removed upon completion of use after construction.

When temporary guardrail is used to extend an existing system, the temporary guardrail must meet the details and standards of the system it is to be connected to. When any modification to an existing guardrail or terminal system is performed and a proper barrier warrant has been completed, the entire barrier installation shall be deemed temporary and completely removed upon completion of use after construction and replaced with a new system that conforms to the current Tollway Standards. Reference "Traffic Barrier Guidelines" for installation requirements.

(f) **Truck Mounted Attenuator.** This type of device is a temporary impact attenuator that is mounted on a truck of suitable size, as specified by the manufacturer. It provides attenuation by deformation of cartridges within the attenuator or some other manner of making the impact energy dissipate mechanically.

(g) **Balsi Beam.** This protection system is essentially a semi-trailer with two telescoping beams on each side. Each of the beams can be rotated to the other side to stack on the other beam, and provide a double beam barrier on the edge of a live traffic lane. The trailer can be extended to provide a thirty foot work area, shielded from traffic by the beams. It has its own dedicated tractor truck to transport it to the work area at normal highway speeds without the need for any permits. The system occupies eight feet of lane width, and does not allow large equipment access into the work zone directly from the rear. An adjacent lane or shoulder must be available for vehicles to access the protected work area. Reference the individual manufacturer's details and specifications for installation requirements.

(h) **Mobile Barrier Trailer.** The mobile barrier trailer protective system is an integrated, rigid wall, trailer that can be used in conjunction with standard semi-tractors to provide mobile, improved, safety and work environments for personnel at applicable maintenance and construction sites. It is capable of providing 40-100 feet of mobile positive protection. These units can provide a self contained work area with integral barrier system, onboard power, lighting, storage, signage and crash attenuation. It is designed to be driven from site to site at normal highway speeds. Reference the individual manufacturer's details and specifications for installation requirements.

## 7.2 Measures and Strategies

The types of measures and strategies to be used are not mutually exclusive to all work zones, and should be considered in combination as appropriate based on characteristics and factors such as those listed below:

1) Project scope

2) Project duration

3) Length of construction work zone for roadway, bridge and utility construction or maintenance projects

4) Anticipated traffic speeds through the work zone

5) Anticipated traffic volume

6) Vehicle mix

7) Type of work (as related to worker exposure and crash risks)

8) Distance between traffic and workers and extent of worker exposure

9) Escape paths available for workers to avoid a vehicle intrusion into the work area

10) Time of day (e.g. night work)

11) Work area restrictions (including impact on worker exposure)

12) Consequences from/to road users resulting from roadway departures

13) Potential hazard to workers and road users presented by device itself and during device placement and removal

14) Geometrics that may increase crash risks (e.g. poor sight distance, sharp curves)

15) Access to/from work area

16) Roadway classification (e.g. mainline, ramp)

17) Impacts on project cost and duration

## 7.3 Use of Positive Protection Devices

### 7.3.1 Condition I: Use of Positive Protection Devices by Engineering Judgment

The need for longitudinal traffic barrier and other positive protection devices in work zones shall be based on engineering evaluation and judgment to guide the decision making process. An engineering assessment should be based on consideration of the factors and characteristics described in Measures and Strategies.

Exposure along the work zone is directly related to the length of time needed for the construction activity. This is a very important point in the design decisions involving worker safety and the level of necessary protection for the traveling public. Also, the designs for work zones are more restrictive due to limiting alignments and cross-sectional areas. Positive protection devices shall be considered in work zone situations that place workers at increased risk from motorized traffic, and where positive protection devices offer the highest potential for increased safety for workers and road users, under the following conditions:

1) Work areas that provide workers no means of escape from motorized traffic.

   - Tunnels
   - Bridges
   - Narrow Medians
   - Others as determined by engineering judgment

2) Roadside hazards or conditions based on engineering judgment.

The Designer shall provide discussion in the Concept Report under maintenance of traffic, work zone conditions where the uses of positive protection devices are to be utilized. This assessment should continue during the project's plan development.

### 7.3.2 Condition II: Mandatory Use of Positive Protection Devices in Work Zones

Positive protection devices shall be utilized under the following work zone conditions:

1) Counter-flow Lanes.

   For temporary concrete barrier a desired 3'-9" barrier clearance distance shall be provided on each side of the barrier. This shall be measured from the toe of barrier to edge of traveled way. When the desired clearance distance is met the temporary concrete barrier can be installed free-standing.

When the desired barrier clearance cannot be met, the barrier system shall be anchored to the deck/pavement according to the clearance distance requirements for the individual positive protection device being utilized.

2) **Longitudinal Edge Drop-Offs** per Tollway Policy.

For temporary concrete barrier a desired 3'-9" barrier clearance distance shall be provided behind the temporary concrete barrier. This shall be measured from the toe of the barrier to the edge of drop-off. When the desired clearance distance is met the temporary concrete barrier can be installed free-standing.

When construction equipment or workers encroach within the barrier deflection limit for free-standing units, the barriers may be restrained using appropriate anchoring techniques to limit the lateral movement. The barrier system shall be anchored to the deck/pavement according to the clearance distance requirements for the individual positive protection device being utilized.

Reference: Barrier Installation Article 6.4.7 (e).
Longitudinal Edge Drop-Off Policy in Section 8 of this document.

3) **Mobile Operations;** intermittently or continuously.

If a standard lane closure is not used, then positive protective devices such as TMA's shall be used to close the lane in advance of the work or workers.

The positioning of the vehicles is dependent on a number of variables which must be assessed for each site location. Roll-ahead distance is the distance the shadow vehicle will displace when impacted. The roll-ahead distance is based on the weight of the shadow truck and attenuator and the weight of the impacting vehicle. The shadow truck should be positioned at a sufficient distance in advance of the workers or equipment being protected, however not so much that the errant vehicle will travel around into the work area. Reference the manufacturer's details and specifications for recommended distances.

# SECTION 8.0 LONGITUDINAL DROP- OFF POLICY

The following conditions have an established course of action which is intended to increase traffic safety using traffic control devices and safety related appurtenances for uneven lanes, milled edges, and edge drop-offs that occur in highway work zones. The best way to increase traffic safety is to minimize exposure to uneven lanes, milled edges, and edge drop-offs. Only when uneven lanes, milled edges, and edge drop-offs are deemed necessary, shall the appropriate portion(s) of this section be applied to enhance traffic safety.

No traffic control treatments are needed if edgelines are installed and shoulder widths and cross section slopes are the same as existing adjacent roadway sections.

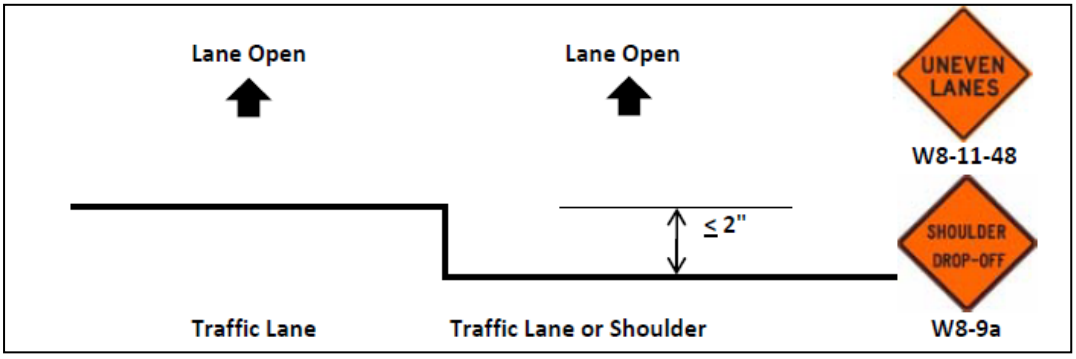
Drop-off is a temporary condition defined as an elevational difference between lanes, or the traveled lane and shoulder, as traversed by the wheel of a motor vehicle.

**Condition 1.** Drop-offs of $\leq$ 2 inch, between traffic carrying lanes do not require any traffic control treatments. Appropriate traffic warning signs “Uneven Lanes” or “Shoulder Drop Off” shall be posted to identify pavement conditions. At no time shall there be more than one uneven lane condition between the traffic carrying lanes which include auxiliary lanes and ramp access or egress areas. The drop-off location is not to be located outside of 3” from the pavement joint line.

MOT: No Lane Closures
Length of Continuous Drop-Off: Any
Duration: Any
45 MPH

Typical Applications:

- Milling Existing Wearing Surface
- Resurfacing Operations

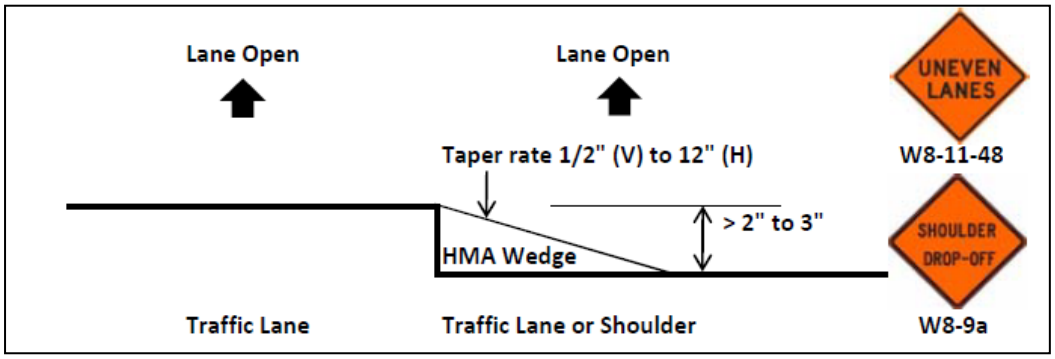


**Condition 2**. Drop-offs of > 2 to 3 inches, between traffic carrying lanes are permitted with the installation of a temporary HMA wedge. The wedge taper rate shall be ½ inch (V) to 12 inch (H). Tapered slopes shall be adequately compacted to provide a firm driving surface. Traffic warning signs "Uneven Lanes" or "Shoulder Drop Off" shall be posted to identify pavement conditions. At no time shall there be more than one uneven lane condition between the traffic carrying lanes which include auxiliary lanes and ramp access or egress areas.

MOT: No Lane Closures
Length of Continuous Drop-Off: Any
Duration: Any
Speeds: 55 MPH or Less

Typical Applications:

- Resurfacing Operations
- Partial Depth Pavement Patching



**Condition 3.** Drop-offs of ≤ 3 inch adjacent to traffic carrying lanes are permitted without tapers or temporary concrete barriers. A desired distance from edge of traveled way to edge of drop-off is 3 feet. Spacing of traffic control devices shall be in accordance with the applicable Tollway Standard Drawing.

**Note:** Tollway Standard for Lane Closure (E2) requires check barricades to be placed in the middle of the closed lane and at the shoulder at 1000 feet centers.

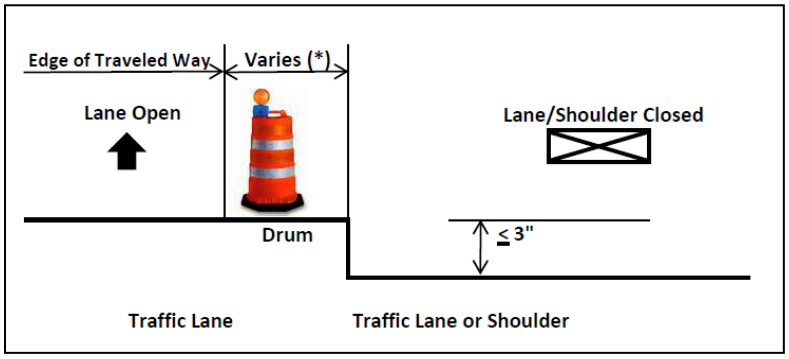
MOT:

- Lane Closure, Tollway Standard E2
- Shoulder Closure, Tollway Standard E3

Length of Continuous Drop-Off: Any
Duration: Any
Speeds: 65 MPH or Less.

Typical Applications:

- Milling Existing Wearing Surface
- Resurfacing Operations
- Partial Depth Pavement Patching




**(*) The desired distance from edge of traveled way to edge of drop-off is 3 feet.**

**Condition 4A.** Drop-offs of > 3 inch to ≤ 18 inch adjacent to traffic carrying lanes are permitted without tapers or temporary concrete barriers when the distance from the edge of traveled way to edge of drop-off is less than 3 feet. Spacing of traffic control devices shall be in accordance with the applicable Tollway Standard Drawing.

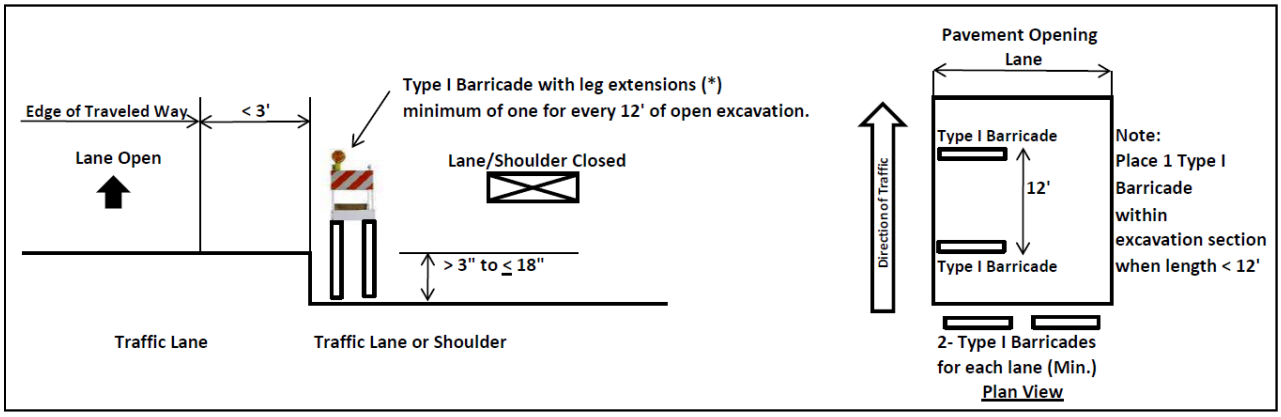
MOT:

- Lane Closure, Tollway Standard E2
- Shoulder Closure, Tollway Standard E3

Length of Continuous Drop-Off: ≤ 50 feet
Duration: ≤ 48 Hrs.
Speeds: 55 MPH or Less

Typical Applications:

- Full Depth Pavement Patching
- Drainage/Utility Excavation
- Bridge Deck Patching




**(*) Type I barricades placed inside the drop-off area are required only when no work is actively being performed within the excavated section.**

For each pavement opening, Type I barricades shall be placed in front of the opening. A minimum of two (2) Type I barricades shall be installed for each lane. The barricades shall remain for a period beginning immediately after removal is completed and until the curing period for the new concrete pavement has elapsed and all debris has been cleared away or until the excavated depth is less than 3 inch.

A minimum of one (1) Type I barricade shall be placed in the drop-off area every 12 feet of open excavation along the edge of the adjacent traffic lane. The Type I barricades placed inside the drop-off area shall have leg extensions and are only required when no work is actively being performed within the excavated section.

The maximum duration for Condition 4A is 48 hours.

**Condition 4B.** Drop-offs of > 3 inch to ≤ 18 inch adjacent to traffic carrying lanes are permitted without tapers or temporary concrete barriers provided a distance of 3 feet from the edge of traveled way to edge of drop-off is available for the placement of traffic drums. Spacing of traffic control devices shall be in accordance with the applicable Tollway Standard Drawing.

When workers or equipment are present within 3 feet or less from the edge of traveled way, the lane open to traffic shall be temporary closed during work activities.

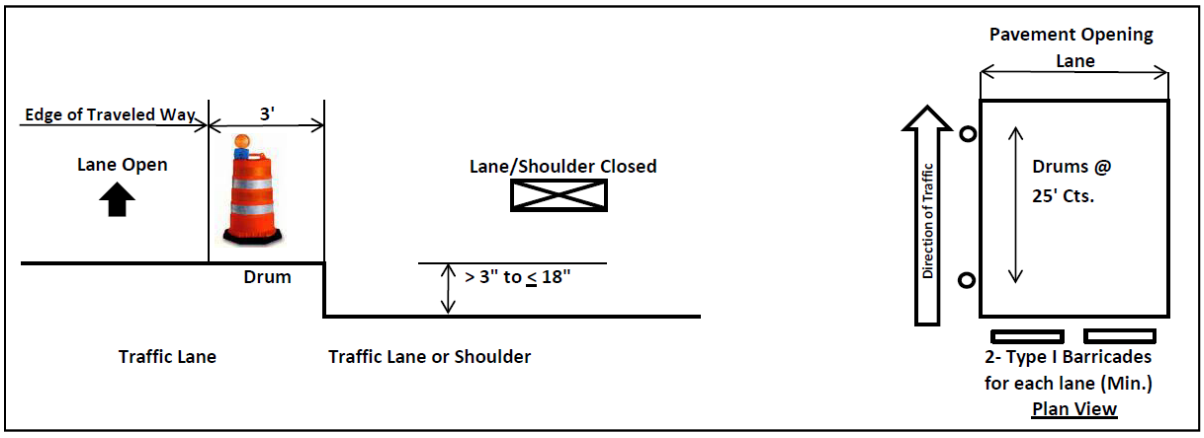
MOT:

- Lane Closure, Tollway Standard E2
- Shoulder Closure, Tollway Standard E3

Length of Continuous Drop-Off: ≤ 50 feet
Duration: ≤ 48 Hrs.
Speeds: 55 MPH or Less

Typical Applications:

- Full Depth Pavement Patching
- Drainage/Utility Excavation
- Bridge Deck Patching




For each pavement opening, Type I barricades shall be placed in front of the opening. A minimum of two (2) Type I barricades shall be installed for each lane. The barricades shall remain for a period beginning immediately after removal is completed and until the curing period for the new concrete pavement has elapsed and all debris has been cleared away or until the excavated depth is less than inch.

Additional drums are to be placed at 25 feet centers adjacent to the drop-off area for a minimum of 100 feet or the length of the drop-off area, whichever is greater.

The maximum duration for Condition 4B is 48 hours.

**Note:** There can be sections of pavement repair in which conditions 3, 4A and 4B are performed concurrently. Tollway Standard for Lane Closure (E2) requires check barricades to be placed in the middle of the closed lane and at the shoulder at 1000 feet centers.

**Condition 5.** Drop-offs of > 3 inch to ≤ 18 inch adjacent to traffic carrying lanes are permitted without tapers or temporary concrete barriers provided a distance of ≥ 6 feet from the edge of traveled way to edge of drop-off is available for the placement of traffic barricades. Spacing of traffic control devices shall be in accordance with the applicable Tollway Standard Drawing.

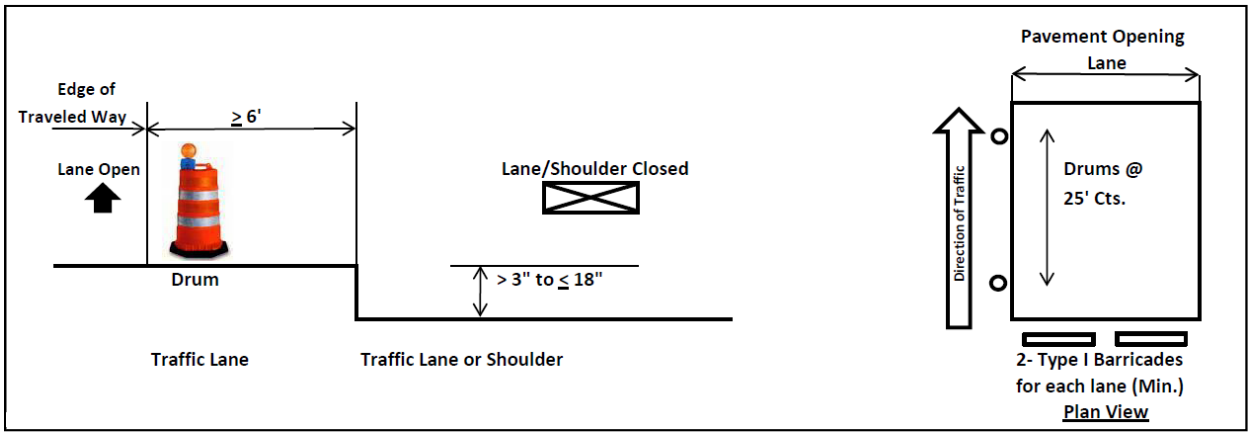
MOT:

- Lane Closure, Tollway Standard E2
- Shoulder Closure, Tollway Standard E3

Length of Continuous Drop-Off: > 50 feet
Duration: Any
**(or)**
Length of Continuous Drop-Off: ≤ 50 feet
Duration: ≤ 48 Hrs.
Speeds: 55 MPH or less

Typical Applications:

- Full Depth Pavement Patching
- Drainage/Utility Excavation
- Bridge Deck Patching




For each pavement opening, Type I barricades shall be placed in front of the opening. A minimum of two (2) Type I barricades shall be installed for each lane. The barricades shall remain for a period beginning immediately after removal is completed and until the curing period for the new concrete pavement has elapsed and all debris has been cleared away or until the excavated depth is less than 3 inch.

Additional drums are to be placed at 25 foot centers adjacent to the drop-off area for a minimum of 100 feet or the length of the drop-off area, whichever is greater.

**Note:** Tollway Standard for Lane Closure (E2) requires check barricades to be placed in the middle of the closed lane and at the shoulder at 1000 foot centers.

**Condition 6.** When Conditions 3 thru 5 cannot be met or by engineering judgment, drop-offs of > 3 inch adjacent to traffic carrying lanes are permitted with placement of temporary concrete barriers provided a distance of 3'-6" from edge of traveled way to edge of drop-off is maintained.

Temporary precast concrete barriers, Type F, are required on construction projects for traffic protection whenever existing bridge parapets are removed.

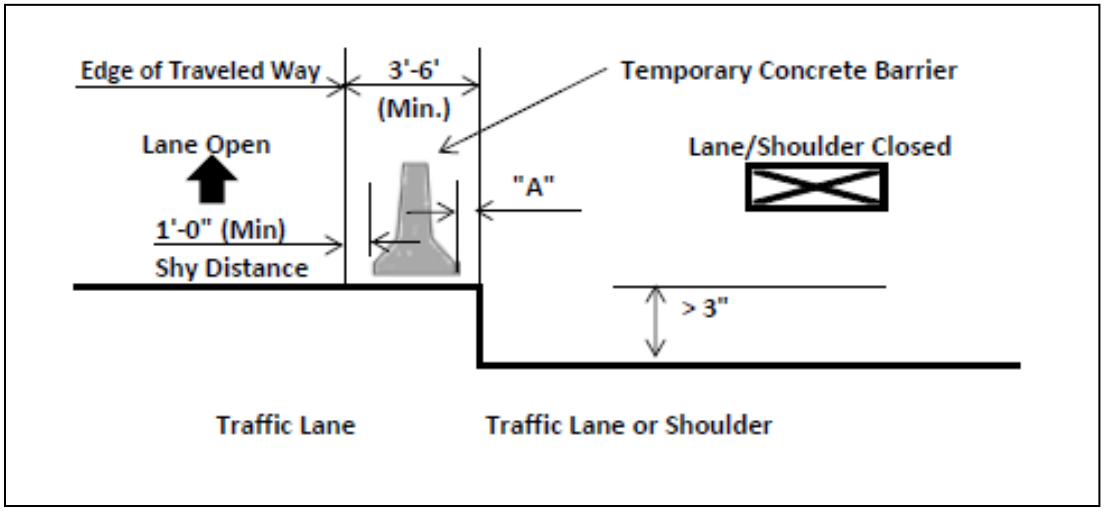
MOT:

- Lane Closure, Tollway Standard E2
- Shoulder Closure, Tollway Standard E3

When Conditions 1 thru 5 Cannot Be Met or By Engineering Judgment
Speeds: 65 MPH or less

Typical Applications:

- Partial/Full Depth Pavement Patching
- Drainage/Utility Excavation
- Reconstruction




When dimension "A" is less than 3'-9" the temporary concrete barrier shall be anchored to pavement or deck. Reference Article 6.4.7 of this MOT MANUAL for barrier anchorage systems.

**General Notes for Longitiudinal Drop-Off Conditions:**

1) All traffic control devices shall be in accordance with applicable Tollway Standard Drawings.

2) Check barricades shall be used as required.

3) A 1 foot minimum shy distance shall be maintained from the edge of traveled way to the traffic control device for Conditions 5 and 6.

# SECTION 9.0 INTELLIGENT TRANSPORTATION SYSTEMS (ITS) & TECHNOLOGY

The goal of intelligent transportation systems (ITS) is to improve the effectiveness, efficiency, and safety of the transportation system. The Tollway management systems utilized, manage traffic by using vehicle detectors, closed-circuit television cameras, variable message signs, computer software applications and graphical display systems aid the traffic operations center (TOC) personnel to manage traffic flow and improve the efficiency of the roadways. The purpose of these systems is to use real-time information to improve the flow of traffic, increase safety, reduce costs and improve traveler experience along the roadway corridors.

In order to sustain these systems it is important to have uninterrupted service during construction. Every effort must be made to assure that existing ITS elements remain functional during construction, or are temporarily replaced by other ITS equipment. This includes Dynamic Message Signs (DMS), Closed Circuit Television (CCTV) elements, Non-Intrusive Detection (NID), Microwave Vehicle Detection Systems (MVDS), wireless Ramp Queue (and mainline) Detection Systems (RQDS) using magnetic, acoustic, radio frequency (RF) or other sensor technologies, Weigh in Motion (WIM) systems and Roadway Weather Information Systems (RWIS). Minimization of disruption of power or communications to the ITS element shall be addressed.

Relocation or temporary replacement of any ITS element in the path of construction to a temporary location/structure must be included in the design of each project.

Element type and current location can be obtained through the Tollway's Utilities Manager, Traffic Operations Center (TOC) Manager and ITS Deployment Engineer. Coordinate removal/relocation and installation of ITS elements with the ITS Deployment Engineer. These units shall be placed in such a manner as to not become hazards to the motoring public.

## 9.1 Tollway ITS (Intelligent Transportation Systems) Standard Procedures

### 9.1.1 Design Phase Procedures

The DSE shall be proactive in determining whether new ITS elements should be included in the Contract. The most recent ITS elements types and location can be obtained from the ITS Unit..

In the Design phase, every effort should be made to place each ITS element in its final location in the plans. The designer shall consult with the ITS Manager (Traffic Operation Manager) who will review the planning documents and make the final decision in determining new or relocated sites of any ITS Element. Design phase details of the new or relocated ITS element should include specifications, plans and cost estimates.

The designer shall provide for a temporary ITS element to be utilized when the out of service time ("outage" period) is anticipated to exceed the daily lane closure period. The 100% availability of ITS elements is essential to the efficient management of daily rush hour traffic, as well as being essential to the management of construction zone traffic and incidents. When an ITS element must be out of service for a longer period, the DSE is to consult with the TOC Manager to develop a mitigation plan. The designer shall provide an out of service time estimate to the PM and TOC Manager as well as a detailed mitigation plan for the outage(s).

The Design Phase should also include Construction Phase procedures which give the Contractor guidance during the ITS element removal/relocation, misalignment or temporary replacement period.

### 9.1.2 Construction Phase Procedures

This article discusses the removal, relocation, reconfiguration or storage of ITS elements during the Construction phase. The following procedures shall be adhered to prior to **ANY** Construction phase removal, disconnection, relocation, or alteration of any ITS element such as (but not limited to) described in Article 9.2.

A common ITS Outage form (forms ITS-01 and ITS-02) is available on the Web-Base Management System, Project 16, under File Management-Folder Templates and Forms, ITS Reference Documents) to be filled out and returned to specific personnel (Tollway PM will provide current Contact Information). Note that the form is applicable to all types of ITS elements, therefore, the Contractor shall be required to fill out this form according to the ITS element affected. This form must be submitted into the system within a specified time prior to the work being started. A detailed contact list can be obtained from the Traffic Operations Manager (630.241.6800 x-3320) or the Traffic Operations Center (TOC) Manager (630.241.6800 x-3703).

Throughout this article, all coordination shall begin with the Traffic Operations Manager followed by the TOC Manager unless otherwise noted in the contract that coordination begins with others (such as Delcan or Traffic.com).

When temporary locations are determined, the Contractor shall attach one or more of the following to assist in the review process:

- Plans
- Schematics
- Aerial View

The Contractor shall also provide GPS (Global Positioning System) locates. The GPS locates shall be in accordance with the ISO (International Organization for Standards) 3110 process.

When equipment is permanently removed, then it must be given back to the Tollway utilizing an A-14 form (Inventory Control Form) available on the Web-Base Management System, Project 16, under File Management-Folder-A Forms). The Contractor shall confer with the Tollway regarding the coordination of equipment transfer.

Per Article 108.09 of the Tollway Supplemental Specifications to IDOT Standard Specifications or Special Provisions (SP) 115, the Contractor shall pay to the Tollway liquidated damages for each and every calendar day beyond the Tollway approved out of service days agreed upon if it is deemed the responsibility of the Contractor.

Any ITS element that is disconnected can be defined as disconnected from the power source and / or from its communication source (whether wireless or wired). When an ITS element is relocated, then the power source and communications source need to be reconnected. In some cases, there may be instances when a Fiber Optic cable or a power cable is required to be relocated but the ITS element connected to that Fiber Optic cable or power cable is not

removed and relocated. These cases will be handled in a similar fashion as if the ITS element itself were removed and relocated.

In cases when a construction contract has been initiated and these procedures do not make it into the Contract Documents, then an Extra Work Order (EWO) will be required to execute the work described herein.

Schedule of Notification. Upon submittal of the preliminary detailed progress schedule (14 days after NTP), the Contractor shall make email notifications to the TOC Manager regarding the ITS elements in conflict. The Contactor shall identify the approximate dates of the relocation or outage (or the date in which the work will ultimately begin) and the expected duration of the outage. Any planned outage extending beyond the start of the next twice-daily peak travel period will require an approved mitigation plan. Other ITS equipment may be used to mitigate the loss of permanent ITS equipment which is normally used to implement Smart Work Zones during construction.

The ITS Outage (ITS-01) form shall be submitted via email to the ITS Deployment Engineer at least 2 weeks prior to the work commencing. Any changes to this form shall be submitted via email and phone call at least two (2) days prior to work commencing. The Construction Manager (CM) must call the TOC Manager the day work begins providing an approximate start time and duration of the outage in order to obtain final approval to proceed. After installation of any ITS element, the TOC manager shall be contacted to confirm proper initial operation of installed devices and all associated equipment. If additional burn-in testing requirements exist, they will be specified in the contract specifications and should then be followed.

## 9.2 ITS Element Details

The Contractor shall use the ITS element details below when completing the Form ITS-01 and ITS -02, available on the Web-Base Management System, Project 16, under File Management-Folder- Public Communications.

### 9.2.1 CCTV (Closed Circuit TV) Camera

Any CCTV Camera(s) that requires disconnection due to construction, shall be temporarily relocated until the construction phase is completed or the new camera(s) is (are) installed. The disconnection and subsequent relocation shall be coordinated with the Tollway TOC Manager and Tollway ITS Deployment Engineer. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly. For outages lasting beyond the start of the next twice-daily peak travel period, prior to disconnection, the Contractor shall install and test a camera (if contractually required) to replace the camera to be out of service.

### 9.2.2 Plaza / Control Building Equipment

Any equipment located in a plaza or control building that requires turning off, disconnection, removal or relocation must be coordinated with the Tollway's TOC Manager, I.T. Data Communication Manager and the Tollway's ITS Deployment Engineer. This equipment may include (but is not limited to): cables, power supplies, video switches, video backhaul, network switches, fiber optic transceivers, etc. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly.

### 9.2.3 MVDS (Microwave Vehicle Detection System)

*Removal/Relocate/Storage*

Any MVDS unit disconnection due to construction purposes must be coordinated with the TOC Manager and the ITS Deployment Engineer. If it is necessary to relocate an MVDS unit, then every effort should be made to place the MVDS unit in its final location. Any single unit relocation required through the duration of the project shall be responsibility of the Contractor. The goal is to remove and immediately relocate the MVDS unit. If construction conditions do not facilitate a removal and immediate relocation, then the Contractor shall remove and store the unit. Once the unit can be re-installed then the Contractor shall complete the re-installation. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly.

*Stage Change Coordination*

Any MVDS unit within construction limits and Maintenance of Traffic (MOT) stage change limits must be recalibrated to Tollway standards at the beginning of each stage to pick up the new traffic lane configurations. The goal is to use MVDS units within construction limits to provide travel times to Tollway patrons entering construction zones. To accommodate this goal, the Contractor shall provide stage change diagrams and lane configuration cross sections at each MVDS unit at the 21 day meeting. The Contractor shall also provide these documents electronically to the Traffic Operations Manager and the TOC Manager by the 21 day meeting. The Contractor shall utilize Form ITS-02 accordingly. Where this recalibration is impractical, and is otherwise specified in the contract scope, the Contractor shall deploy blue tooth traffic sensors prior to the first MOT shift, provide monthly processing and blue tooth data feed into the Tollway and maintain them throughout the construction period. Then the MVDS units may be deactivated until construction ends.

### 9.2.4 DMS (Dynamic Message Sign)

DMS signs are critical elements of the Tollway traffic management system and are not to remain out of service beyond the start of the next twice-daily peak traffic period if at all possible. Any DMS unit disconnection due to construction purposes must be coordinated with the TOC Manager, the ITS Deployment Engineer, and the Tollway IT department (only if involving a tag reader). The temporary relocation of DMS is allowed, when involving no more than a 2 working day outage, preferably over a weekend if required due to construction conflicts. Contractor to furnish and install a minimum of one (1) Tollway approved and pre-tested (with TIMS) Full Matrix Portable Changeable Message Sign (PCMS) during approved DMS out of service time beyond 24 hours. The PCMS will be utilized for incident and travel time messaging. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly.

### 9.2.5 RWIS (Road Weather Information System)

Co-ordinate with the ITS Deployment Engineer to obtain an RWIS Pre-construction Test Report prior to commencing construction activity in the vicinity of an RWIS system. All affected RWIS roadway sensors are to be replaced with non-intrusive temperature sensors prior to commencing pavement grinding, stripping or resurfacing operations at a RWIS site. Any RWIS unit or roadway sensor disconnection due to construction purposes must be coordinated with Tollway's ITS Deployment Engineer and the TOC Manager. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly. The Contractor is responsible for restoring the RWIS to 100% functionality after construction unless the Pre-construction report shows a pre-existing failure. Even if the construction period spans more than one year, the Contractor shall restore the RWIS to full operation during snow season (December thru March).

### 9.2.6 WIM (Weigh in Motion)

All affected WIM roadway sensors are to be disconnected and/or removed prior to commencing pavement grinding, stripping or resurfacing operations at a WIM site. Any WIM unit disconnection or in-pavement sensor disconnection due to construction purposes must be coordinated with the Tollway's ITS Deployment Engineer and the TOC Manager. All in-pavement WIM sensors affected by roadway construction must be replaced with new sensors and that the entire system must be recalibrated at the end of road construction. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly.

### 9.2.7 RQDS (Ramp Queue Detection System)

RQDS (queue/count system) elements are for the most part wireless and off-road, therefore not affected by road construction. The exceptions are the Access Point (connected to a camera system) and the in-pavement magnetic detection sensors. They can be removed and reinstalled in less than one hour. This should be done prior to commencing any pavement grinding, stripping or resurfacing operations at a RQDS sensor location. Any RQDS element disconnection due to construction purposes must be coordinated with the ITS Deployment Engineer and the TOC Manager. Planned removal of permanent RQDS must include temporary replacement with NID equipment. Testing of NID equipment and its interface to the TIMS system must be conducted with Traffic Operations Center. If it is necessary to relocate the RQDS unit, then every effort should be made to place the RQDS unit in its final location. Contractor must coordinate with the ITS Deployment Engineer for interface of the permanent system to the ITS network. Testing of the permanent system and its interface to the TIMS system must be conducted by the Contractor and witnessed by the ITS Deployment Engineer. The goal is to remove and immediately relocate the RQDS unit. If construction conditions do not facilitate a removal and immediate relocation, then the Contractor will remove and store the unit if approved by the Tollway. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly.

### 9.2.8 Blue Tooth Traffic Sensors

These sensors are quickly relocatable, omni-directional, and do not require calibration. Even though they can and should be relocated within a single non-peak traffic window, co-ordination still must be handled through the ITS Deployment Engineer and the TOC Manager.

### 9.2.9 Power Service and Cable

Any power service or cable disconnection may affect ITS elements when these elements are powered from those sources. When these services or cables are disrupted due to construction purposes, then coordination must be handled through the ITS Deployment Engineer and TOC manager. Outages lasting beyond the start of the next twice-daily peak travel period are to be avoided. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly.

### 9.2.10 Fiber Optic Cable

Any Fiber Optic cable disconnection may affect ITS elements when these elements communicate through this cable. When these cables are disrupted due to construction purposes, then coordination must be handled through the ITS Deployment Engineer and the TOC manager. Outages lasting beyond the start of the next twice-daily peak travel period are to be avoided. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly.

### 9.2.11 Temporary Interruption of an ITS Element

Outages lasting beyond the start of the next twice-daily peak travel period are to be avoided. Final approval of all scheduled outages of ITS elements that will temporarily be disrupted due to construction purposes will need to be obtained by calling the TOC manager on the day of the outage prior to its commencement. The hours of 5:00 AM – 9:00 AM and 3:00 PM to 7:00 PM are to be avoided. See schedule of notification-Article 9.1.2. The Contractor shall utilize Form ITS-01 accordingly.

# SECTION 10.0 SMART WORK ZONE (SWZ)

The Smart Work Zone (SWZ) is a fully integrated, organic function of the Tollway's Intelligent Transportation System. Prior to the start of construction, the TOC Manager defines one or more SWZs in each direction within a construction zone by choosing start and end mileposts and configuring the SWZ in TIMS. The TIMS system automatically incorporates all permanent ITS sensors (CCTV, MVDS, RQDS, NID, Blue Tooth, DMS, etc.) within these milepost limits into it. Then additional sensors and full matrix PCMS (FMPCMS) signs are added to the SWZ as needed to configure a customized solution for the particular work zone. Each FMPCMS is further customized with preselected messages that are triggered by real-time traffic conditions. Any automatic messaging can be overridden by TOC operators as needed. The nearest DMS signs are also configured to provide SWZ messages, if appropriate.

The purpose of this system is to provide advance traffic condition information to motorists at key decision points due to construction activity. The information reported to the public may include an accurate drive time through the work zone, the congestion level to expect or other relevant information. This system shall be in operation 24 hours per day, seven days per week, during the construction period.

The Contractor furnishes, installs and maintains the following components of the SWZ:

- Full Matrix Portable Changeable Message Signs (minimum of 6 - more for larger work zones as determined by the Designer and TOC Manager).

- Additional non-intrusive traffic sensors (such as Blue Tooth sensors as determined by the Designer and Traffic Operation Manager).

- Solar/battery powered CCTV and vehicle detection devices on poles outside of the clear zone or shielded behind barriers where existing fixed ITS equipment offers inadequate coverage.

The Contractor shall repair or replace within 24 hours any additional ITS unit that fails while construction work is in progress. This includes all failures, but especially communication failures, power system failures, sensor failures and Automatic Vehicle Locator (AVL) failures.

The Contractor shall complete the repositioning of PCMS or Bluetoad unit within the work zone within 4 hours of receiving each request for repositioning from the TOC Manager. The Contractor shall reposition each unit during each stage change as needed.

These devices (if not crashworthy) must be placed outside of the clear zone or behind otherwise warranted barrier.

# SECTION 11.0 INSTALLATION AND OPERATION OF WORK ZONES

## 11.1 Installation, Modification and Removal

### 11.1.1 Need for Expediency

It is important that the installation, modification or removal of work zones proceed as expeditiously and rapidly as practical to minimize the period of time that workers and motorists alike are exposed to changing conditions. Thorough planning and preparation are necessary prior to performing these functions to insure that they are performed efficiently and effectively.

### 11.1.2 Types of Closures

#### 11.1.2.1 Scheduled or Contract Closure

A scheduled or contract closure typically includes a MOT plan that has been previously submitted, reviewed and approved.

#### 11.1.2.2 Daily Closure

A daily closure typically includes most maintenance activities and contract projects that did not require a MOT plan.

#### 11.1.2.3 Permit Closure

A permit closure includes any board approved or construction approved permits such as utility repair/installation or outside agency (IDOT, counties, etc.) coordination project.

#### 11.1.2.4 Emergency (non-incident) Closure

An emergency (non-incident) closure typically involves unanticipated maintenance and contract activities on the roadway where the need to complete is immediate without advance notice. These may include failed pavement or joints that pose a safety concern or repair/replacement of the roadway or appurtenances due to an incident.

#### 11.1.2.5 Emergency (incident) Closure

Typically, an emergency (incident) closure includes any incident occurring on the roadway requiring a lane closure.

### 11.1.3 Preparation

Each of the following steps should be taken to prepare for an orderly establishment of work zone traffic control. Advance planning, coordination and scheduling are essential components of the process. The following is intended for construction projects and any other major activities that are either of a long-term nature or will have a significant impact upon traffic operations.

There shall be a clear assignment of responsibility for installing and operating the MOT plan. For maintenance projects, the respective Tollway Maintenance Section Manager/Supervisor shall be the responsible person. For contract work, the Contractor shall designate a Work Zone Traffic Supervisor who has at least one year of experience directly related to work zone traffic control, to be responsible for MOT in the work zone.

Crew and equipment requirements shall be determined on the basis of a detailed review of the proposed MOT plan. For contract work, the Contractor's responsible person and the CM shall be present at the review.

The equipment and devices to be installed should be checked before the installation to insure that each device is on hand, in satisfactory condition, clean and ready for field installation. Contractors shall furnish to the CM a list of equipment to be installed so that the devices may be inspected before installation.

The position of traffic control devices at the work zone should be determined before installation. For complex MOT plans it may be necessary to pre-mark on the roadway the proper position for such devices. Pre-marking should be done in advance of installation following prescribed traffic control procedures.

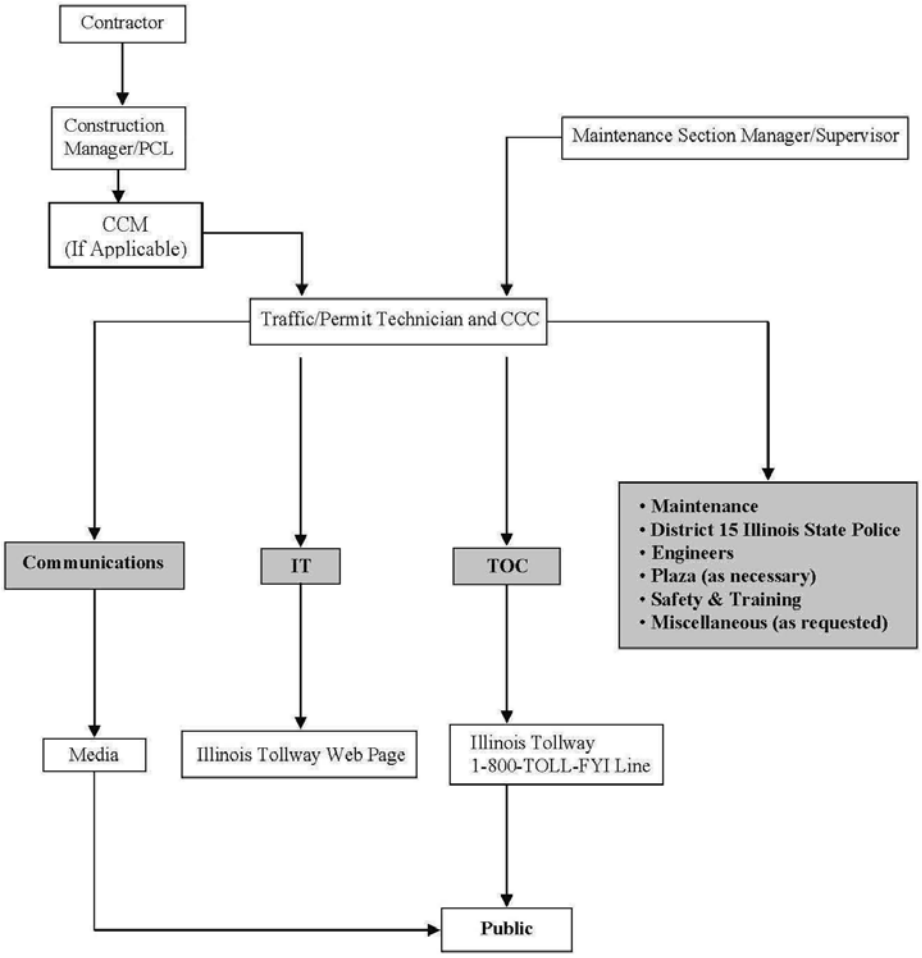
### 11.1.4 Notification

All parties directly affected by the project shall be notified upon establishment of the project schedule so that their activities can be coordinated with the project. This notification shall state when work will start, where the project is located, direction of travel and lanes involved, description of the project and the duration. The Tollway's Engineering and Communications Departments, Traffic/Permit Technician, Maintenance District Manager and District 15 Illinois State Police (ISP) shall be included in the notification. Reports of traffic control operations will be issued by the Tollway to keep all parties informed of current conditions at the work zone after the project is underway.

The Contractors will provide a proposed master plan schedule for lane closures prior to the Notice to Proceed and shall update the plan as necessary.

The Engineering Department Maintenance & Traffic Division has, ultimately, the final approval for all lane closures. For reviewing and scheduling purposes, a detailed road closure plan must be submitted for all scheduled lane closures (as defined in Article 5.1.2.) to the Incident Manager 10 days prior to the date of the required closure. Temporary lane closures must be requested through the Traffic/Permit Technician during Tollway business hours, before 9 a.m. the working day preceding the closure. For contract work, the Contractor should submit the lane closure to the CM for approval prior to submittal to the Traffic/Permit Technician and CCC. Appendix B includes a sample form used to request lane closures from the CM. The CM will notify, by electronic mail, Traffic/Permit Technician, Communications, Maintenance, Plazas (if necessary), Engineering, TOC, IT, Safety and Training, ISP and others as requested. The following flow chart illustrates the process for non-emergency lane closure notification.

***General Process for Lane Closure Notification***




*Lane Closure Process Diagram*

Emergency (incident) notification is handled by Illinois State Police District 15 and on-site maintenance personnel through existing communication procedures.

### 11.1.5 Sequence

(a) Installation Sequence - The work zone is installed in the direction that traffic is moving. Devices are placed in the Advance Warning Area as the first step. One pass through the area is made to place signs on the right side of the roadway. A second pass is made to place signs on the left side. Reference Exhibit 1, Elements of a Work Zone Article 5.2.1.

Next, the devices in the Transition Area are placed in the downstream direction. When lane closures are involved, the installation of these first two areas should be performed as quickly as practical.

The devices in the Activity Area are then installed, again working downstream. Lastly, the devices in the Termination Area are placed.

Exhibit 2 illustrates the procedure for carrying out the center lane closure.

(b) Removal Sequence - The removal sequence is essentially the reverse of that employed for the installation process, with one important exception; work vehicles shall not back up in an open lane.

Working upstream, the devices in the Termination Area and then the Work Area are picked up. Next, the devices in the Transition Area are picked up with a work vehicle positioned in the closed lane or on the shoulder, if available.

Two downstream passes must then be made with traffic to retrieve the signs in the Advance Warning Area--first on the left side of the roadway and second on the right side.

(c) Modification - Work zones often require modification for each phase of a major project. The modification process is a combination of removal and installation steps. The modification plan shall be devised using the principles set forth above. During such alterations, particular care must be exercised to provide clear instructions to drivers during each step of the modification.

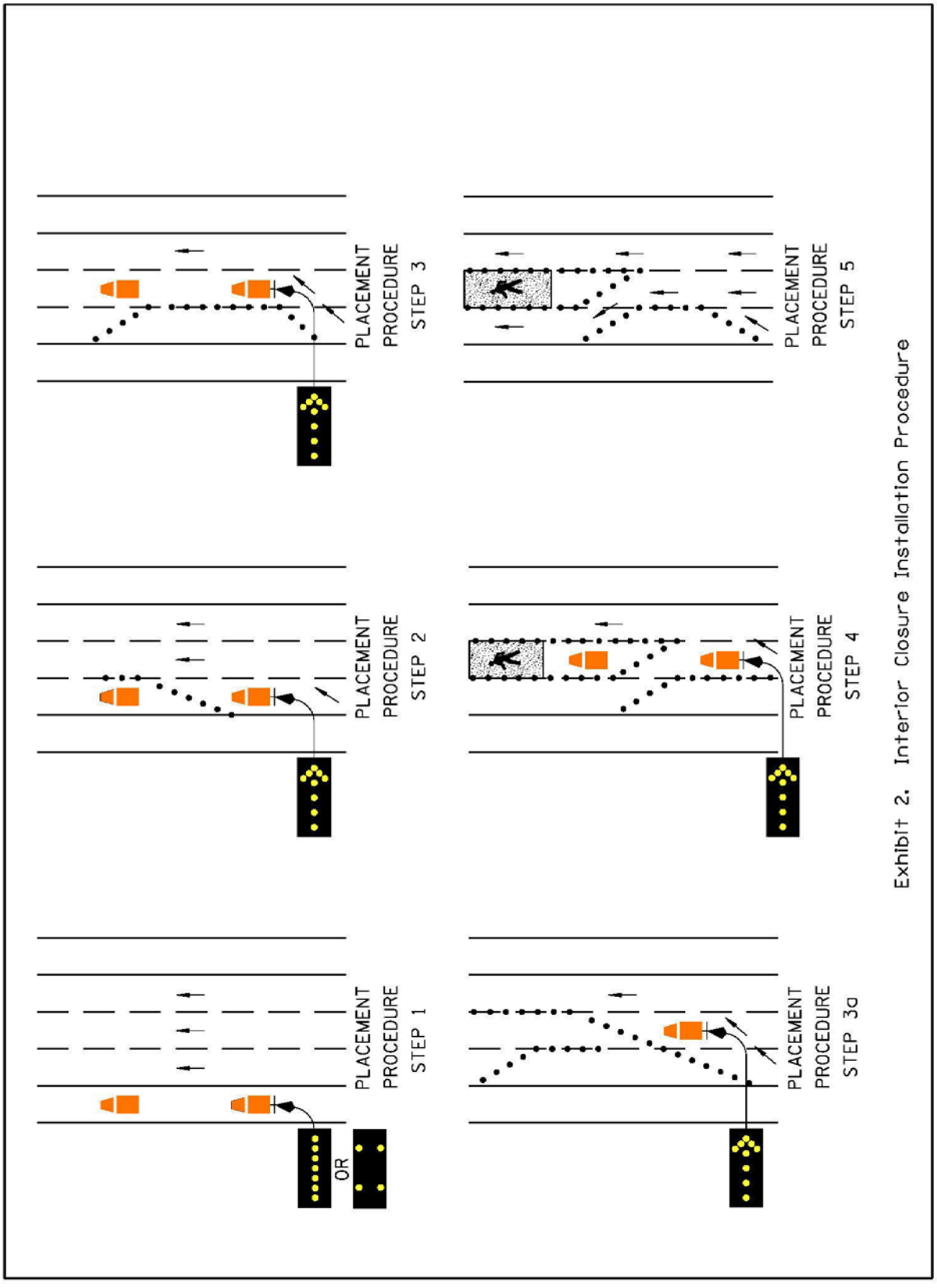



Exhibit 2. Interior Closure Installation Procedure

### 11.1.6 Allowable Lane Closure Schedule

Lane closures should be scheduled during days and times that will minimize the effect to traffic flow. (See Illinois Tollway Lane Closure Reference Guide)

### 11.1.7 Special Techniques

The setting and retrieving of signs in the Advance Warning Area is basically a moving operation along the shoulder. The MOT Diagram for this operation is given in Plate 8. For installation and removal activities, however, the work vehicle should be equipped with changeable message arrow boards, because they will be used in a variety of situations during the various steps of the process.

When no shoulder is available, the work in the advance warning area becomes an intermittent stop operation. The arrow boards on the work vehicle shall indicate that the outside lane is closed.

To expedite the placement of lane-closing channelizing tapers, directional barricades may be placed from a moving work vehicle. The worker performing this task shall have an adequate platform cage from which to work. The cage shall be securely fastened to the rear of a large stake body truck equipped with a directional arrow board on the truck and the flashing light mounted at 3 feet above pavement on the protective platform. A worker is positioned on the back end of a truck setting out a channelizing taper.

Signs to be installed on semi-permanent supports may be erected in advance and covered until the traffic zone is put in operation. This procedure reduces the time required to establish the advance warning area during installation. The material used to cover signs shall be opaque, securely attached and resistant to tearing under windy conditions.

### 11.1.8 Ballasting Devices

Ballast may be provided as needed to provide stability for traffic control devices and to enable them to stand under anticipated road and wind conditions. Ballast shall be placed near ground level to minimize the possibility of the ballast hitting the windshield of an impacting vehicle.

Ballast shall be of a type that will spread out over the roadway if the device is demolished by an impacting vehicle. The standard form of ballast is sandbags. During freezing weather provision must be made to prevent the sand from becoming wet and freezing. A waterproof bag covering or chemicals may be used for this purpose.

Portable sign supports and barricades should have ballast added, as needed. Cones should have integral weighted bases. Drums should be ballasted with either sandbags, or weighted collar. Care must be taken to avoid placing excessive weight in drums; sand ballast shall not exceed a depth in the drum of 8 inches.

In no instance shall ballast or warning lights obscure a sign face or a reflectorized surface on a channelizing device.

## 11.2 Work Zone Evaluation

### 11.2.1 Evaluation Following Installation

When the installation or modification of a work zone has been completed, its effectiveness shall be evaluated. When practical, this evaluation should be performed before the work area is occupied and work commenced.

For maintenance operations this evaluation shall be performed by the Tollway Section Manager/Supervisor. For contract work the evaluation shall be performed by the CM.

The purpose of the evaluation is to assure that devices have been set out in accordance with plans and that traffic is flowing properly through the control zone. Even though the control procedure is carefully planned, designed and installed, the real test is that it works well in the field.

Items to be observed during the evaluation process include the following traffic flow characteristics:

- Excessively high or low speeds
- Erratic maneuvers
- Frequent application of brakes, as seen by brake lights
- Skid marks
- Vehicles following improper paths
- Vehicles operating in prohibited area (on shoulders, between channelizing devices, etc.)
- Congestion and backups
- Driver gawking
- Damaged or displaced devices.

When changes in the MOT plan are necessary, they shall be made as soon as practical and the changes shall be properly documented. If the changes made are significant, the work zone shall be re-evaluated after modifications are completed.

### 11.2.2 Work Zone Performance

All motor vehicle accidents or worker accidents related to traffic flow that occur in a work zone shall be investigated to determine if some modification of the work zone is warranted to reduce the likelihood of a recurrence of a similar accident. Accident investigations should include a field review, an analysis of reports made by traffic officers and drivers and discussions with knowledgeable persons who were at the work zone. All recommendations for modifications and/or changes to work zones should be forwarded to the Traffic Operations Safety Committee for formal review and subsequent action if appropriate.

## 11.3 Maintenance of Traffic Control Devices

### 11.3.1 Inspection of Work Zones

For intermediate and long-term projects periodic inspection shall be made to determine that all traffic control devices in the work zone are in place, functioning effectively and in good repair.

Inspection Responsibility - For contract work the basic inspection responsibility for maintenance inspections lies with the CM and the Contractor's work zone Traffic Supervisor designated as the responsible person for traffic control. On major activities performed by Tollway forces, this inspection should be made by the Section Manager/Supervisor.

(a) Inspection Frequency - The frequency of inspections should be determined by considering the following factors:

- Project size and duration
- Severity of hazards
- Frequency at which damage is occurring
- Numbers of deficiencies noted during earlier inspections.

At a minimum, maintenance inspections shall be made twice each day--once during daylight and once at night.

(b) Inspection Procedures - The MOT plan (or modified MOT plan) shall be a basic tool for the inspection. When formal plans have not been developed, Tollway Supplemental Specifications and Tollway Standard Drawings shall guide the inspection.

The inspection may be made by driving through the work zone or by a walk-through, or both, as needed. All entrance and exit points within the work zone shall be included during the inspection. Accurate inspection records shall be maintained which state deficiencies observed, and when and what corrective measures were taken.

### 11.3.2 Maintenance

(a) Device Maintenance - All traffic control devices within the work zone shall be maintained and kept clean to insure that they will function as intended.

(b) Work Area Maintenance - The work crew and/or Contractor shall maintain the work area in a neat and orderly manner. Travel lanes should be kept free of dirt and debris.

## 11.4 Work Operations

### 11.4.1 Work and Storage Locations

The activities of workers and equipment should be restricted to the designated work area. If it is necessary to operate beyond the work area, the work area and buffer space should be extended to include the activity.

Provisions should be made to move equipment and materials into and out of the work area, as needed. Materials and equipment shall be kept in safe locations when not in use in accordance with the Tollway Supplemental Specifications, Article 701.13

Storage areas, when placed behind guardrail, must provide for the deflection of rail upon impact. Materials or equipment shall be placed a minimum of 4 feet behind the guardrail posts.

Consideration for the types of materials to be stored need to be assessed. Materials which when impacted that become projectiles may present increased hazards to workers or to the vehicle occupants.

No storage of any kind is permitted in the recovery area for the Traffic Barrier Terminal Type T1 (Special) or Traffic Barrier Terminal Type T1-A (Special).
Reference Documents (Current Edition): Tollway Standard Drawings C-6 and C-12.

### 11.4.2 Traffic Control during Non-work Periods

During non-work periods the roadway should be returned to as near normal conditions as practical. Materials and equipment should be removed from the roadway and stored in a shielded location behind guardrail or well outside the clear zone. Traffic Control devices temporarily stored behind existing guardrail shall be stored a minimum of 4 feet behind the guardrail posts.

Reference Document (Current Edition): Tollway Standard Drawing C-1.

No storage of any kind is permitted in the recovery area for the Traffic Barrier Terminal Type T1 (Special) or Traffic Barrier Terminal Type T1-A (Special).

Reference Document (Current Edition): Tollway Standard Drawing C-6 and C-12.

Signs which are not applicable shall be removed. All warning lights and other devices not required for nighttime traffic control shall be removed.

(a) FLAGGER Signs - FLAGGER signs are required in advance of a flagger station whenever a flagger is used to warn traffic. Such signs shall be removed or covered when the flagger is not present.

(b) WORKERS Signs - WORKERS signs shall be used only when work is being performed at the work area. During non-work periods these signs shall be removed, covered or replaced with an appropriate sign.

# SECTION 12.0 WORKER PROCEDURES

## 12.1 General

### 12.1.1 Recognition of Hazards

Clearly, personnel performing maintenance, construction and utility operations on the Tollway are working in a potentially vulnerable environment. Workers must constantly stay alert to surrounding conditions and carry out their duties so as to protect themselves and the traveling public.

Motorists traveling in a work zone situation may encounter different traffic patterns. These provisions of the MOT MANUAL are designed to provide ample information and adequate notice to accommodate drivers' needs. Workers performing tasks in or adjacent to the roadway must remain aware of surrounding conditions and diligently install and maintain traffic control devices in accordance with the procedures set forth in this MOT MANUAL.

### 12.1.2 Work Zone Practices

Good work habits based on safety awareness provide the best protection available for workers and motorists of the Tollway. A few fairly simple practices, routinely followed, will nurture these habits and increase the effectiveness of traffic control in work zones.

The CM personnel must wear proper safety equipment (i.e. hard hat and reflective vest) however they are not responsible for the overall safety of the work zone. The CM is responsible to monitor situations and conditions for contract compliance.

Plan and prepare for any change in traffic control with the objective of completing it as quickly as possible to minimize worker exposure and impact to motorists.

- Check in advance to be sure that necessary devices and equipment are available and in good condition.
- Assign duties in advance and make sure they are understood by all workers.
- Before occupying the site, rehearse the activity to be accomplished, stressing safety at each step of the process.
- If possible, schedule the activity for a daylight off-peak period.
- Carry out traffic control changes in a manner that emphasizes safety for motorists and the workers.
- Always wear proper attire including hard hat.
    - American National Standard Institute (ANSI) specification ANSI Class 2 apparel is required for all workers in a work zone during daytime hours.
    - ANSI Class 3 apparel is required for all nighttime work.

- Follow Tollway rules, regulations and policies for vehicle operation, particularly those covering low-speed travel, use of emergency turnarounds, stopping on the Tollway, loading and unloading and discharging passengers.

- Utilize beacons to increase visibility of work vehicles. Consider use of shadow trucks, arrow boards and flaggers, as needed, to increase protection while work is in progress.

Carefully inspect traffic control devices and report on their condition when they are returned to inventory upon completion of the work.

### 12.1.3 Obeying Rules and Regulations

When operating a vehicle on the Illinois Tollway, all operators must abide by the rules and regulations established for the Illinois State Toll Highway Authority. Tollway policies regarding the use of emergency turnarounds, maintenance operations, equipment and general operating practices shall be followed at all times. At no time will vehicles be permitted to travel against traffic in an open travel lane.

### 12.1.4 Worker Attire

All personnel on foot, excluding flaggers, within the highway right-of-way shall wear a fluorescent orange, fluorescent yellow/green or a combination of fluorescent orange and fluorescent yellow/green vest, meeting the requirements of ANSI/ISEA 107-2004 for Conspicuity Class 2 garments. Other types of garments may be substituted for the vest as long as the garments have manufacturer's tag identifying them as meeting the ANSI Class 2 requirement.

Whenever a flagger is required to be assigned to traffic control for daytime operations, the flagger(s) shall be equipped with a fluorescent orange, fluorescent yellow/green, or a combination of fluorescent orange and fluorescent yellow/green vest meeting the requirements of ANSI/ISEA 107-2004 for Conspicuity Class 2 garments and flagger traffic control paddles. If the flagger is required during nighttime operations, the flagger shall be equipped with a full-body garment of fluorescent orange or fluorescent orange and fluorescent yellow-green meeting the requirements of ANSI/ISEA 107-2004 for Conspicuity Class 3 garments. All maintenance workers are required to wear ANSI Class 3 apparel during nighttime operations.

Hard hats shall be worn by all persons in a work zone.

## 12.2 Flagging

### 12.2.1 Flagging Functions

Closures on the Tollway are affected through the use of signs and channelizing devices.

A flagger could be used as needed to assist with special operations of a short-term nature, such as the following:

- Installing, relocating and removing traffic control devices,
- Moving equipment or materials into and out of the work area.

### 12.2.2 Flagging Devices

The standard device to be employed by a flagger is the SLOW paddle mounted on a staff. Sign paddles shall be fabricated with a SLOW sign face, following the design specification set forth in the MUTCD.

When a two sided “STOP/SLOW” paddle is used, the “STOP” text shall not be displayed.

Flaggers are not permitted to stop traffic on the Tollway mainline, and the stoppage of traffic on ramps will not be allowed without the prior approval of the Tollway Maintenance & Traffic Division. When it is necessary to halt traffic on the Tollway, District 15 Police are required to assist in this operation.

### 12.2.3 Flagging Procedures

The signaling methods used by flaggers shall comply with those contained in the IDOT’s “Flagger Handbook”.

### 12.2.4 Flagger Training

Prior to being assigned duties as a flagger, personnel shall be trained in flagging responsibilities and procedures. For Tollway personnel, flagger training will be stressed periodically as part of routine safety meetings to insure that all persons involved in flagging are capable of performing the function safely and effectively. Contractors are responsible for training other personnel in proper flagging techniques before such persons are assigned to field operation. Flaggers shall be certified by the Illinois Department of Transportation or by an agency approved by IDOT. Each flagger shall have in his/her possession a current driver’s license and current flagger certification ID meeting IDOT requirements. For non-drivers, the Illinois Identification Card issued by the Secretary of State will meet the requirement for a current driver’s license.

Persons assigned as flaggers shall have good vision and hearing and be in good physical condition. Other requisite attributes are reliability, alertness and good judgment.

# SECTION 13.0 MAINTENANCE OF TRAFFIC PROCEDURES

## 13.1 Use of Plates

MOT Plates are presented in this section to illustrate the principles set forth in the MOT MANUAL for moving operations, emergency situations and typical temporary closures. The traffic control situations depicted cover a range of work operations commonly encountered. The work zones shown represent typical solutions. In application, adjustments may be required to accommodate field conditions.

## 13.2 Description of Plates

The MOT Plates are contained in Section 15 of this MOT MANUAL as individually numbered Plates. Each plate makes reference by number to General Notes. The General Notes are also presented in Section 15, preceding the Plates. In addition, special notes are provided as part of the Plates. The Plates are not drawn to scale. All signs shall be 48” x 48” unless otherwise indicated on the diagram.

### 13.2.1 Off Road Activities

When activities are at all times out of the shoulder or median and more than 15 feet from the edge of the pavement, no traffic control procedures are required.

Plate 1 illustrates the traffic control devices for off-road activities that are performed 15 feet or more from the edge of pavement, but do not encroach upon shoulders or travel lanes. When the work is being done only on the outside (right side) of the roadway, signs are only required on the right side of the roadway. When work is being done in the median area, signs shall be placed on both sides of the roadway.

### 13.2.2 Shoulder Closure

Plate 2 shows the work zone for work activities on the right shoulder. Devices are only required on the right side of the roadway. For left shoulder closure, devices are only required on the left side of the roadway.

### 13.2.3 Mainline Lane Closures

Plates 3R and 3L illustrate the traffic control devices for a typical temporary one lane closure. Plate 3R shows the right lane closure and Plate 3L shows the left lane closure.

Plates 4R and 4L illustrate the traffic control devices for typical temporary two lanes closure. Plate 4R shows the two right lanes closure and Plate 4L shows the two left lanes closure.

### 13.2.4 Ramps

(a) Ramp Closures - When work is performed on one-lane ramps and there is insufficient width for maintaining traffic, the ramp should be closed. Appropriate signs should be placed on the Tollway mainline when an exit ramp is closed and upon the connecting roadway when an entrance ramp to the Tollway is closed.

(b) Acceleration Lane Closures - If an acceleration lane is closed, the procedure to be used is shown in Plate 5. The right lane is closed upstream so that it may be used as an acceleration lane at the entrance point.

(c) Deceleration Lane Closure - When one lane of a two-lane exit ramp is closed or if work must be performed within the deceleration lane for such a ramp, the procedure to be used is shown in Plate 6.

### 13.2.5 Toll Plazas

Plate 7 illustrates a closure in a mainline conventional toll plaza upstream of the toll gates. Where a distance of 300 feet or more is available between the end of the work area and the toll gates, the closed lane(s) may be reopened if needed. When a single lane is closed, the channelization taper should be placed to direct traffic in the closed lane to the side with the greater number of lanes available.

For lane closures beyond the toll gates, the lane should be closed by closing the upstream toll gate and channelization devices should extend from the toll plaza through the work area.

### 13.2.6 Moving Operations

(a) Shoulder - Plate 8 illustrates a moving operation on the right shoulder. A similar procedure may be used on left shoulders when sufficient width is available for vehicles to travel on the shoulder. The adjacent lane shall be closed when insufficient width is available for vehicles to travel on the shoulder.

(b) Single Lane - Plate 9R illustrates a moving operation in the right lane and Plate 9L illustrates a moving operation in the left lane.

(c) Double Lane – Plate 10R illustrates a moving operation involving two right lanes. And Plate 10L illustrate a moving operation involving two left lanes.

### 13.2.7 Emergency Situations

Plate 11R depicts emergency closure techniques for the right lane and Plate 11L depicts emergency closure techniques for the left lane. Plates 12R and 12L depict emergency closure for the two right lanes and the two left lanes respectively. Such work zones are usually installed under less than desirable conditions without the benefit of advance planning. These are usually short-duration closures. To enable the work zone to be installed rapidly and to minimize the number of devices that are kept on hand for emergency closures, the Plates call for fewer devices than are specified for normal lane closures. Signs are placed only on the side of the roadway being closed.

### 13.2.8 Mainline ORT Maintenance

Plates 13, 14 and 15 cover maintenance in the ORT lanes which requires the temporary full closure of all through lanes at mainline toll plazas. This closure is accomplished with the use of mobile operations by Tollway maintenance or Contractor vehicles. The existing roadway traffic is paced as the mobile operation vehicles are slowly set into a stationary position, each coming to a complete stop at strategic points in advance of the toll plazas monotubes which support the electronic tolling equipment. All roadway traffic is temporarily routed onto the cash side of the toll plaza.

# SECTION 14.0 QUALITY STANDARDS – TRAFFIC CONTROL DEVICES

Traffic controls are a necessary part of highway work zones to warn motorists of hazards, advise them of the proper path through the work zone, delineate areas where they may not operate, and to separate them from the workers. This is accomplished by the deployment of a system of devices. The success of this system depends on the quality of each device and its placement.

Reference Document (Current Edition): “Quality Standard for Work Zone Traffic Control Devices”.

# SECTION 15.0 MAINTENANCE OF TRAFFIC PLATES AND NOTES

## 15.1 General Notes for the MOT Plates

Note 1

No signs and channelizing devices are required when all vehicles, equipment, workers or their activities are at all times out of the median and more than 15 feet from the edge of pavement.

Note 2

The shoulder shall be closed when a work activity requiring 15 or more minutes is performed at a distance which is less than 15 feet but not closer than 2 feet from the edge of pavement.

Note 3

When persons or equipment occupy the shoulder for brief periods of time (less than 15 minutes), the equipment itself or a supplementary vehicle placed upstream of the operation shall show a flashing amber beacon or an arrow board displaying the caution mode (non-directional).

Note 4

The adjacent exterior lane shall be closed when work is performed within 2 feet from the edge of pavement.

Note 5

Any unattended obstacle or excavation left on the shoulder overnight shall be shielded by temporary concrete barrier.

Note 6

If the closure is expected to produce traffic backups extending beyond the first warning sign shown, use additional upstream signs, PCMS or shadow vehicle so that the work zone will encompass the anticipated backup.

Note 7

When the closure is expected to extend into darkness, Type II barricades with steady-burning Type C lights shall be substituted for cones.

Note 8

Sign placement should conform to the following guidelines wherever possible:

(a) Temporary signs or signs mounted on barricades – a minimum of 2 feet from the adjacent travel lane and a minimum of 2 feet above the pavement elevation.

(b) Post-mounted signs – a minimum of 2 feet from the edge of the shoulder and a minimum of 7 feet above the pavement.

Note 9

Wherever the closure is of duration greater than 4 days, solid white and/or yellow reflectorized pavement marking tape should be placed in addition to drums and/or barricades at the direction of the CM.

Note 10

Short duration and Maintenance closures do not require speed reduction or end of work zone signing.

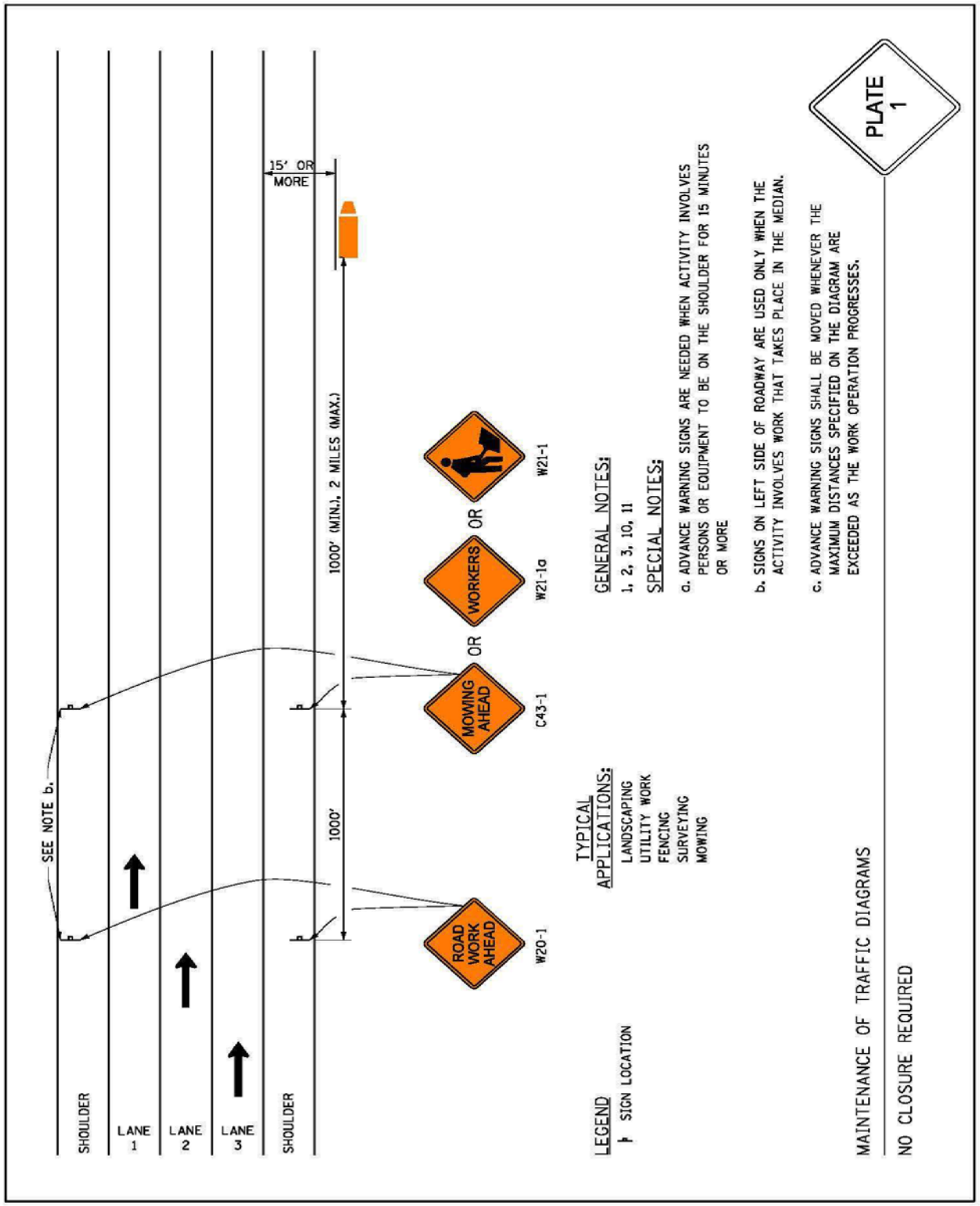
Note 11

In case of discrepancy between the contract document and this guideline, the Contractor shall follow the contract document.

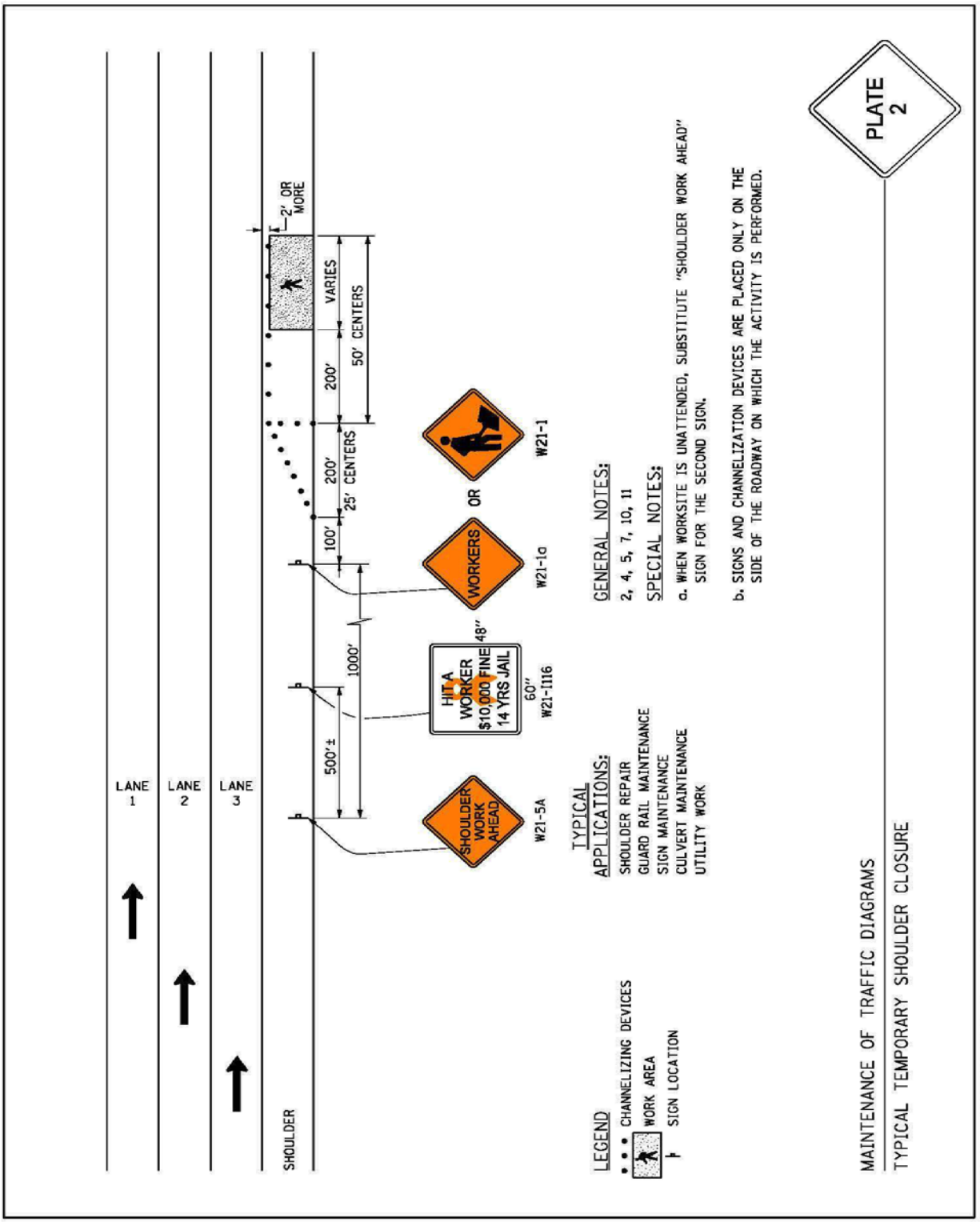
## 15.2 Plates 1 Through 15

PLATE 1 NO CLOSURE REQUIRED
PLATE 2 TYPICAL TEMPORARY SHOULDER CLOSURE
PLATE 3R TYPICAL TEMPORARY RIGHT LANE CLOSURE
PLATE 3L TYPICAL TEMPORARY LEFT LANE CLOSURE
PLATE 4R TYPICAL TEMPORARY TWO RIGHT LANES CLOSURE
PLATE 4L TYPICAL TEMPORARY TWO LEFT LANES CLOSURE
PLATE 5 TYPICAL TEMPORARY WORK ON ACCELERATION LANE
PLATE 6 TYPICAL DECELERATION LANE AND/OR RAMP LANE CLOSURE
PLATE 7 TYPICAL WORK IN TOLL PLAZA
PLATE 8 TYPICAL MOBILE OPERATION ON SHOULDER
PLATE 9R TYPICAL MOBILE OPERATION-SINGLE RIGHT LANE CLOSURE
PLATE 9L TYPICAL MOBILE OPERATION-SINGLE LEFT LANE CLOSURE
PLATE 10R TYPICAL MOBILE OPERATION-TWO RIGHT LANES CLOSURE
PLATE 10L TYPICAL MOBILE OPERATION-TWO LEFT LANES CLOSURE
PLATE 11R TYPICAL RIGHT LANE CLOSURE-EMERGENCY SITUATION
PLATE 11L TYPICAL LEFT LANE CLOSURE-EMERGENCY SITUATION
PLATE 12R TYPICAL TWO RIGHT LANES CLOSURE-EMERGENCY SITUATION
PLATE 12L TYPICAL TWO LEFT LANES CLOSURE-EMERGENCY SITUATION
PLATE 13 PLAZA MAINTENANCE FULL ORT CLOSURE-TWO LANES
PLATE 14 PLAZA MAINTENANCE FULL ORT CLOSURE-THREE LANES
PLATE 15 PLAZA MAINTENANCE FULL ORT CLOSURE-FOUR LANES

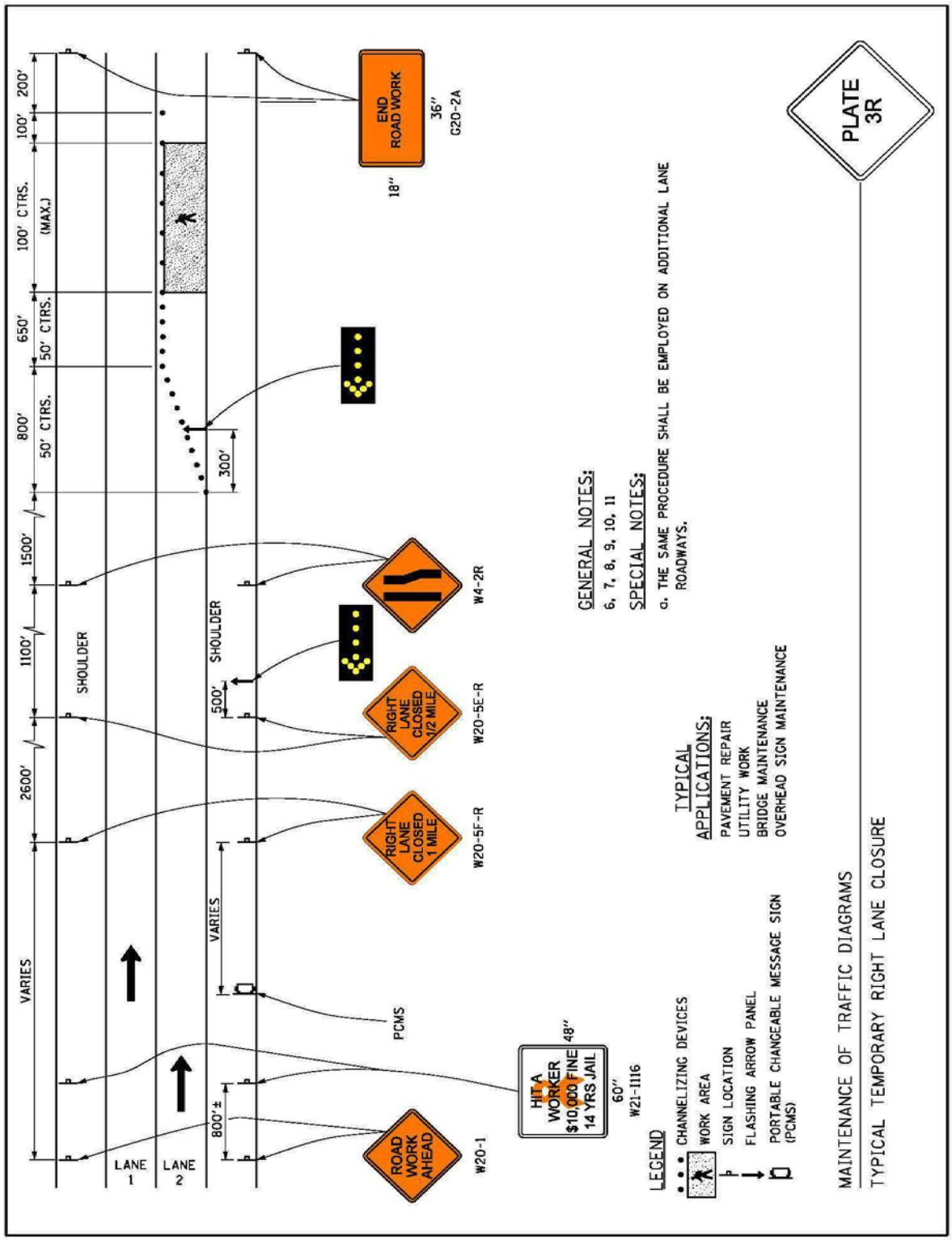
## 15.2.1 PLATE 1 - NO CLOSURE REQUIRED



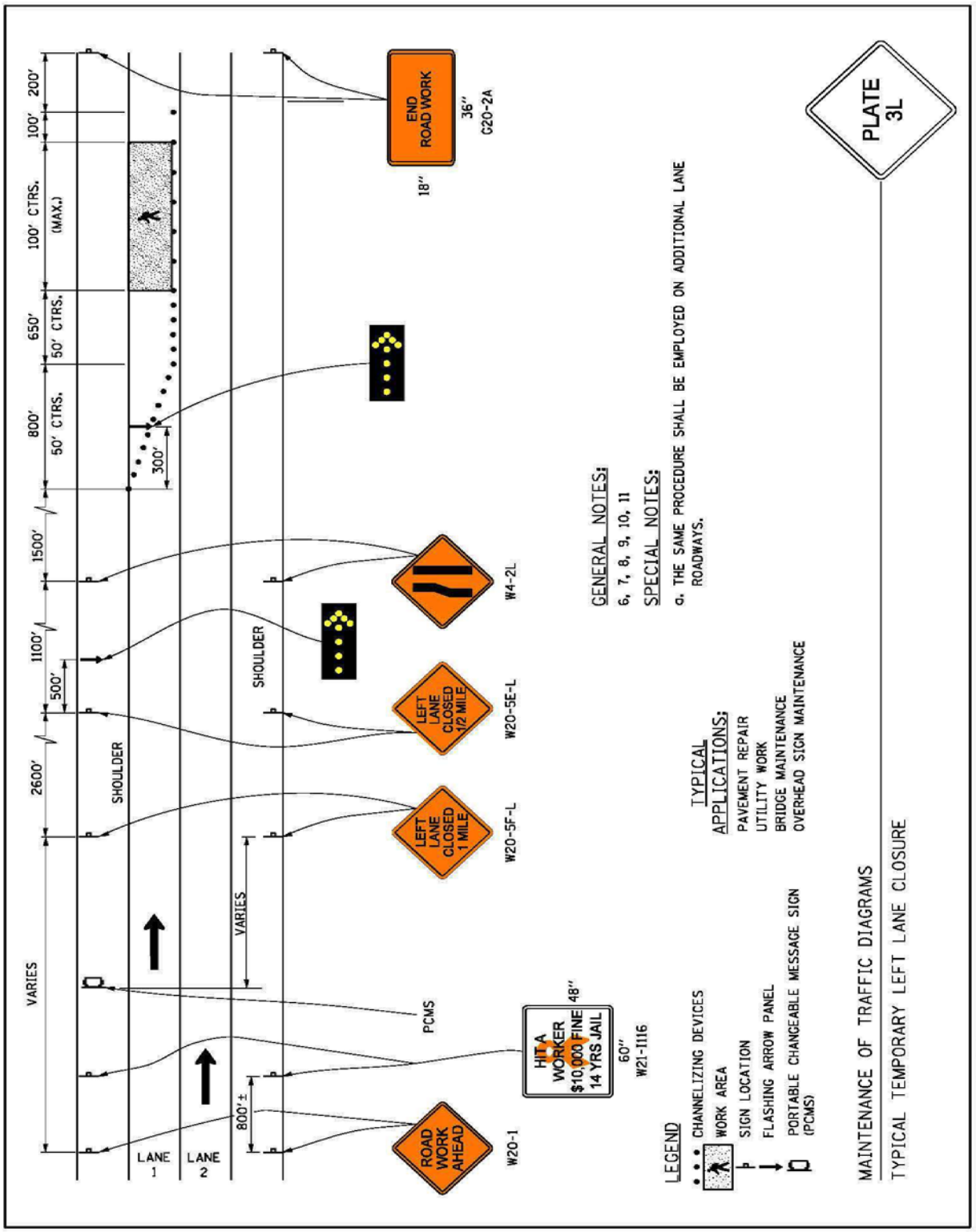
## 15.2.2 PLATE 2 - TYPICAL TEMPORARY SHOULDER CLOSURE



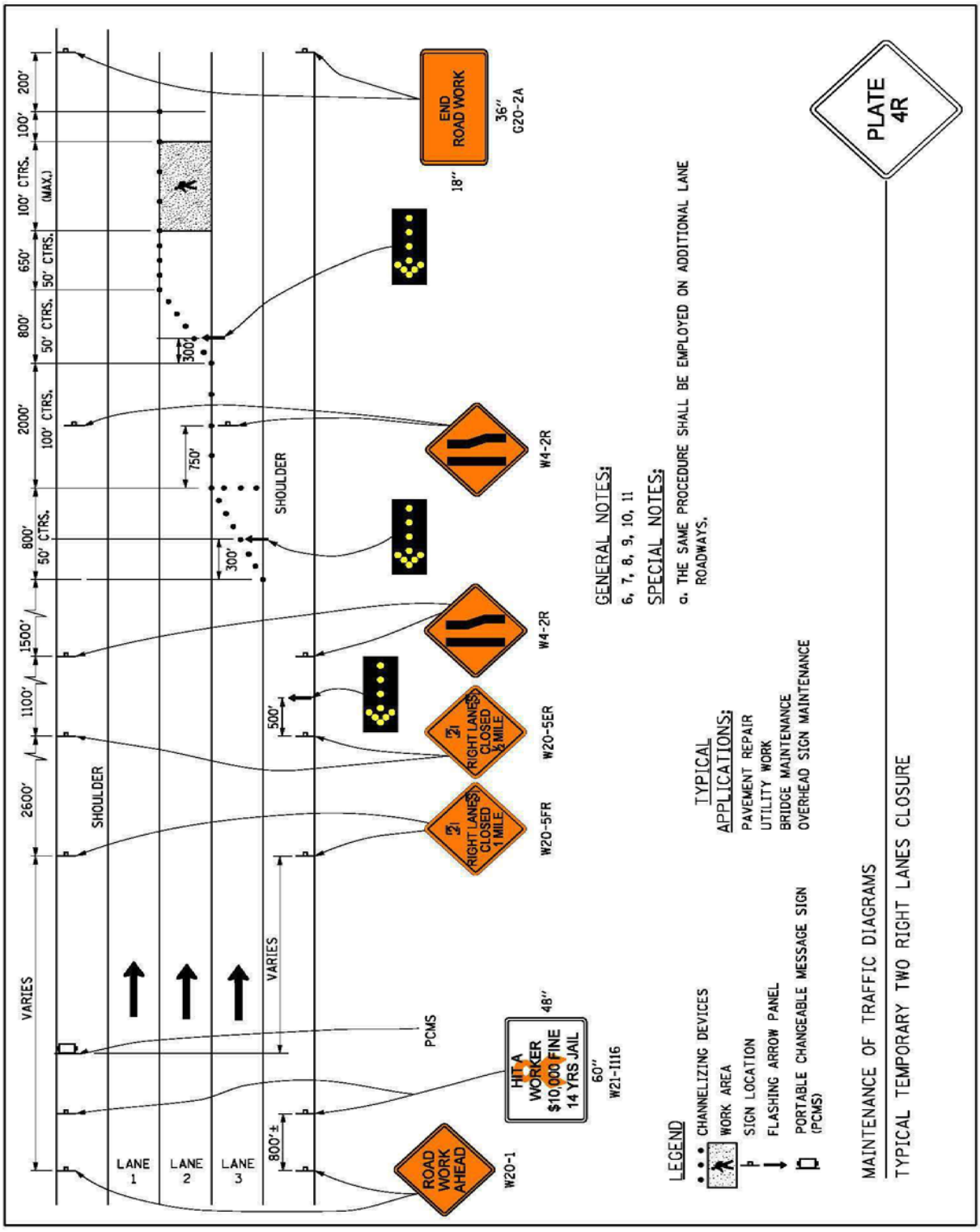
## 15.2.3 PLATE 3R - TYPICAL TEMPORARY RIGHT LANE CLOSURE



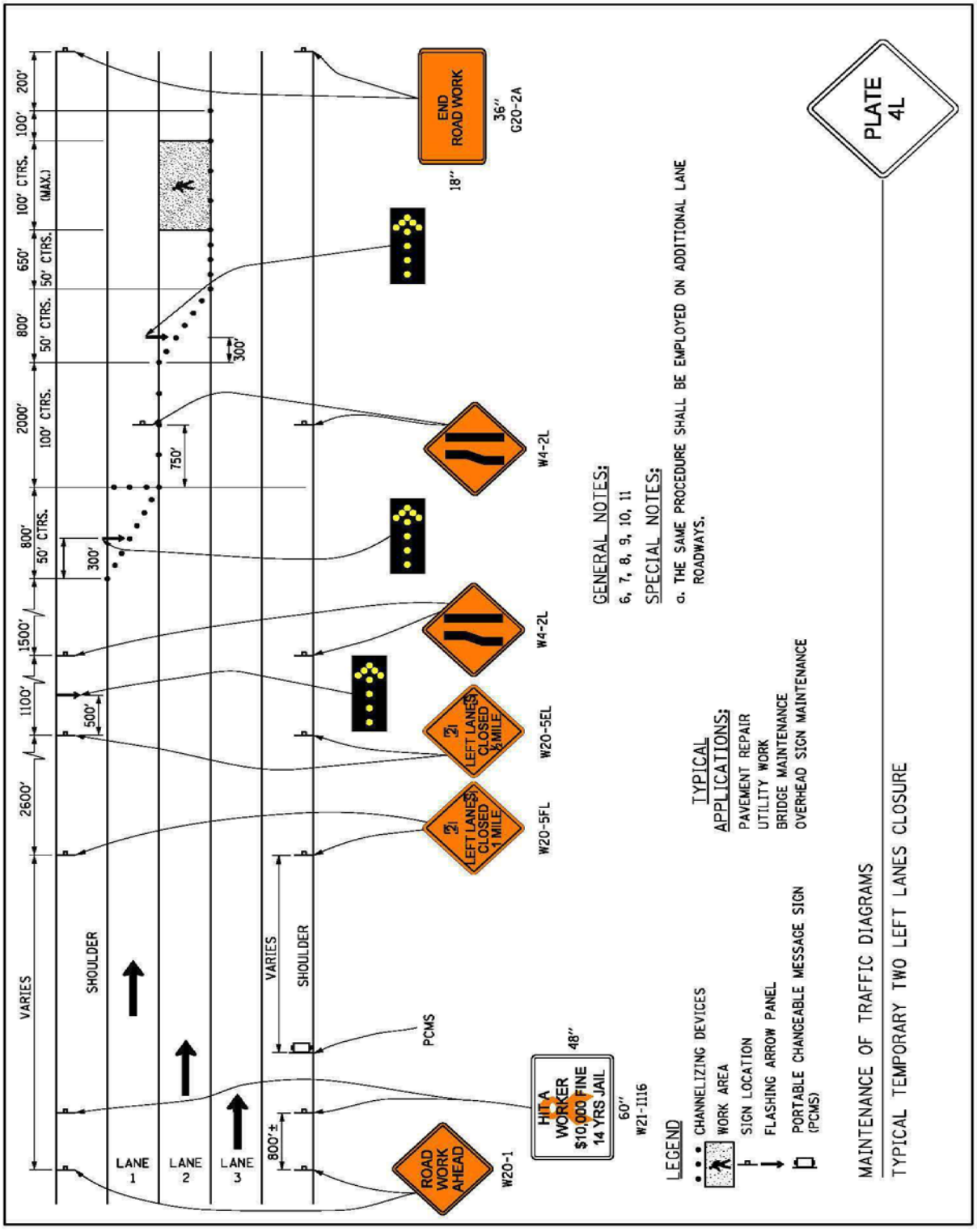
## 15.2.4 PLATE 3L - TYPICAL TEMPORARY LEFT LANE CLOSURE



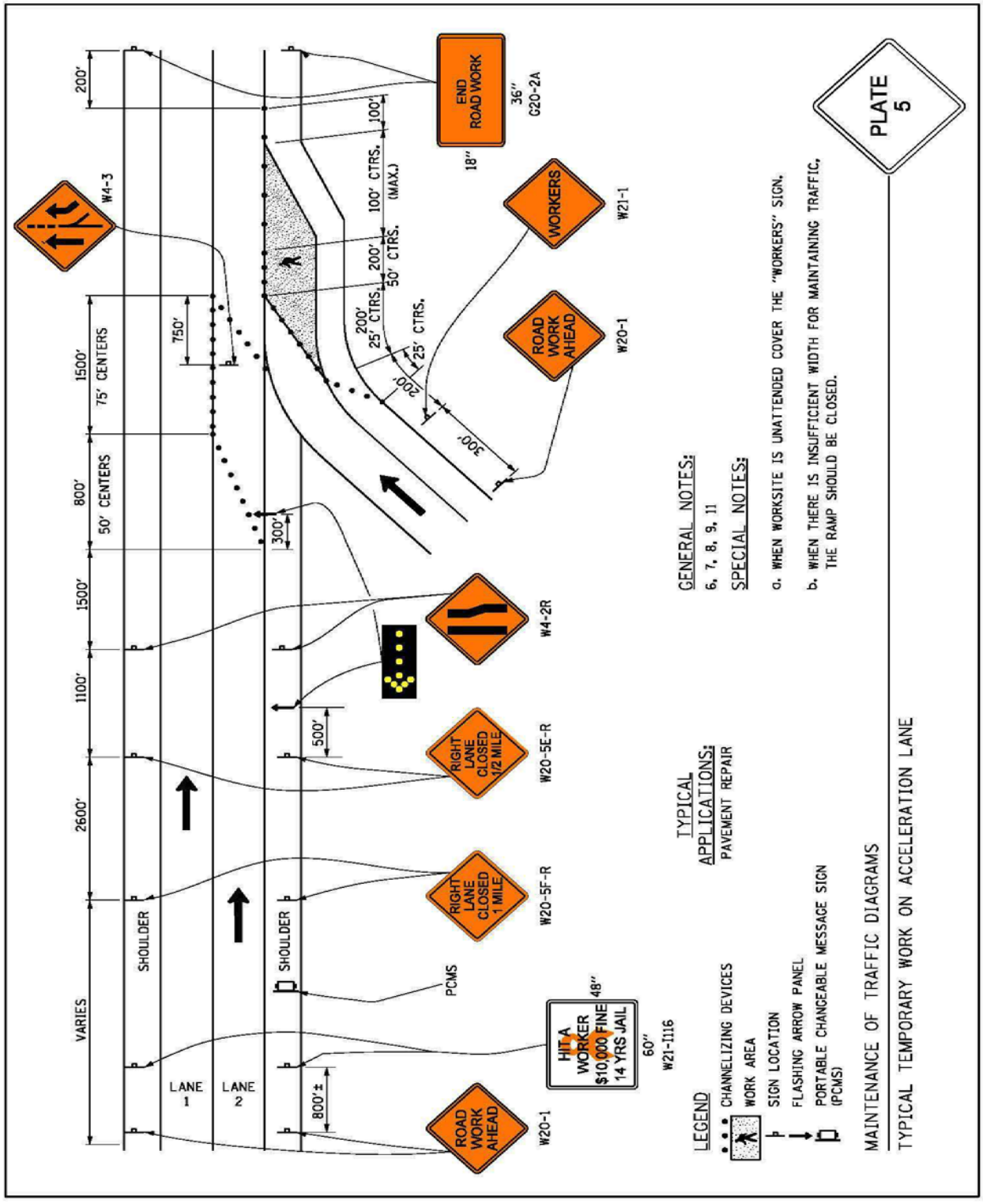
## 15.2.5 PLATE 4R - TYPICAL TEMPORARY TWO RIGHT LANES CLOSURE



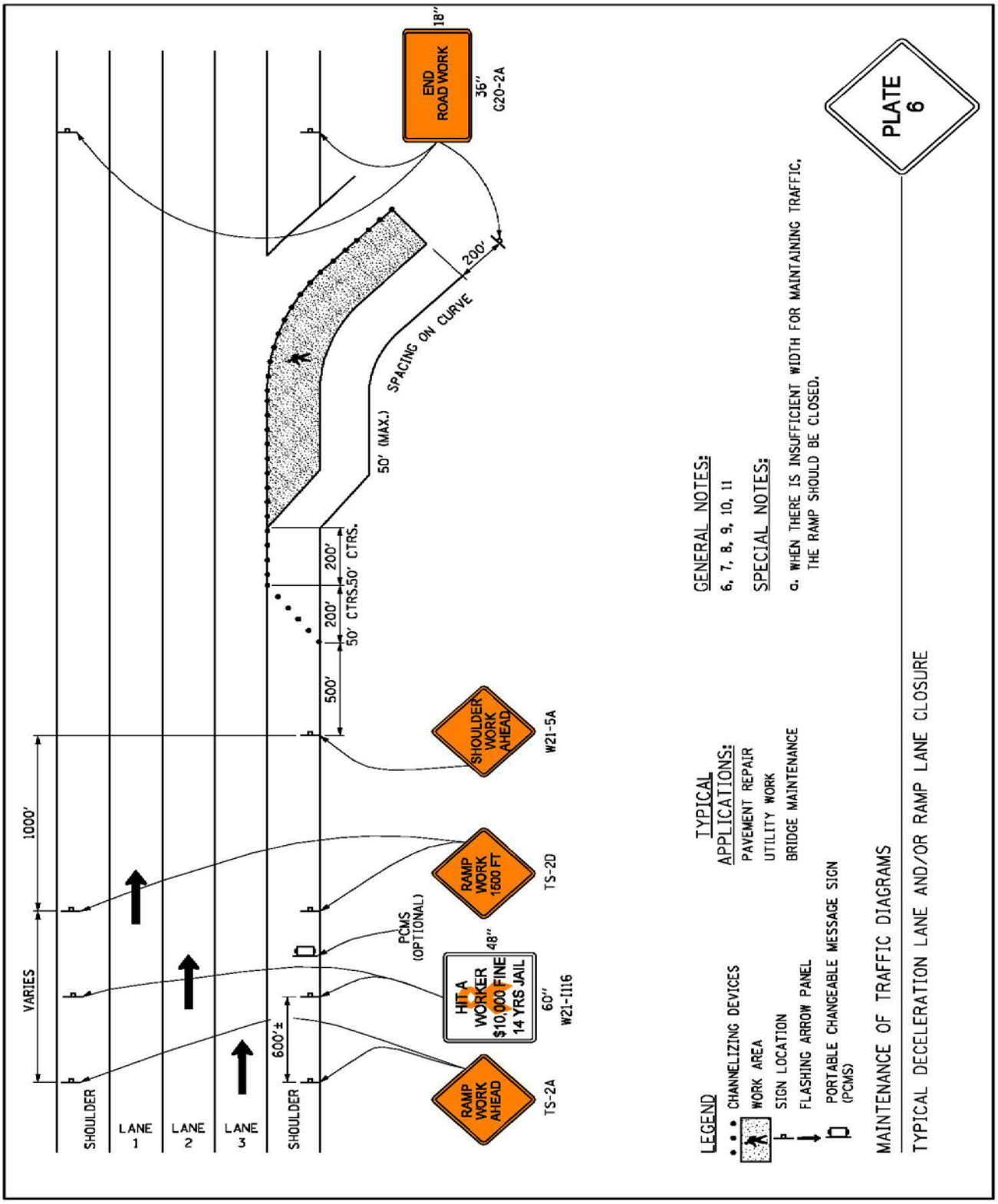
## 15.2.6 PLATE 4L - TYPICAL TEMPORARY TWO LEFT LANES CLOSURE



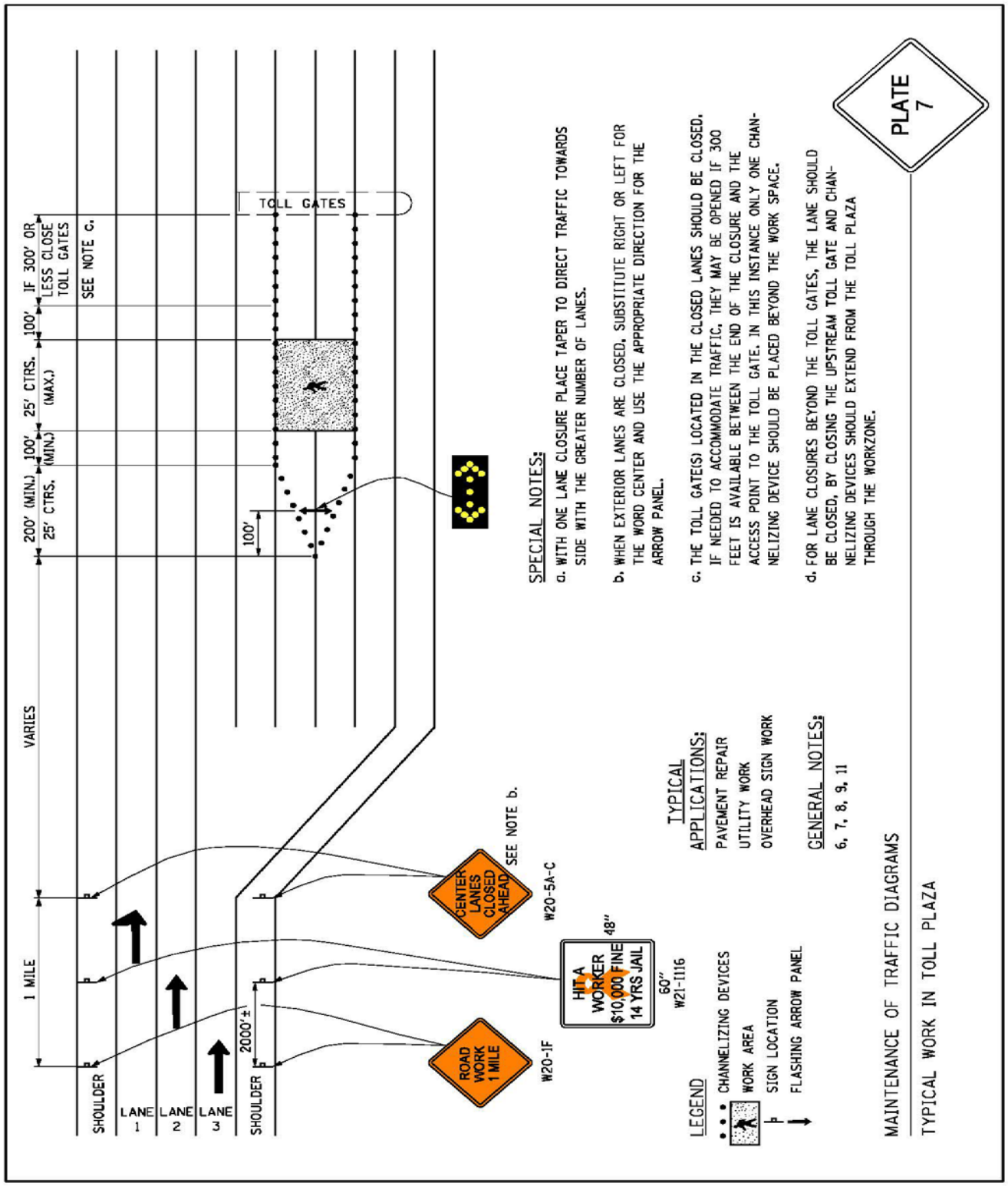
## 15.2.7 PLATE 5 - TYPICAL TEMPORARY WORK ON ACCELERATION LANE



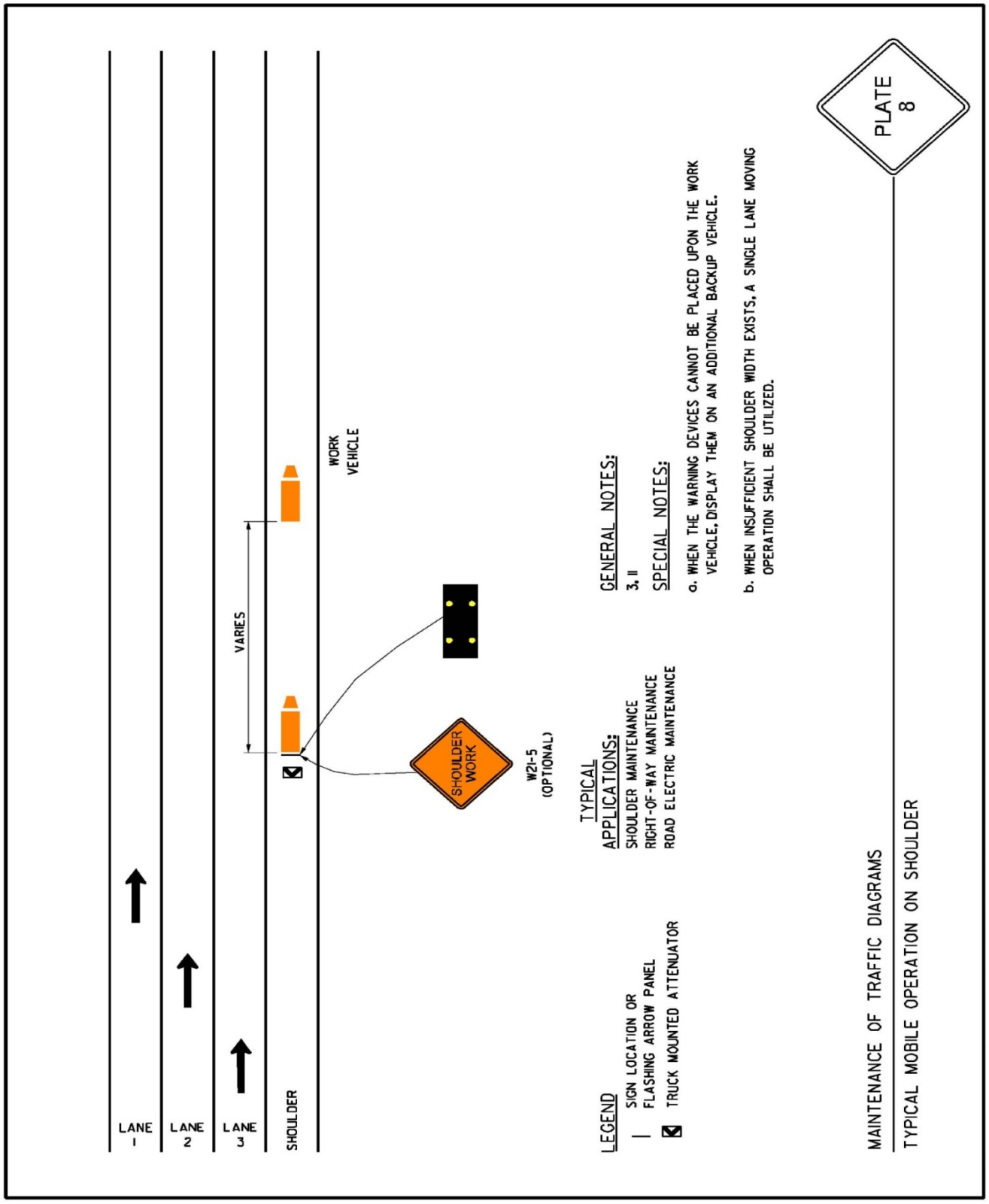
## 15.2.8 PLATE 6 - TYPICAL DECELERATION LANE AND/OR RAMP LANE CLOSURE



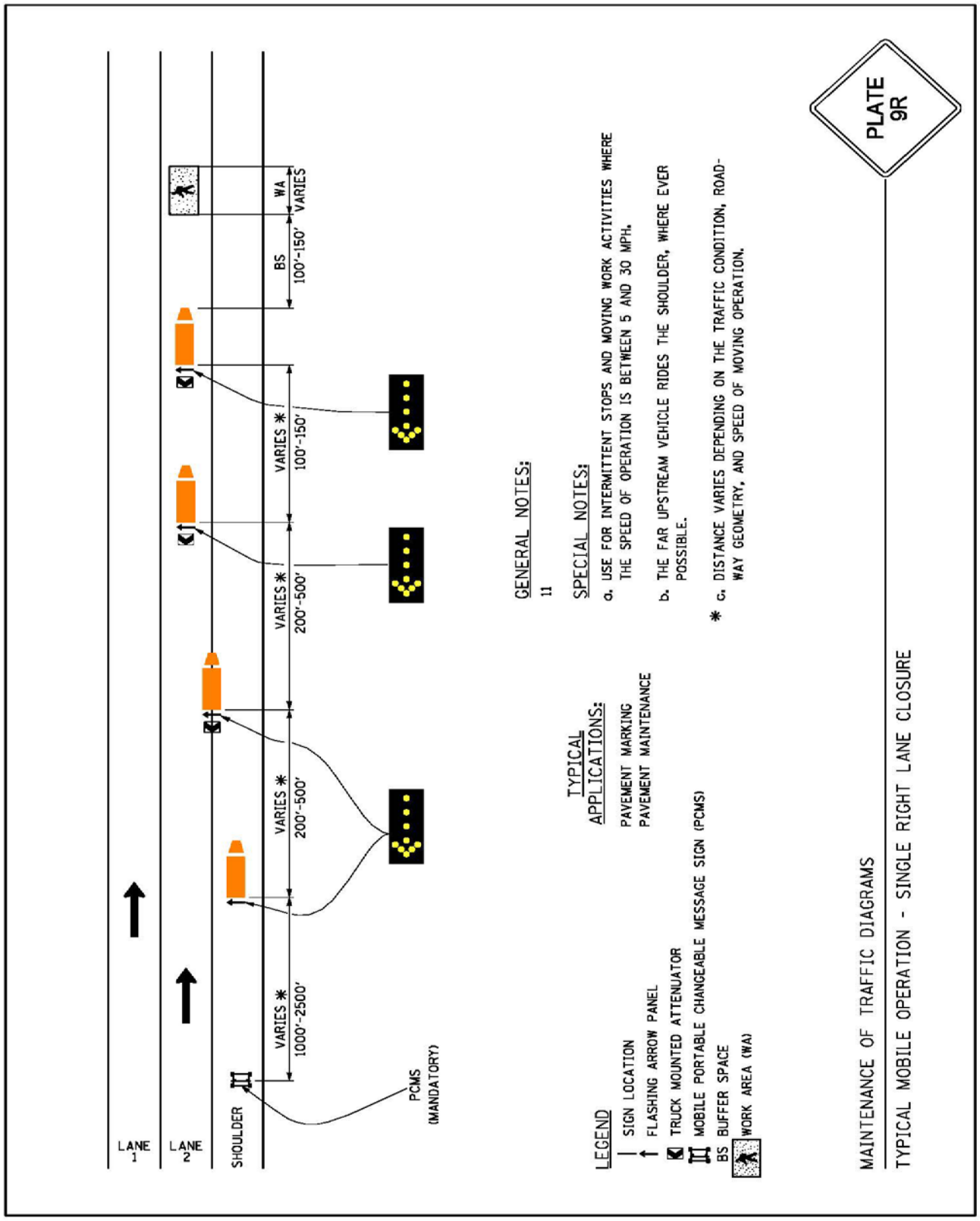
## 15.2.9 PLATE 7 - TYPICAL WORK IN TOLL PLAZA



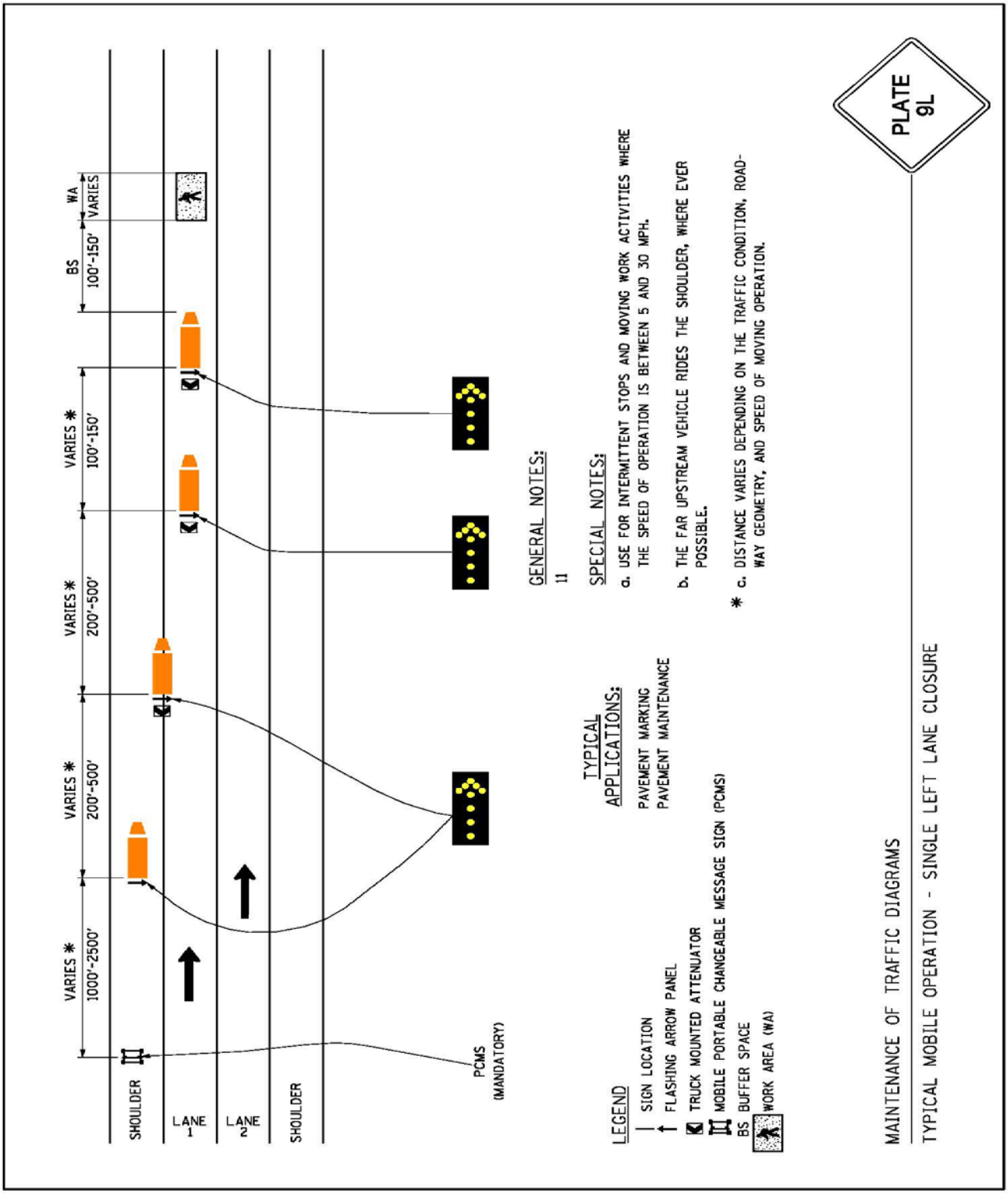
## 15.2.10 PLATE 8 - TYPICAL MOBILE OPERATION ON SHOULDER



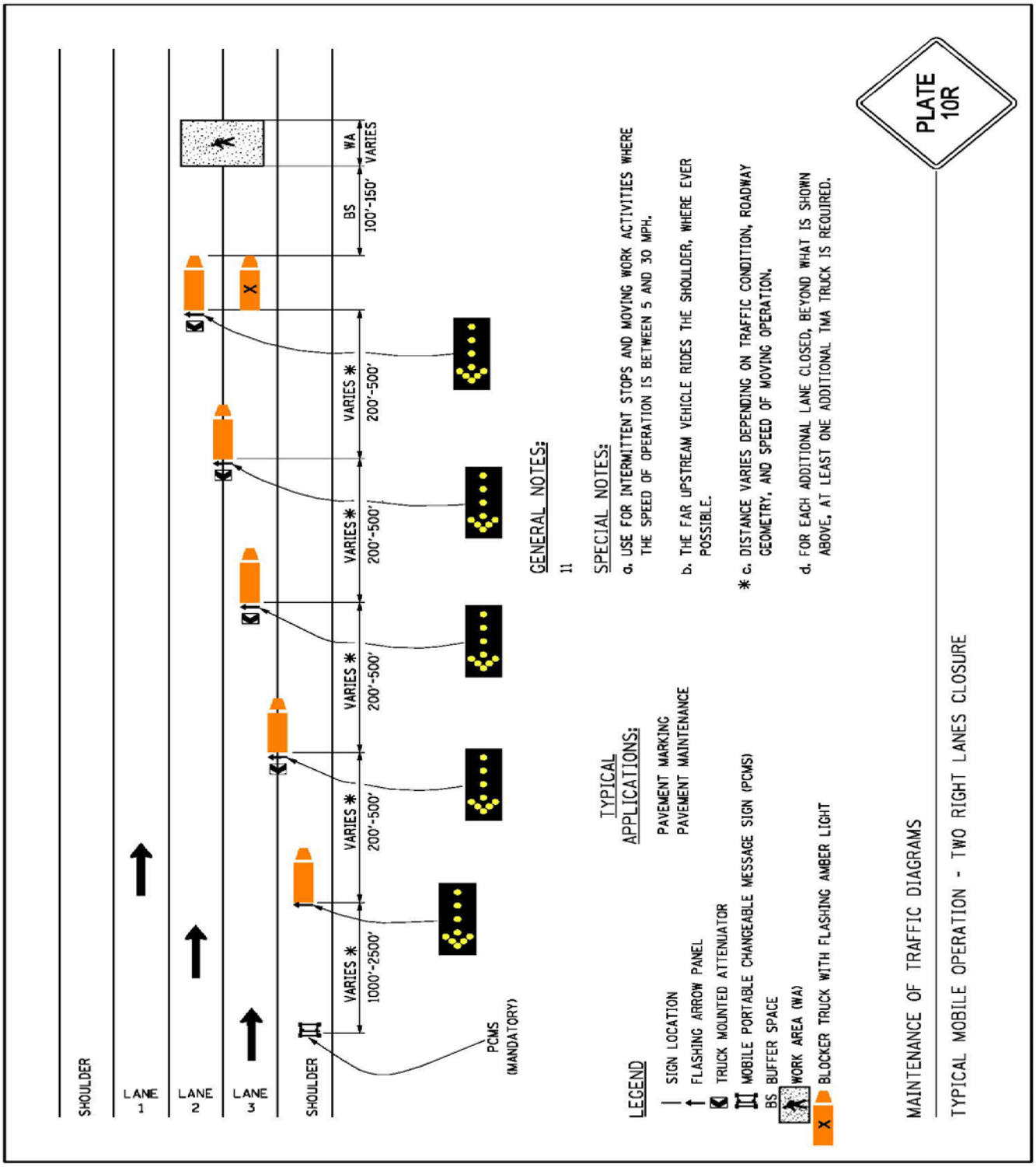
## 15.2.11 PLATE 9R - TYPICAL MOBILE OPERATION-SINGLE RIGHT LANE CLOSURE



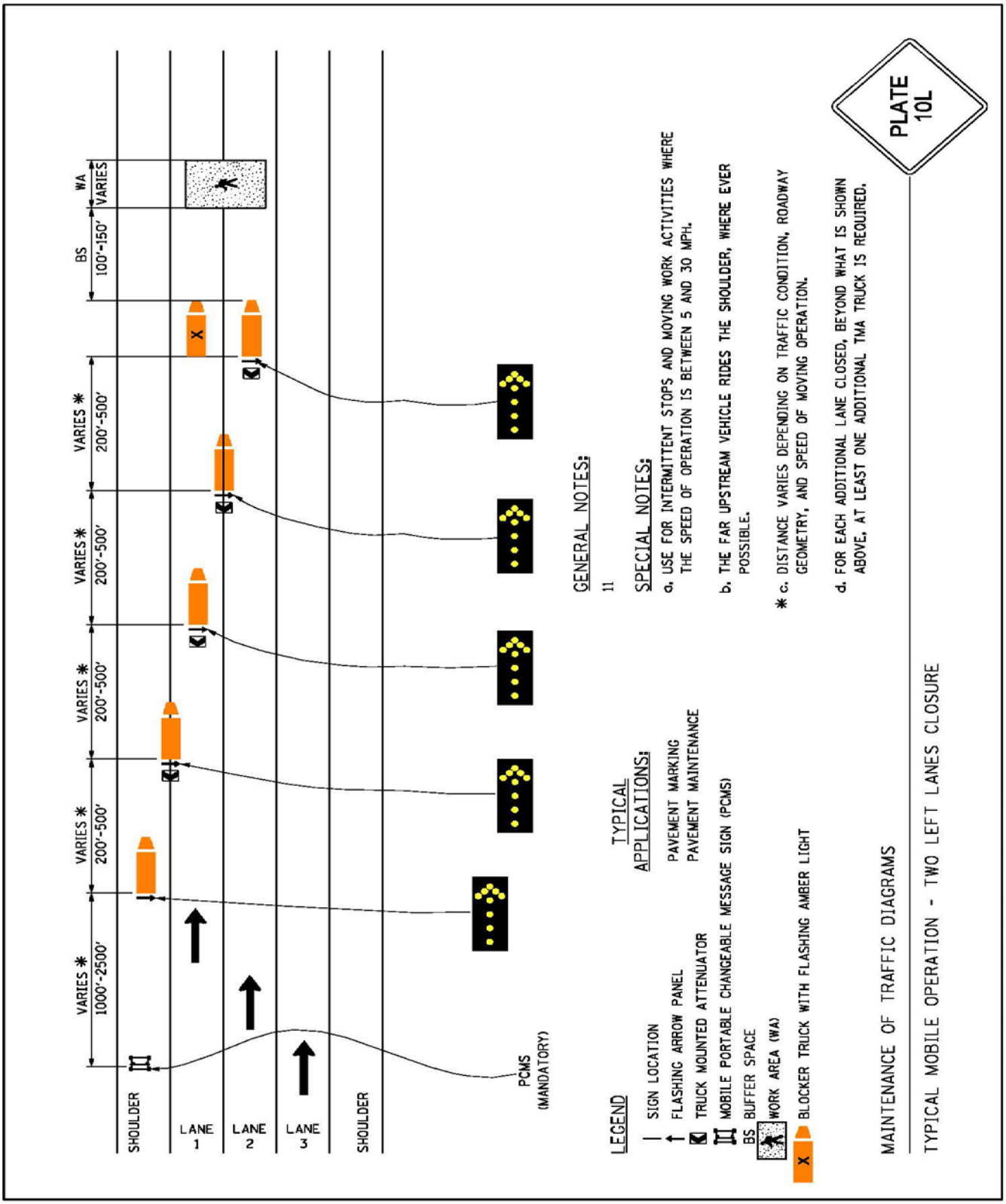
## 15.2.12 PLATE 9L - TYPICAL MOBILE OPERATION-SINGLE LEFT LANE CLOSURE



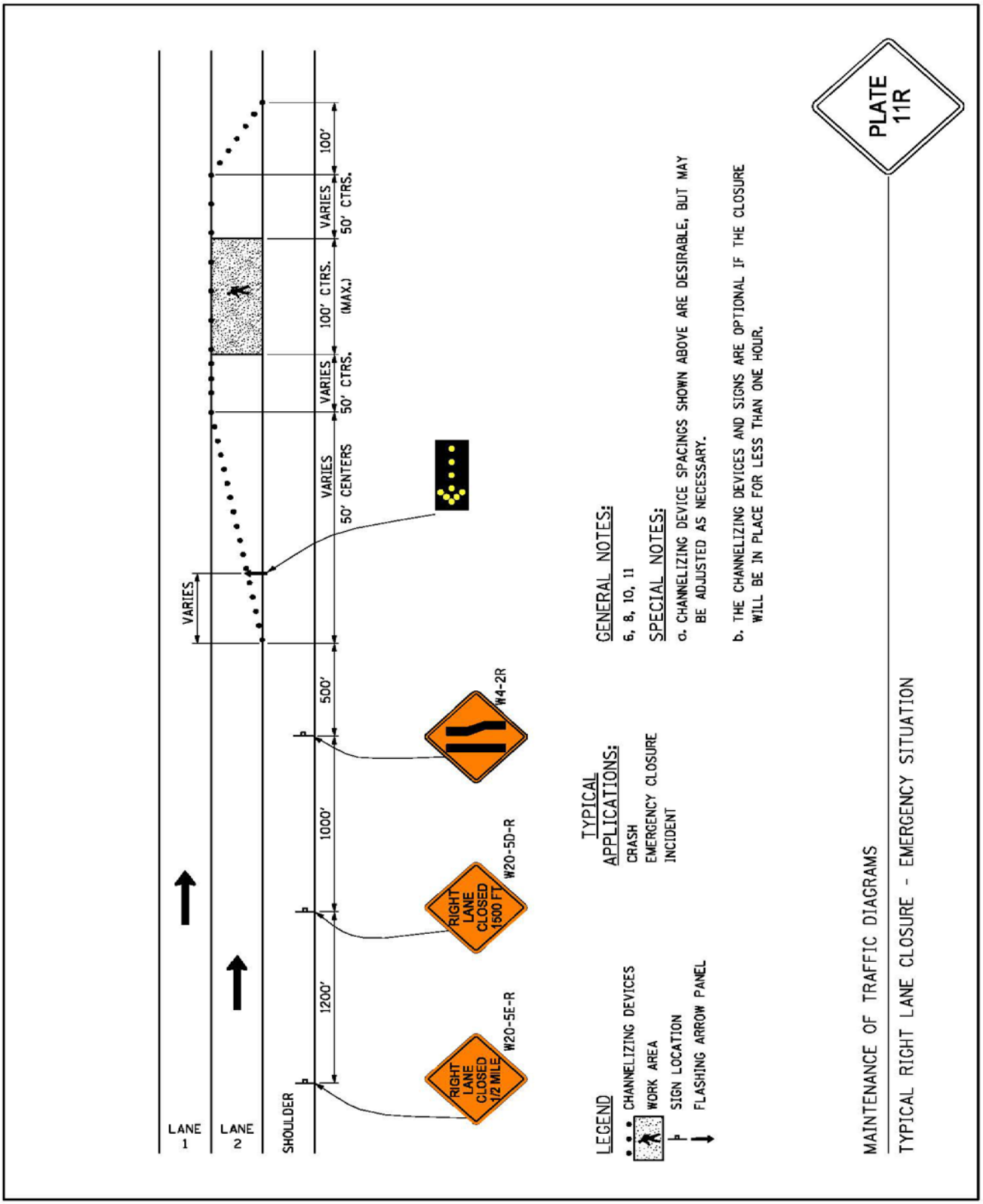
## 15.2.13 PLATE 10R - TYPICAL MOBILE OPERATION-TWO RIGHT LANES CLOSURE



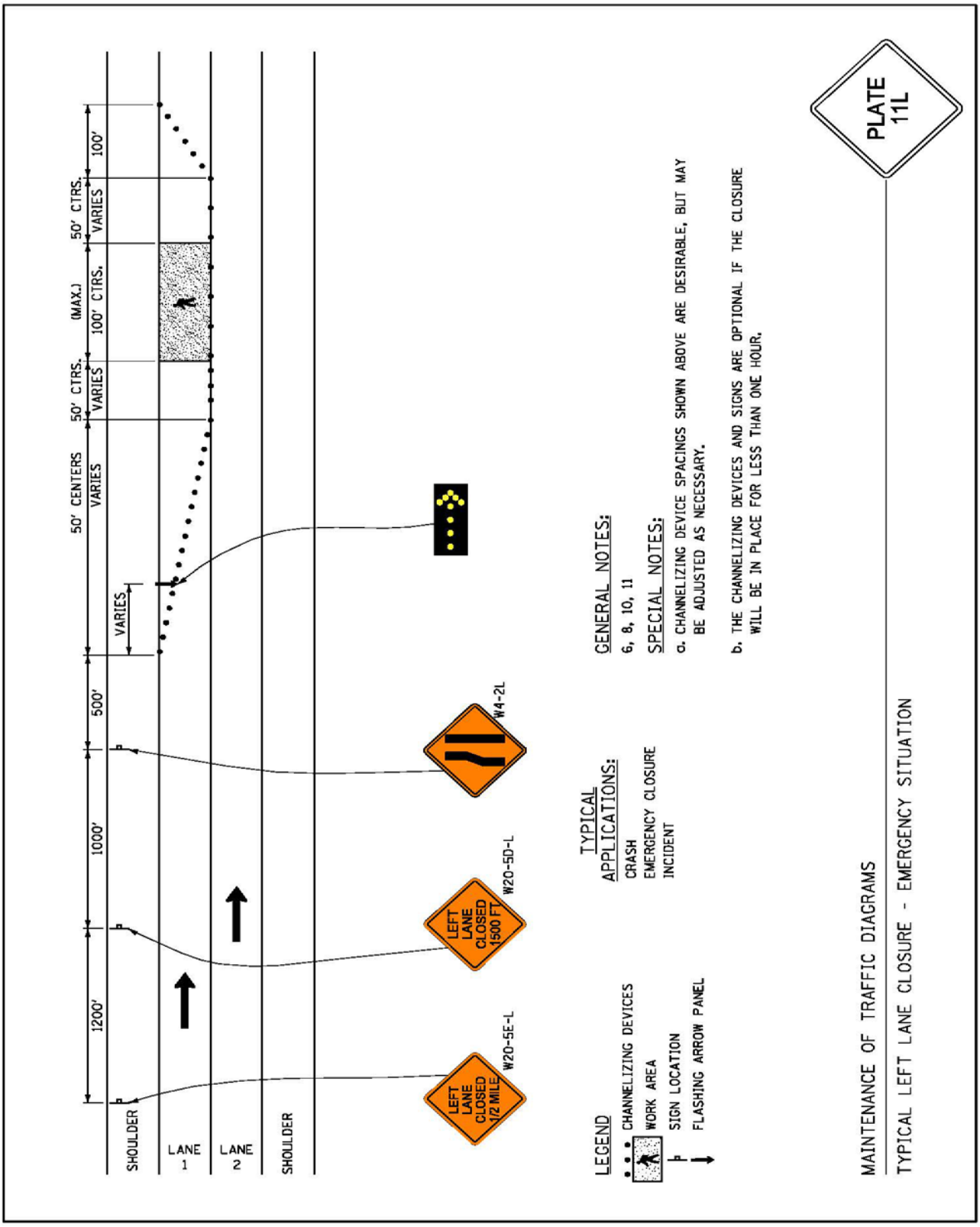
## 15.2.14 PLATE 10L - TYPICAL MOBILE OPERATION-TWO LEFT LANES CLOSURE



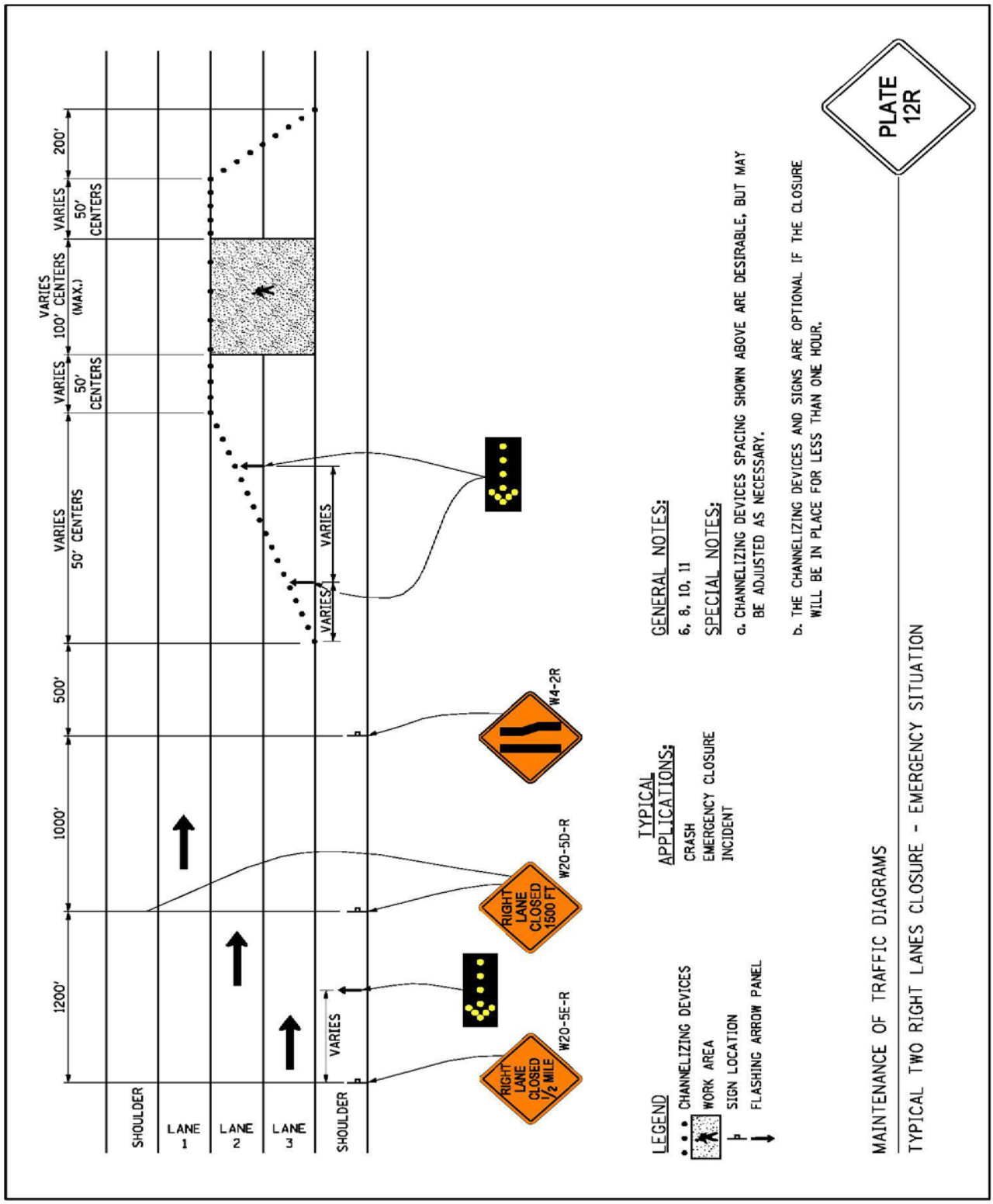
## 15.2.15 PLATE 11R - TYPICAL RIGHT LANE CLOSURE-EMERGENCY SITUATION



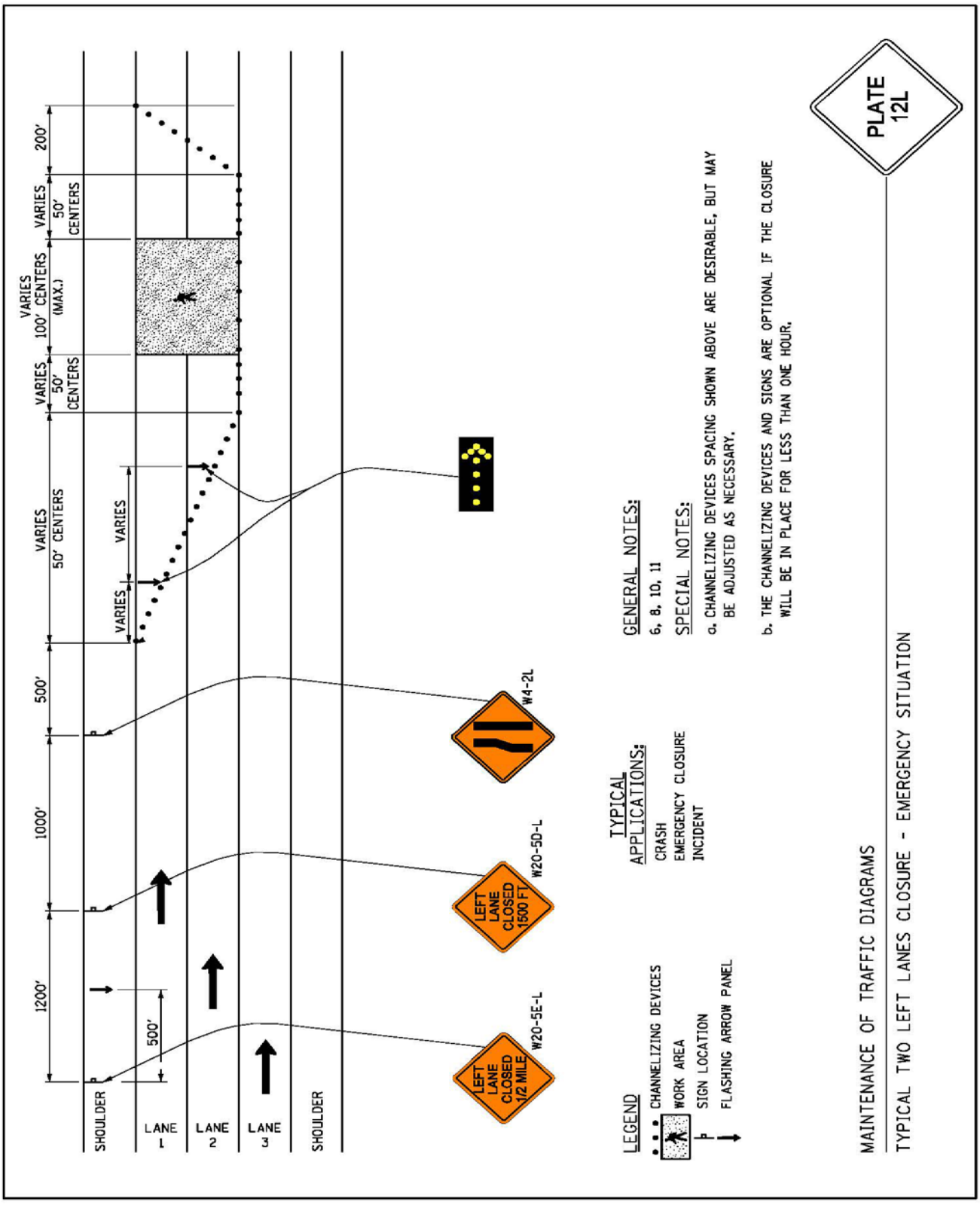
## 15.2.16 PLATE 11L - TYPICAL LEFT LANE CLOSURE-EMERGENCY SITUATION



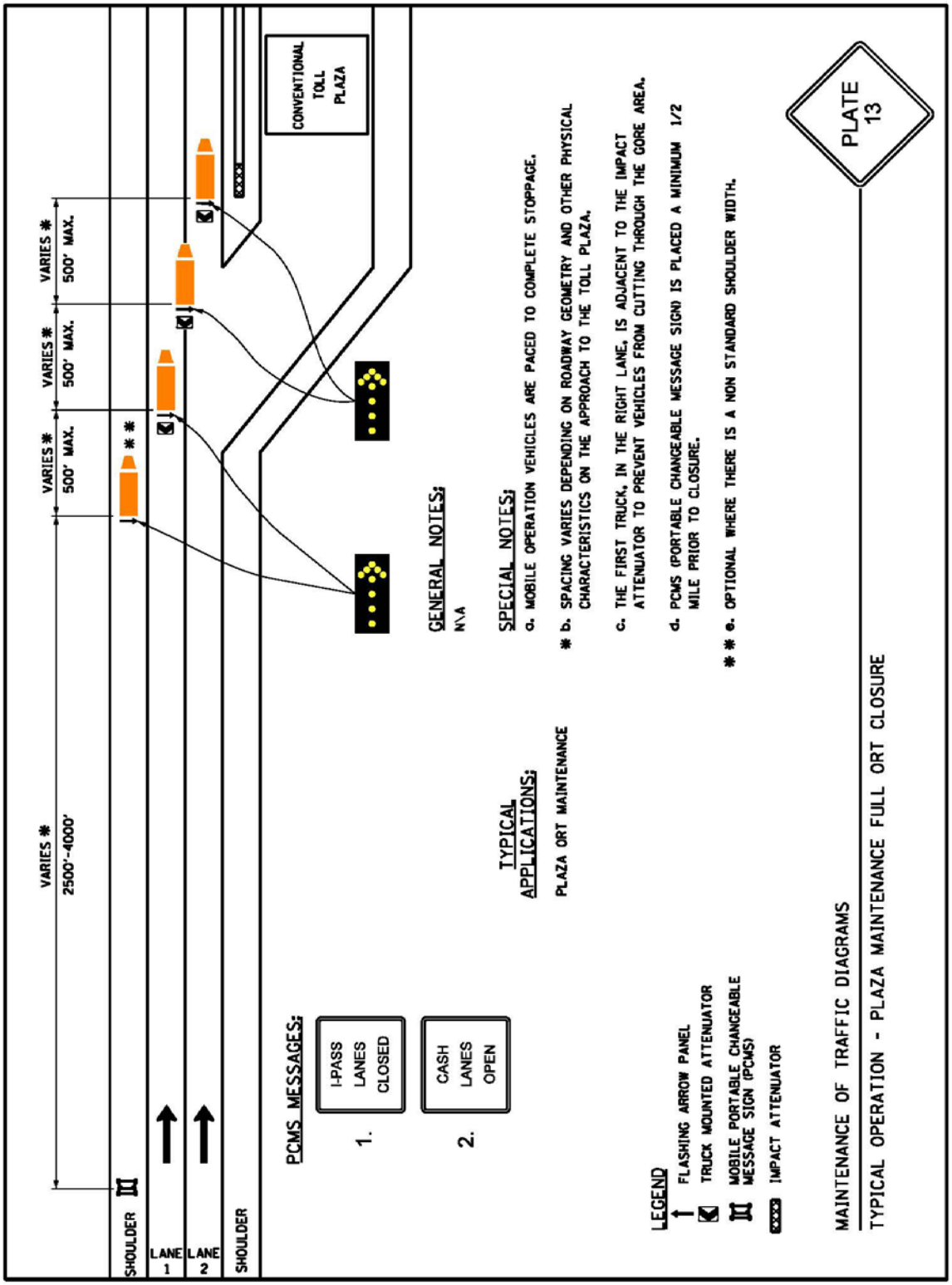
## 15.2.17 PLATE 12R - TYPICAL TWO RIGHT LANES CLOSURE-EMERGENCY SITUATION



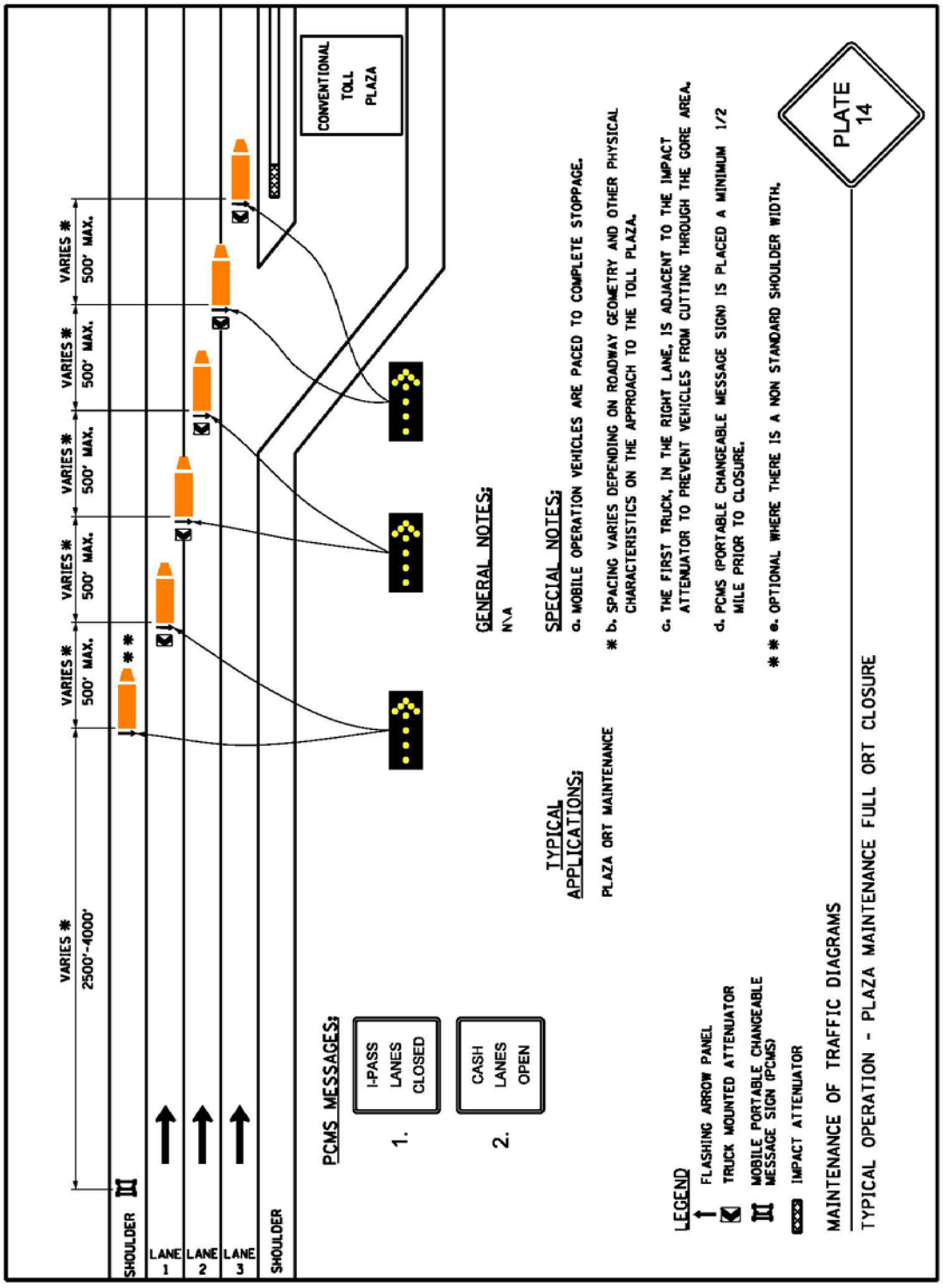
## 15.2.18 PLATE 12L - TYPICAL TWO LEFT LANES CLOSURE-EMERGENCY SITUATION



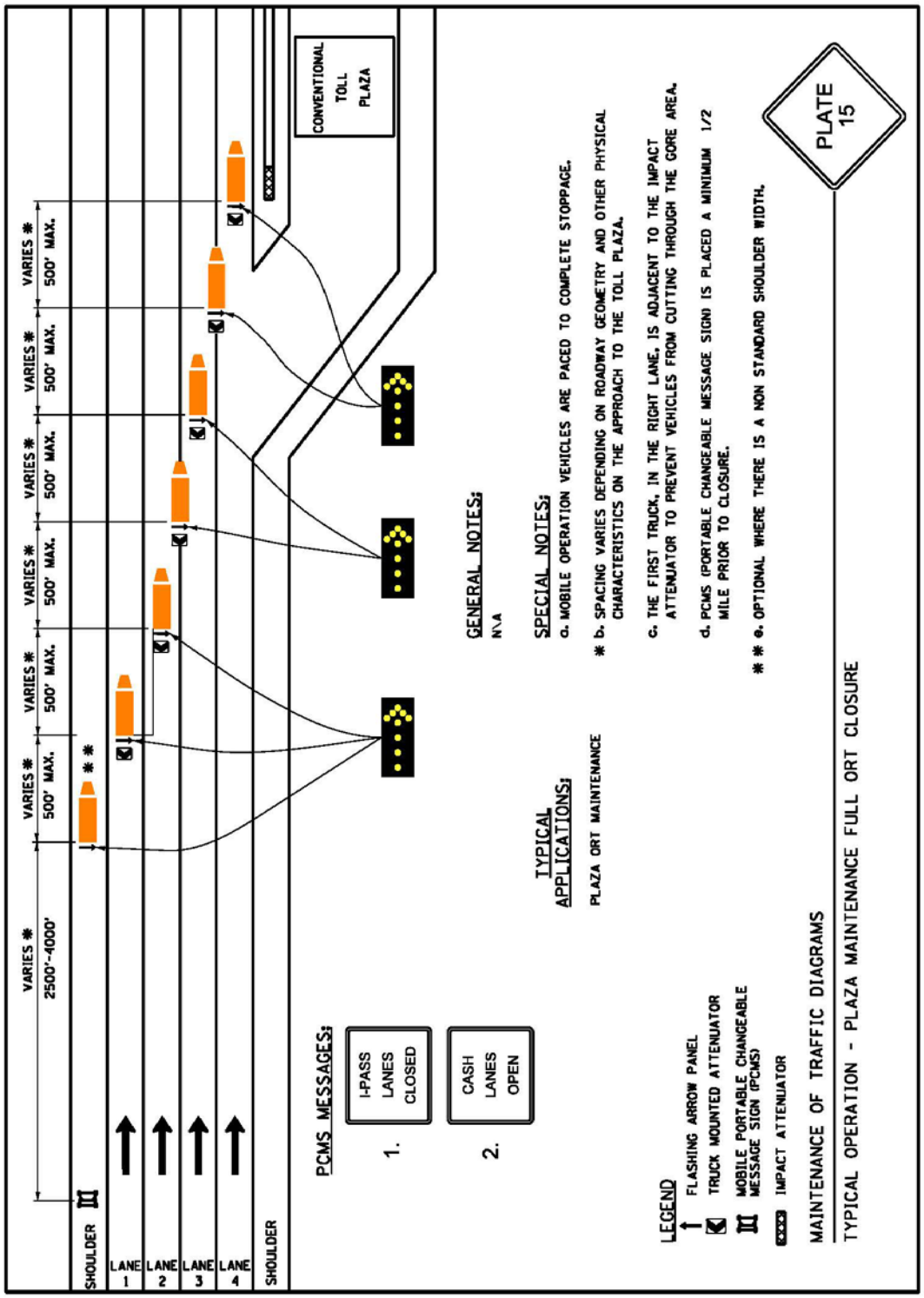
## 15.2.19 PLATE 13 - PLAZA MAINTENANCE FULL ORT CLOSURE-TWO LANES



## 15.2.20 PLATE 14 - PLAZA MAINTENANCE FULL ORT CLOSURE-THREE LANES



## 15.2.21 PLATE 15 - PLAZA MAINTENANCE FULL ORT CLOSURE-FOUR LANES



# APPENDIX A – CONSTRUCTION COMMUNICATIONS ROLES AND RESPONSIBILITIES

Providing a high level of safety for the Tollway is enhanced by providing information about maintenance and construction activities to the traveling public in a timely manner. The Tollway's Communication and Marketing Department (hereinafter referred to as 'Communications'), uses various means for these public communications, including press releases, emailed construction alerts, fact sheets, palm cards distributed by toll collectors, dynamic message signs (DMS), Construction Communications Initiatives (CCI) signs, etc. Communications also works to ensure that the content of signage is clear and consistent with other messages being delivered to Tollway users.

To facilitate the link between Communications and Construction Managers (CM), a Project Communications Liaison (PCL) will be established. In most cases, the PCL will have already been established for a Tollway corridor or group of Tollway projects. In some cases, the PCL will be an employee of the CM. It is the responsibility of the PCL to fully understand the scope and schedule of work to be performed on the Tollway, and to transmit that information to the Tollway's Communications Department. A Construction Communication Coordinator (CCC) at the Tollway is then responsible for developing various communications to inform the traveling public and news media.

CM's will be informed at or before notice to proceed of whether a PCL exists, who that person is, and how to contact them. If a PCL has not been identified, a CM employee will be designated to fulfill PCL responsibilities.

The PCL should review lane closure requests with the CM before they are submitted, so the PCL should be aware of all requests but the CM should also copy the PCL on all lane closure requests to verify when the forms are submitted.

Cancellations or changes of planned lane closures should be in accordance with Tollway-Lane Closure Reference Guide.

# APPENDIX B – TRAFFIC FORMS

Traffic forms and guides are available on the Web-Base Management System,

Project Name: 16-CRP Program Wide
File Management, Folder: Traffic-MOT:

# APPENDIX C – PROCEDURES FOR PLACING TRAFFIC CONTROL SIGNAGE

The following are guidelines that Contractors, Maintenance, Utility Companies, Design Section Engineers and Construction Managers may use for the placement of Traffic Control devices when needed along the Illinois Tollway system.

In case of discrepancy between the contract document and this MOT MANUAL, the Contractor shall follow the contract document.

The dimensions provided may be adjusted to avoid conflicts in the field. The noted devices shall apply for all contracts with the Tollway – measures used by Tollway Maintenance may be modified as necessary.

## Shoulder Closure

A shoulder closure is required whenever activities are required on the paved shoulder or within 2 feet from the edge of shoulder. Whenever practical, the median and the outside shoulder should not be closed at a given location at the same time. See Plate 2 for details.

Provided the widths of the traveled lanes are not reduced, the speed limit through the limits of the shoulder closure shall be 55 mph or the posted speed limit whichever is less. Short duration and maintenance closures do not require speed reduction.

400 feet in advance of the work zone a 200-foot taper shall be placed from the edge of shoulder to two feet outside of the traveled pavement. The devices shall be either Type II barricades, vertical barricades or drums. When the closure is to be placed during the day and removed the same day, cones may be used in lieu of barricades.

## Advance Signage

Prior to all permanent lane closures and lane shifts, the Contractor shall place a series of three (3) traffic control devices to give sufficient advance notice to motorists of the impending construction and the revised lane configuration. These signs shall be stationary (except as noted herein), and will remain throughout the duration of the Contract. These signs shall be placed from three to five (3 to 5) miles in advance of the work area – the exact location will be either shown on the Plans or will be as directed by the CM. The following factors will influence the location of these signs:

- Is the location an urban or rural Tollway?
- Number of Lanes in each direction
- Posted speed limit
- Interchange within the 3 to 5 miles of the work area. It is desirable to place the advance signing prior to the interchange, to allow motorists the opportunity to use an alternate route.

- Duration of the closure. Closures and/or shifts that are short term may require less advance notice.

Care must be taken to avoid conflicts between project information signage and construction signage.

**Single Lane Closure**

Whenever work is required in either the inside or outside lane of mainline pavement, or on the shoulder and within two feet of the edge of pavement, a single lane closure shall be set and properly maintained. See Plate 3R and 3L for details.

When the expected duration of the lane closure will exceed four days or as specified in the Contract Documents, existing pavement markings which conflict in message with the traffic control will be removed in accordance with Section 703 of the Standard Specifications. The reflectors for existing raised pavement lane markers, within the limits of the conflicting pavement markings, shall also be removed. Additionally, Temporary Pavement Marking (either paint or tape, per Section 703 of the Standard Specifications) will be applied beginning 100 feet prior to the beginning of the taper to the end of the buffer space. The temporary pavement markings may be extended through the work area, should the work area be of limited length or of an extended duration, as determined by the CM.

Direction Indicator Barricades shall exclusively be used for all closure tapers, with the barricades spaced 50 feet on center and the arrows pointing in the direction of the open lane(s).

The requirements for traffic control within the limits of the work area are presented in Article V, Work Zone Area.

**Two-Lane Closure**

For two-lane closure see Plate 4R and 4L for details.

When the existing cross-section consists of three or more lanes, and it is necessary to close a center lane, then all lanes between the center lane and the nearest shoulder shall be closed.

**Work Zone Area**

Type II barricades, vertical barricades, or drums shall be used tangent to the work areas established by lane closures or lane shifts. Lane closures of a short duration or for Maintenance operations may use cones in lieu of barricades tangent to the buffer space and work zone areas.

Whenever a permanent lane closure and /or lane shift is required, the speed limit for the open lanes shall be established in accordance with Article 5.3.2.

Check barricades (Type II) shall be placed in the closed lane and/or shoulder at 1000-foot intervals to discourage motorists from driving in the work area. Check barricades may be omitted if patching barricades are required.

## Lane Shifts

The Tollway recommends the use of lane shifts when the anticipated duration of work as well as the traffic volume along a section of the Tollway system would cause backups on a regular basis, and there is sufficient shoulder width opposite the work area so the shoulder can be used as a lane of traffic on an interim basis.

The traffic control measures for a lane shift are dependent upon the roadway geometry, the locations of interchange ramps or grade separation structures within or near the limits of the lane shift. The details for this work should be developed as part of the Contract Plan preparation, and be reviewed by the Tollway prior to construction.

# APPENDIX D – WORK ZONE SAFETY INSPECTION CHECKLIST

## Work Zone Safety Inspection Checklist

### Basic Requirements

All traffic control devices should:

☑ Fulfill a need;

☑ Command attention;

☑ Convey a clear, simple message;

☑ Command respect from road users; and

☑ Give adequate time for proper response.

The work zone is easy to navigate in a safe manner for someone unfamiliar with the roadway and with some typically reduced visual, mental, and physical capabilities.

- Roadway changes that will require rapid maneuvers, such as lane narrowing, dropped lanes, changes in geometrics, etc., are avoided where possible.
- Temporary traffic control devices are used with the assumption in mind that drivers will only reduce their speeds if they see a need to.

If temporary work zone requires regulatory measures that differ from existing devices (e.g. Speed Limits), existing devices have either been covered or removed.

### Conventional Signing

### Sign Visibility

☑ Appropriate sign sheeting designated by project documents.

☑ Signs are clean, legible and are positioned properly.

☑ Retroreflective material used displays approximately the same color in day or night conditions.

☑ All signs meet the acceptable category in the Tollway Quality Standards for Work Zone Traffic Control Devices guide.

### Appropriate signing for all activities/hazardous conditions

☑ Signs are spaced so that drivers are able to read each sign and take appropriate actions.

☑ Lane closures are properly marked.

☑ Where there are drop-offs and the adjacent lane remains opened to traffic, appropriate sign(s) are in place (UNEVEN LANES and SHOULDER DROP-OFF.)

**Proper placement and installation of signs**

☑ Signs should be on the right side of the road unless otherwise stated in MUTCD or contract (Where there are two or more travel lanes in the same direction, as is normally the case on the Tollway, the sign message should be repeated on the left side of the roadway).

☑ Sign Height

- Post-mounted signs shall be placed with the bottom a minimum of 7 feet above the roadway.

☑ Lateral Offset

- Edges of signs are a minimum of 2 feet away from adjacent lane.
- For long-term projects, a distance of 8 to 12 feet is desirable.

☑ Signs smaller than 36” x 36” may be mounted on a single 4” x 6” wooden post. Signs larger than 36” x 36” or with a width greater than 36 inches must have two wooden posts.

☑ Sign sizes are as designated by project documents.

☑ Temporary sign stands are ballasted safely (ballast is not suspended off ground).

☑ Signs with wooden posts have been drilled for proper breakaway performance.

**Electronic Signing**

**Portable Changeable Message Systems (PCMS)**

☑ The front face of the PCMS sign should be covered with a protective material. The color of the elements should be yellow or orange on a black background.

☑ The PCMS should be visible from 3000 feet under both day and night conditions. Each sign character shall be clearly legible from a minimum distance of 600 feet for nighttime conditions and 800 feet for normal daylight conditions. The message should have adjustable display rates, so that the entire message can be read at least twice at the posted speed or the anticipated speed.

☑ Bottom of the panel is at least 7 feet above the roadway.

☑ The control system should include a display screen for reviewing messages and be capable of maintaining memory when power is interrupted.

☑ PCMS will automatically adjust brightness under varying light conditions.

☑ PCMS is equipped with a power source and a back-up battery to provide continuous operation.

☑ PCMS is compatible and functional with the Illinois Tollway Traffic Management Center (TIMS) Sign Control Software, if required.

**Arrow Boards**

☑ For daytime use, the minimum arrow board size shall be 30” by 60” with 13 lamps.

☑ For nighttime use the minimum size is 48” by 96” with 15 lamps.

☑ Arrow Board is visible from 0.5 mile under night and day conditions.

☑ The light intensity shall be reduced during nighttime use to avoid glare and returned to full intensity for daytime use.

☑ Bottom of the panel is at least 7 feet above the roadway (6 feet to the bottom of the panel for vehicle-mounted arrow boards).

☑ Arrow Board is equipped with a power source and a back-up battery.

**Delineation Devices**

**Visibility**

☑ Delineation devices are clean and legible.

☑ Retroreflective material used displays approximately the same color in day or night conditions.

**Proper Use of Channelizing Devices**

**General**

☑ Temporary delineation devices are ballasted safely (not suspended off the ground.)

☑ The spacing of channelizing devices should not exceed a distance in feet equal to 1.0 times the speed limit in mph when used for taper channelization, and a distance in feet of 2.0 times the speed limit in mph when used for tangent channelization.

☑ If warning lights are used they should be put on the side of the device where the traffic is intended to travel.

**Cones**

☑ Cones shall be predominantly orange in color and are made out of a material that can be struck without causing damage to the impacting vehicle.

☑ Cones are proper height for their use and are retroreflectorized for nighttime use.

☑ Steps are taken to make sure that the cones will not be blown over or displaced by wind or moving traffic, with ballast kept to minimum needed.

**Tubular Markers**

☑ Tubular markers shall be predominantly orange in color and are made out of a material that can be struck without causing damage to the impacting vehicle.

☑ Tubular Markers are proper height for their use and retroreflectorized for nighttime use.

☑ Markers are affixed to the pavement with ballast kept to minimum needed. If non-cylindrical tubular markers are used they are attached to the pavement ensuring that the width facing road users meet the minimum requirements (2 inches).

☑ Tubular markers are only used when there is a limited space.

**Vertical Panels**

☑ Vertical panels have alternating orange and white diagonal strips.

☑ Diagonal stripes slant downward to the direction where the traffic is intended to travel.

☑ If panels are used at night they are retroreflectorized.

**Drums**

☑ Drums are a minimum of 36 inches in height and have at least 18 inches in width regardless of orientation.

☑ Metal drums shall not be used.

☑ Markings on the drums are horizontal, circumferential, alternating orange and white retroreflective stripes 4 to 6 inches wide.

☑ Drums have closed tops to prevent construction and other debris from collecting in them.

☑ Sand or any other type of ballast is not placed on top of the drum.

☑ Drums are not weighed down with ballast to the extent that would make them hazardous to road users or construction personnel.

☑ Holes are drilled in the bottom of the drum to drain any water.

**Type II or III Barricades**

☑ Diagonal stripes slant downward to the direction where the traffic is intended to travel.

☑ When a highway is legally closed but access is still allowed for local road users barricades are not extended completely across the road. And appropriate striping is used:

| Road Closures | |
|---|---|
|  If traffic is to turn left. |  If traffic may turn either left or right. |
|  If traffic is to turn right. |  If no turns are intended. |

☑ Stripes are retroreflective.

☑ Minimum length for type II barricades is 24 inches, minimum for type III is 48 inches, and rails are 8 to 12 inches wide.

☑ Barricades are supported in a way that allow road users to see them, and in a manner that provides a stable support that is not easily blown over or displaced.

☑ Ballast is not placed on the upper rails of the barricade and no nondeformable objects such as rocks or chunks of concrete are used as ballast.

☑ Signs may not be placed on type III barricades, but shall be supported on independent supports.

**Direction Indicator Barricade**

☑ Consists of a retroreflective horizontal arrow on the top panel and a striped retroreflective bottom panel.

☑ The arrow board is a black on orange and is 24 inches x 12 inches.

☑ The striped panel has 4 inch stripes at a 45° angle, pointing down in the direction the arrow points. The panel is 24 inches x 8 inches.

**Markings**

☑ Pavement markings match the markings on either end of the project, unless:

- the road is unsurfaced,
- it is not possible to provide markings and proper channelizing devices are in place.
- the contract allows temporary markings, if so:

- Tape or painted markings for broken lines are at least 2 feet long, every 40 feet
- All temporary markings are in place no longer than allowed by contract.

☑ Markings that are no longer applicable are completely obliterated (painting over the markings is not acceptable).

☑ Surfaced detours or temporary roadways should have normal pavement markings along the entire length.

**Flaggers**

☑ Flaggers are certified and have a sense of responsibility, adequate training, average intelligence, are in good physical condition, are mentally alert, courteous but firm and have a neat appearance.

**High-visibility clothing**

☑ DAY- Vest, shirt or jackets should be orange, yellow, yellow/green or a fluorescent version of these colors that meets the Performance Class 2 requirements of the ANSI/ISEA 107-2004 publication entitled "American National Standard for High-Visibility Safety Apparel and Headwear".

☑ NIGHT- Similar clothing as above but material should be retroreflective that meets the Performance Class 3 requirements of the ANSI/ISEA 107-2004 publication entitled "American National Standard for High-Visibility Safety Apparel and Headwear".

**Proper devices and procedures**

☑ Flaggers should have SLOW Paddles made out of type III or IV retroreflective material.

☑ SLOW paddles are a minimum of 18 inch with minimum 6 inch height of letters.

☑ Flaggers and pilot cars are provided with 2-way radios unless they are within sight of each other.

☑ If railroad crossing exists the flagger will not be allowed to create conditions where vehicles can be stopped with no means of escape.

☑ Flagger Stations is at an appropriate distance from the work zone.

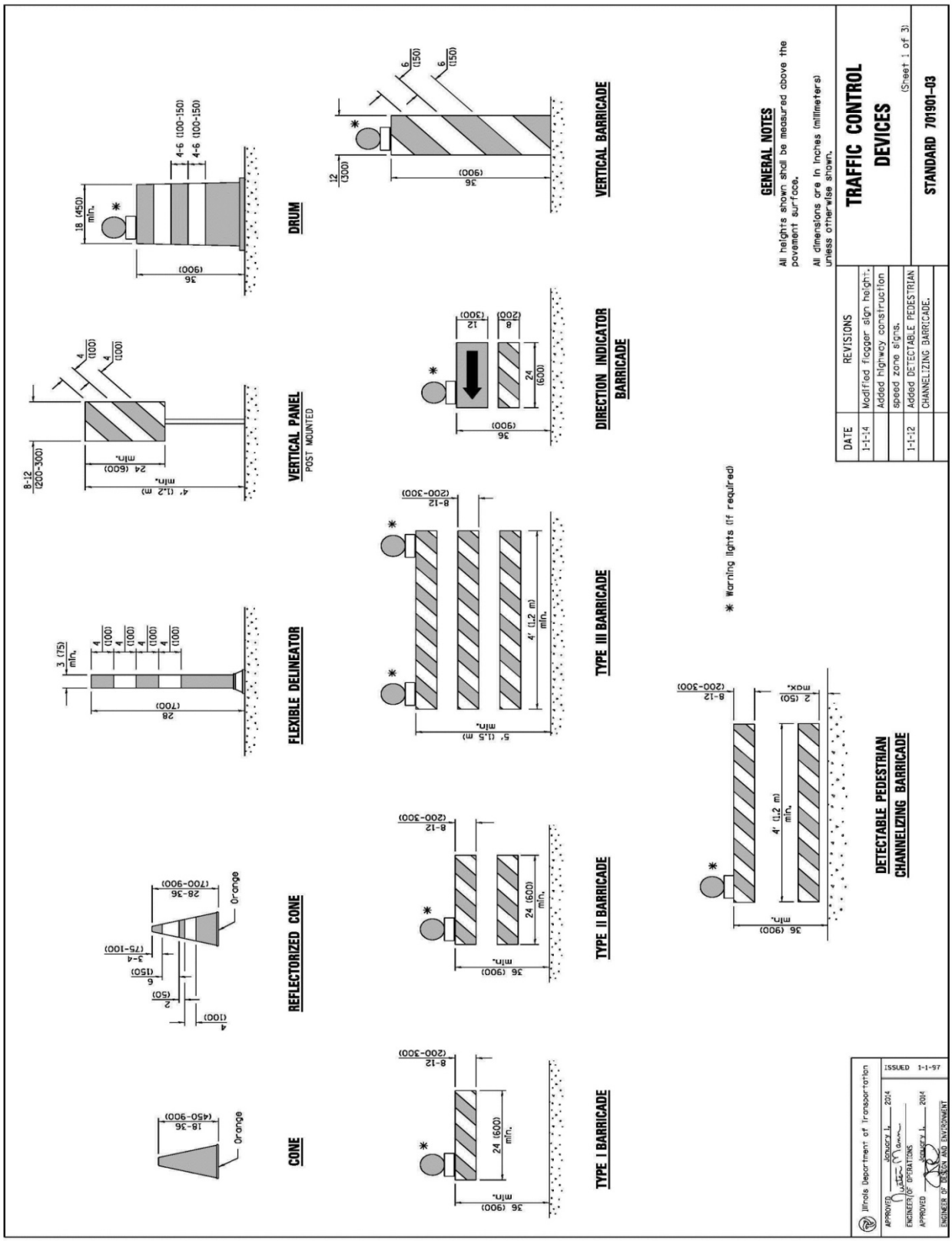
**Flagger Station Location in Advance of Work Area**

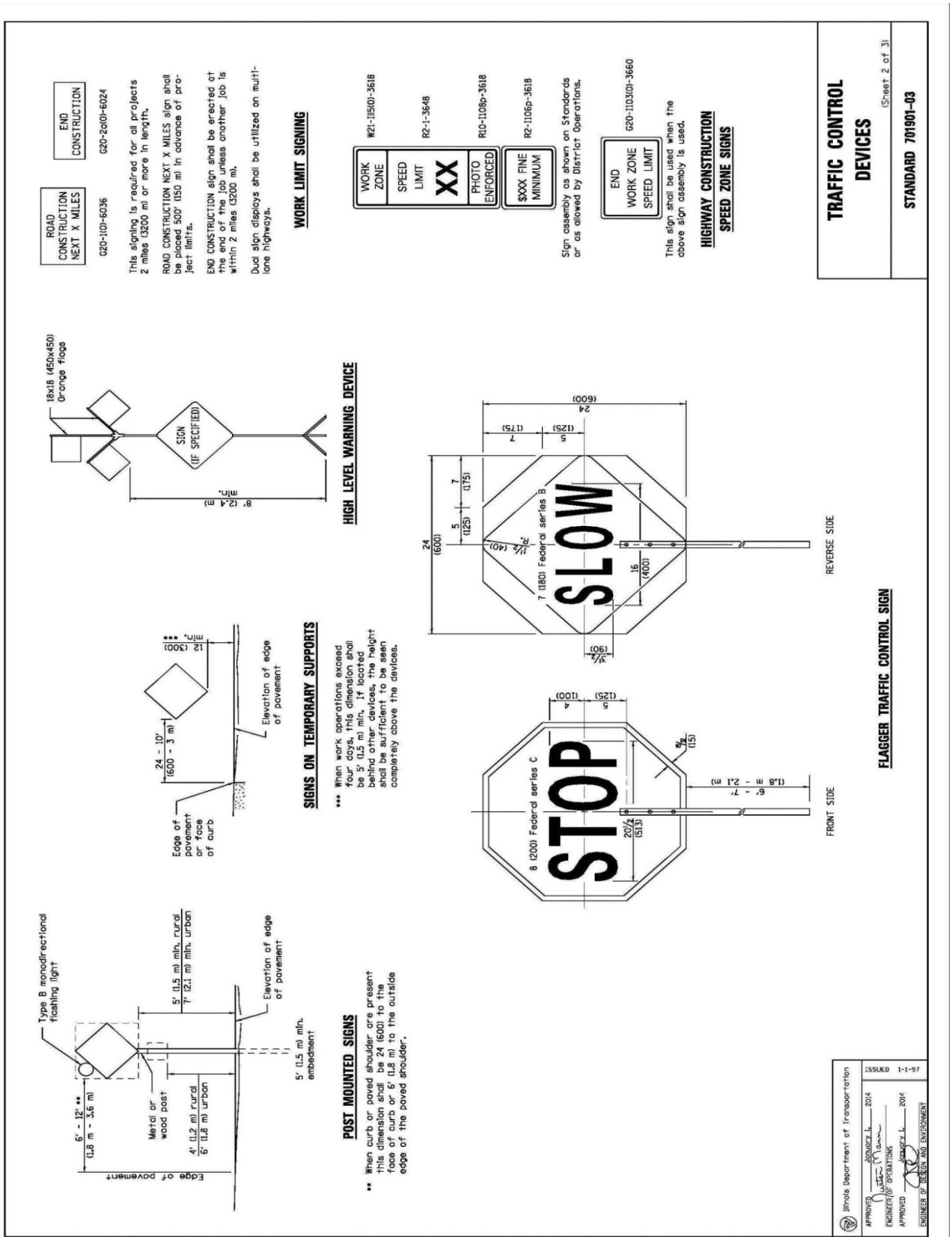
| **Flagger Station Location** | **Speed mph** | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Distance feet** | 35 | 55 | 85 | 120 | 170 | 220 | 280 | 335 | 415 |

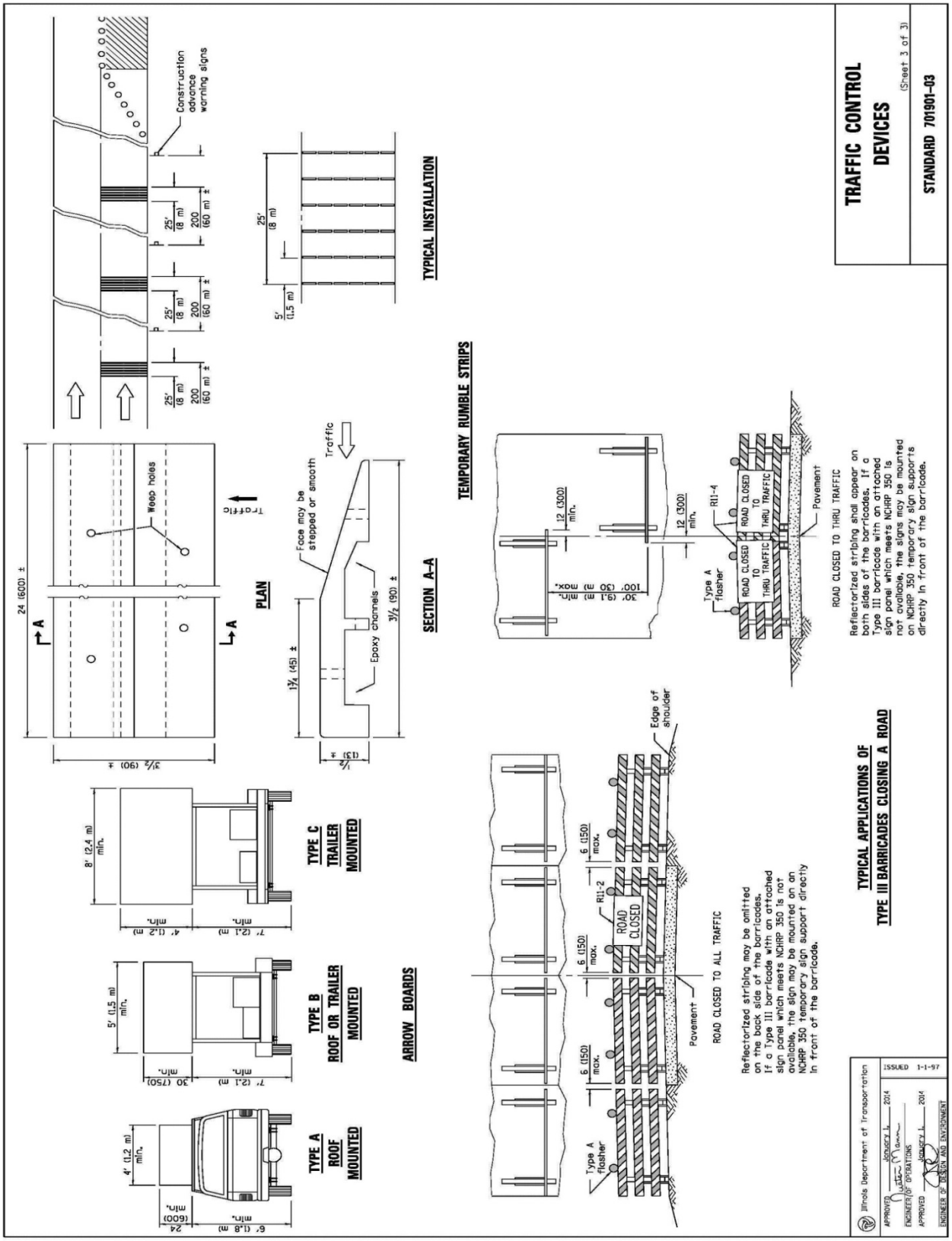
**Construction Personnel/Equipment**

- ☑ High-visibility clothing, use same standards that are used for flaggers.
- ☑ Personal vehicles are parked off the traveled roadway (preferred) or at least outside the clear zone.
- ☑ Construction equipment and supplies (including traffic control devices) that are not in use are stored off the traveled roadway and outside the clear zone.

# APPENDIX E – IDOT STANDARDS


CONE
REFLECTORIZED CONE
FLEXIBLE DELINEATOR
VERTICAL PANEL
POST MOUNTED
DRUM
VERTICAL BARRICADE
DIRECTION INDICATOR BARRICADE
TYPE III BARRICADE
TYPE II BARRICADE
TYPE I BARRICADE
DETECTABLE PEDESTRIAN CHANNELIZING BARRICADE
* Warning lights (if required)
GENERAL NOTES
All heights shown shall be measured above the pavement surface.
All dimensions are in inches (millimeters) unless otherwise shown.
DATE
REVISIONS
1-1-14 Modified flagger sign height, Added highway construction speed zone signs.
1-1-12 Added DETECTABLE PEDESTRIAN CHANNELIZING BARRICADE.
TRAFFIC CONTROL DEVICES
(Sheet 1 of 3)
STANDARD 701901-03
Illinois Department of Transportation
APPROVED
ENGINEER OF OPERATIONS
APPROVED
ENGINEER OF DESIGN AND ENVIRONMENT
ISSUED 1-1-97


TRAFFIC CONTROL DEVICES
(Sheet 2 of 3)
STANDARD 701901-03
Illinois Department of Transportation
ISSUED 1-1-97
APPROVED
ENGINEER OF OPERATIONS
APPROVED
ENGINEER OF DESIGN AND ENVIRONMENT
FLAGGER TRAFFIC CONTROL SIGN
FRONT SIDE
REVERSE SIDE
8 (200) Federal series C
STOP
7 (180) Federal series B
SLOW
SIGNS ON TEMPORARY SUPPORTS
*** When work operations exceed four days, this dimension shall be 5' (1.5 m) min. If located behind other devices, the height shall be sufficient to be seen completely above the devices.
POST MOUNTED SIGNS
** When curb or paved shoulder are present this dimension shall be 24 (600) to the face of curb or 6' (1.8 m) to the outside edge of the paved shoulder.
Type B monodirectional flashing light
Metal or wood post
Edge of pavement
Elevation of edge of pavement
5' (1.5 m) min. embedment
Edge of pavement or face of curb
HIGH LEVEL WARNING DEVICE
18x18 (450x450) Orange flags
SIGN (IF SPECIFIED)
WORK LIMIT SIGNING
ROAD CONSTRUCTION NEXT X MILES
G20-1101-6036
This signing is required for all projects 2 miles (3200 m) or more in length.
ROAD CONSTRUCTION NEXT X MILES sign shall be placed 500' (150 m) in advance of project limits.
END CONSTRUCTION sign shall be erected at the end of the job unless another job is within 2 miles (3200 m).
Dual sign displays shall be utilized on multi-lane highways.
END CONSTRUCTION
G20-2001-6024
WORK ZONE
SPEED LIMIT XX
PHOTO ENFORCED
$XXX FINE MINIMUM
W21-1116(0)-3618
R2-1-3648
R10-1108p-3618
R2-1106p-3618
Sign assembly as shown on Standards or as allowed by District Operations.
END WORK ZONE SPEED LIMIT
G20-1103(0)-3660
This sign shall be used when the above sign assembly is used.
HIGHWAY CONSTRUCTION SPEED ZONE SIGNS


TRAFFIC CONTROL DEVICES
(Sheet 3 of 3)
STANDARD 701901-03
TYPICAL INSTALLATION
Construction advance warning signs
25' (8 m)
200 (60 m) ±
5' (1.5 m)
PLAN
24 (600) ±
Weep holes
Traffic
SECTION A-A
Face may be stepped or smooth
Epoxy channels
1¾ (45) ±
3½ (90) ±
TEMPORARY RUMBLE STRIPS
12 (300) min.
30' (9.1 m) max.
100' (30 m) max.
Type A flasher
ROAD CLOSED TO THRU TRAFFIC
R11-4
Pavement
Reflectorized striping shall appear on both sides of the barricades. If a Type III barricade with an attached sign panel which meets NCHRP 350 is not available, the signs may be mounted on NCHRP 350 temporary sign supports directly in front of the barricade.
TYPE A ROOF MOUNTED
4' (1.2 m) min.
24 (600) min.
6' (1.8 m) min.
TYPE B ROOF OR TRAILER MOUNTED
5' (1.5 m) min.
30 (750) min.
7' (2.1 m) min.
TYPE C TRAILER MOUNTED
8' (2.4 m) min.
4' (1.2 m) min.
ARROW BOARDS
6 (150) max.
R11-2
ROAD CLOSED
Edge of shoulder
ROAD CLOSED TO ALL TRAFFIC
Reflectorized striping may be omitted on the back side of the barricades. If a Type III barricade with an attached sign panel which meets NCHRP 350 is not available, the sign may be mounted on an NCHRP 350 temporary sign support directly in front of the barricade.
TYPICAL APPLICATIONS OF TYPE III BARRICADES CLOSING A ROAD
Illinois Department of Transportation
APPROVED
ENGINEER OF OPERATIONS
January 1, 2014
APPROVED
ENGINEER OF DESIGN AND ENVIRONMENT
January 1, 2014
ISSUED 1-1-97

# APPENDIX F

# FLOW CHARTS FOR CONSIDERATION OF WORK ZONE SPEED LIMITS

**Location: e-Builder; Project 16,**
**Folder: Templates and Forms**
**Subfolder: Traffic-MOT**

Hyperlink:WZSL Flow Charts Version 1.4
https://app.e-builder.net/da2/Documents/FileView.aspx?FileID={8F5CFB3E-1C5D-4F54-9A82-A4D4F4BE6475}&Logged=true

## APPENDIX G

# Work Zone Speed Limit Form

**Location: e-Builder; Project 16,**
**Folder: Templates and Forms**
**Subfolder: Traffic-MOT**

Hyperlink: WZSL Form Version 1.5
https://app.e-builder.net/da2/Documents/FileView.aspx?FileID={E57A4696-74BA-4DEF-83C3-3BEC7AB39A02}&Logged=true