

American Traffic Safety Services Association

**Minimizing
Worker Exposure
in Highway Work
Zones Through
the Use of
Positive
Protection and
Other Strategies**



Why This Course?

- ◆ More guidance is needed on:
 - ◆ The use of positive protection and other strategies to minimize worker exposure in work zones
 - ◆ The decision process to use positive protection devices
- ◆ FHWA has requirement documents that governs work zone safety and mobility, including ***positive protection and other strategies***

What are these Requirements?

- ◆ SAFETEA-LU and MAP 21 mandate for **development of a policy** for use of positive protection to address intrusion issues
- ◆ Agency processes, procedures, and/or guidance are to be based on guidance from the *MUTCD* and the *AASHTO Roadside Design Guide*

Why these Requirements?

- ◆ 15% of work zone fatalities are workers!
- ◆ Number of work zones will continue to increase
- ◆ 20% of National Highway System (NHS) will be under construction
- ◆ Most work is reconstruction or rehabilitation
- ◆ More vehicle-miles driven
- ◆ Although declining, work zone fatalities remain high

Course Objectives

- ◆ To provide guidance for the use of positive protection devices (PP) and other strategies to minimize worker exposure
- ◆ To discuss factors that may influence the decision to use positive protection devices
- ◆ To discuss the decision-making process (and assessment tool) on the use of positive protection devices and other exposure control measures

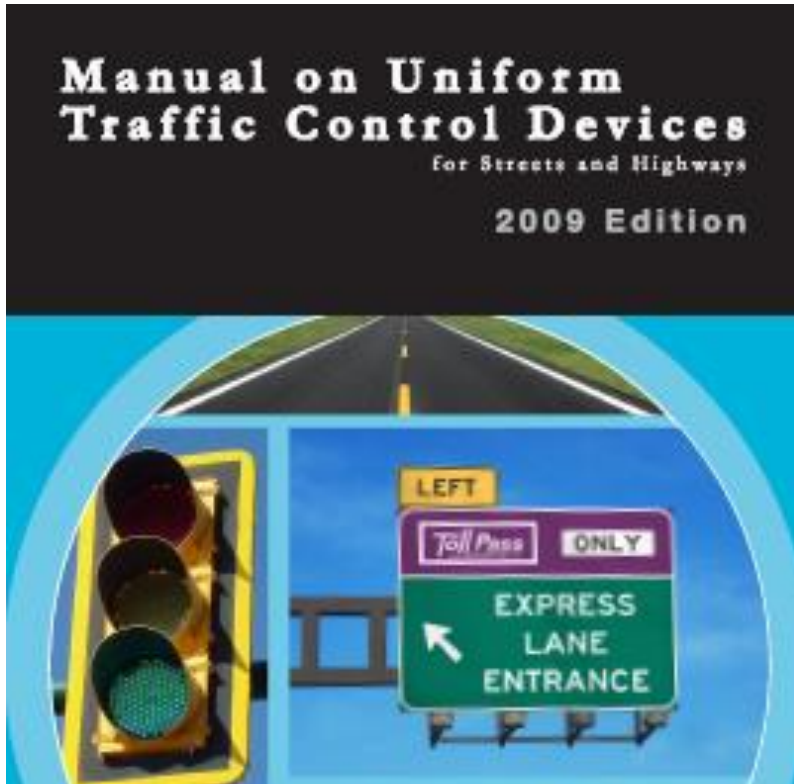
Upon completion, you will be able to:

- ◆ Identify the most appropriate exposure control measure to use for given project characteristics
- ◆ Define positive protection devices
- ◆ Assess the need for the use of positive protection and/or other strategies

Upon completion, you will be able to (cont):

- ◆ Identify the characteristics of projects that are best suited for consideration of exposure control measures and positive protection devices, and propose guidelines for their use
- ◆ Use decision tools to determine the suitability of appropriate positive protection devices (or other worker exposure control measures) for a specific work zone situation

About this Course



***Will address this
State's PP Guidelines
tomorrow!***



Based on:



The 2009 *MUTCD*



The Temporary Traffic Control Devices, 23 CFR 630, Subpart K

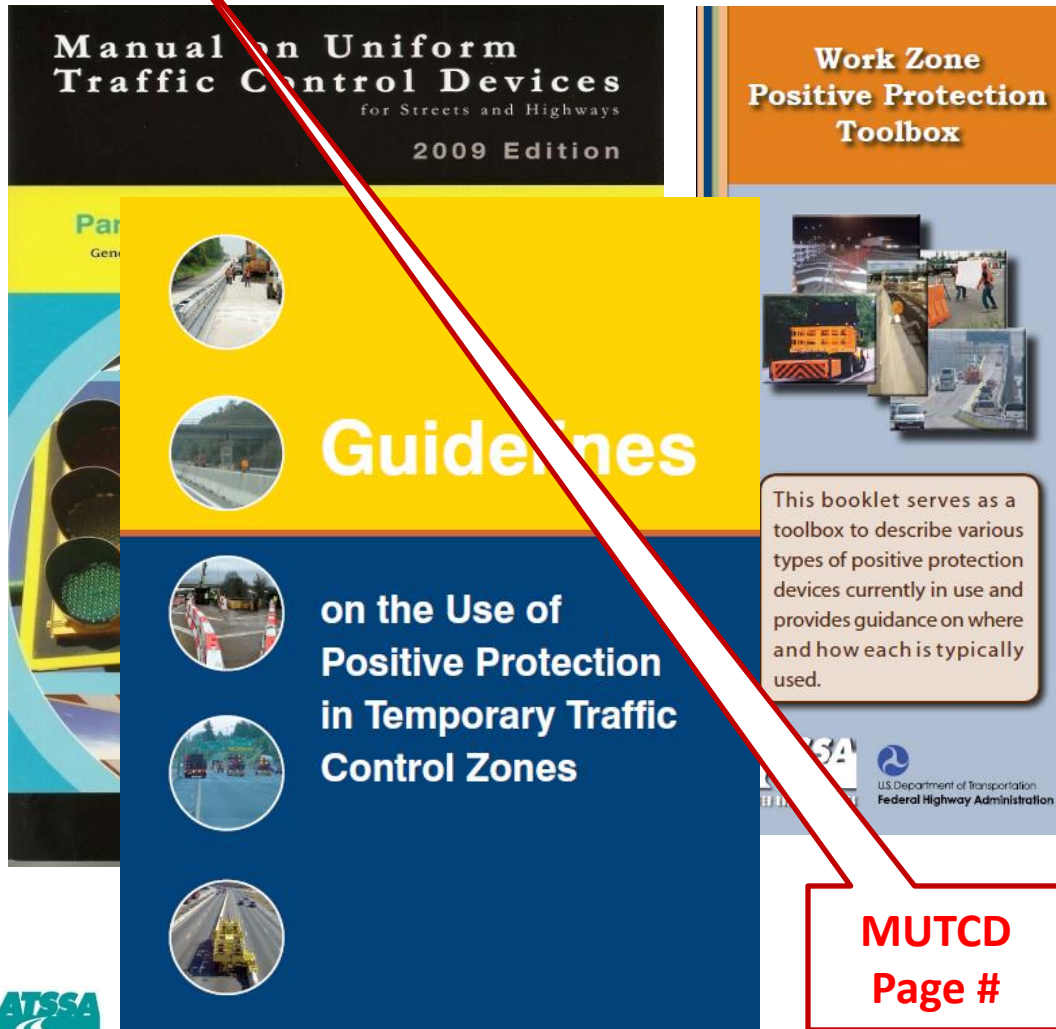


The 2011 *Roadside Design Guide*



Other various publications

Course Materials



- ◆ Course notebook
- ◆ MUTCD (1, 5, 6)
- ◆ Positive Protection Guidelines
- ◆ PP Toolbox
- ◆ Flash drive
- ◆ Pencil
- ◆ Tent name sign

Course Schedule: DAY 1

1	Introduction
2	Project Characteristics and Factors to Consider
3	Positive Protection Devices
4	Other Exposure and Traffic Control Measures

Course Schedule: DAY 2

5	Making Decisions
6	-Decision-Making Scenarios -MNDOT's Overview of PP Process (Ted Ulven)
7	Workshops
8	Closing (Exam)

Exam

- ◆ 25 true/false questions
- ◆ 4 pts each = 100 pts
- ◆ 30 minutes
- ◆ Open book, open notes
- ◆ Passing grade = 80%



Minimizing Worker Exposure Through the Use of Positive Protection and Other Strategies

-MODULE 1- Introduction



SAFER ROADS SAVE LIVES



Module Objectives

- ◆ Define positive protection
- ◆ Discuss the need for a decision-making process to minimize worker exposure
- ◆ Discuss Subpart K's and MAP-21 positive protection requirements
- ◆ Discuss positive protection reference guidance
- ◆ Define engineering judgment & the designer's role

Issues with Worker Exposure

- ◆ Workers are vulnerable!
- ◆ Their protection is left to engineering judgment, if at all
- ◆ Seldom considered on paving and other maintenance projects
- ◆ Short duration projects may be a problem
- ◆ Positive protection not always feasible, cost-effective or practical

What is Positive Protection?



The use of “a device which contains and redirects vehicles in accordance with National Cooperative Highway Research Program (NCHRP) Report 350, preventing their intrusion into the work space.”



72

Questions to Ponder

- ◆ How do we minimize worker exposure during short duration and other maintenance projects?
- ◆ When positive protection is not feasible, what “other” strategies exist?
- ◆ Is there a methodical process to assess the need for positive protection and other strategies?
- ◆ What guidance exists in this State?

How to Minimize Worker Exposure?

◆ Utilizing the *entire range* of traffic management and control and highway safety strategies and devices used to avoid crashes in work zones that can lead to worker and road user injuries and fatalities, including:

1. Positive Protection Devices

Module 3

2. Exposure Control Measures

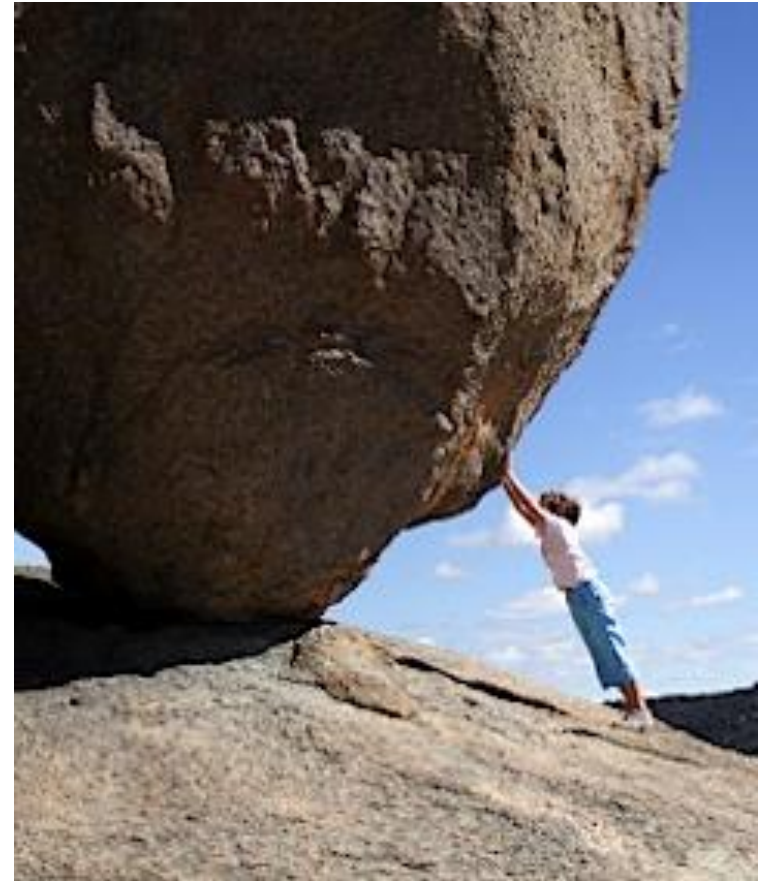
Module 4

3. Other Traffic Control Measures

Module 4

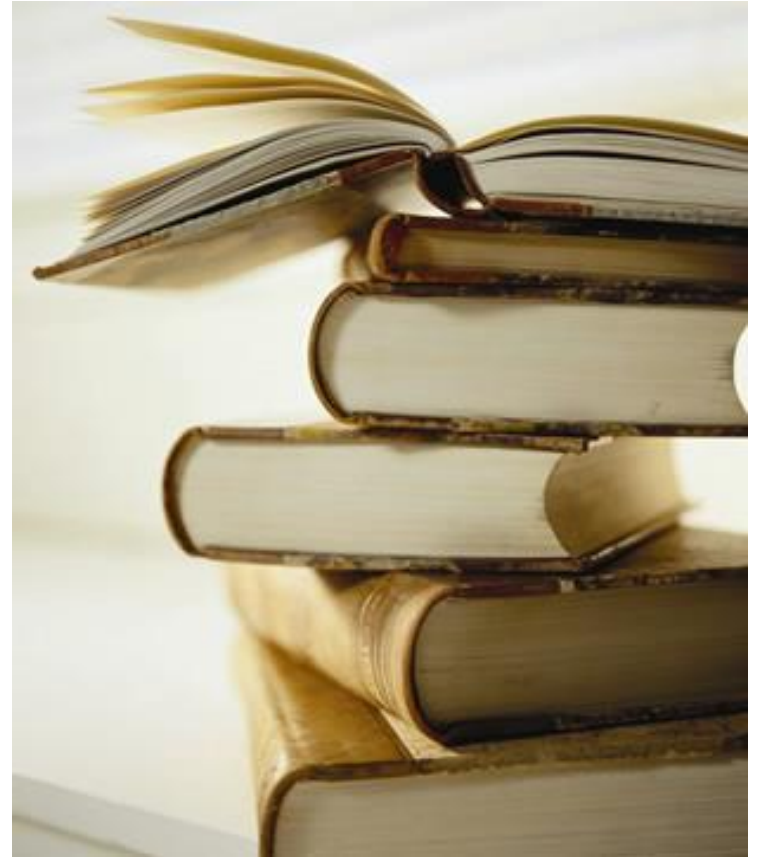
Obstacles to Overcome in the Deployment of PP Devices

- ◆ Cost
- ◆ Installation/removal
- ◆ Work space access
- ◆ Adverse affects of barrier
- ◆ Lack of suitable devices
- ◆ Lack of standardized guidelines
- ◆ Reliance on judgment



Applicable Standards and Guidance

1. *Manual on Uniform Traffic Control Devices*
2. *AASHTO Roadside Design Guide*
3. *State's PP Guidelines*
4. *Manufacturer's Instructions*



Let's review these!

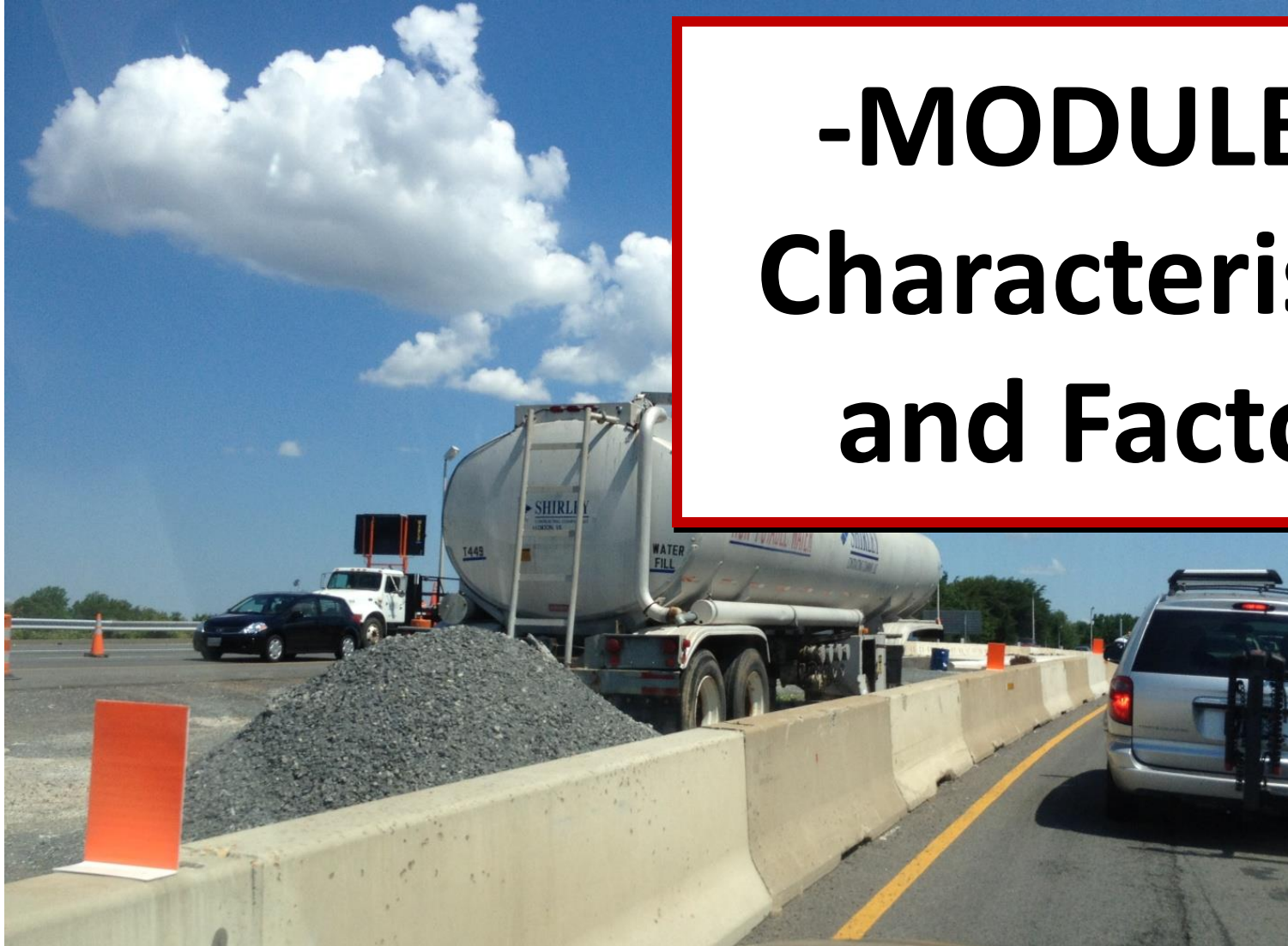
The Designer's Role

- ◆ To consider **ALL** project characteristics and factors, the standards and guidelines, and apply engineering judgment to **minimize worker exposure** through the use of positive protection and/or other strategies



Minimizing Worker Exposure Through the Use of Positive Protection and Other Strategies

-MODULE 2- Characteristics and Factors



SAFER ROADS SAVE LIVES



Module Objectives

- ◆ Discuss the project characteristics and factors that need to be considered when:
 - ◆ Assessing the need for positive protection
 - ◆ Selecting positive protection measures and other strategies to minimize worker exposure

What Should be Considered When Assessing Worker Exposure Strategies?

1. Project scope and duration
2. Anticipated traffic speeds through the work zone
3. Anticipated traffic volume
4. Vehicle mix
5. Type of work (as related to worker exposure and crash risks)

What Should be Considered When Determining the Need for a PP Device?

6. Distance between traffic and workers, and extent of worker exposure
7. Limited escape paths
8. Time of day
9. Consequences to road users resulting from roadway departure
10. Potential hazard to workers and road users presented by the device itself and during device placement and removal

Minimizing Worker Exposure Through the Use of Positive Protection and Other Strategies

-MODULE 3- Positive Protection Devices



SAFER ROADS SAVE LIVES



Module Objectives

- ◆ Discuss design considerations of positive protection devices
- ◆ Discuss the application of various positive protection devices
 - A. Temporary Traffic Barriers
 - B. Truck-Mounted Attenuators
 - C. Vehicle-Arresting Systems

Remember: Positive Protection Devices Shall be Crashworthy

- ◆ As per crashworthiness evaluation criteria contained in National Cooperative Highway Research Program (NCHRP) Report 350/Manual for Assessing Safety Hardware (MASH)



Positive Protection Devices

Can be Grouped as:

- A. Temporary Traffic Barriers
 - A. Various types
- B. Truck-Mounted Attenuators (TMA)
- C. Vehicle-Arresting Systems

Let's Discuss Them!

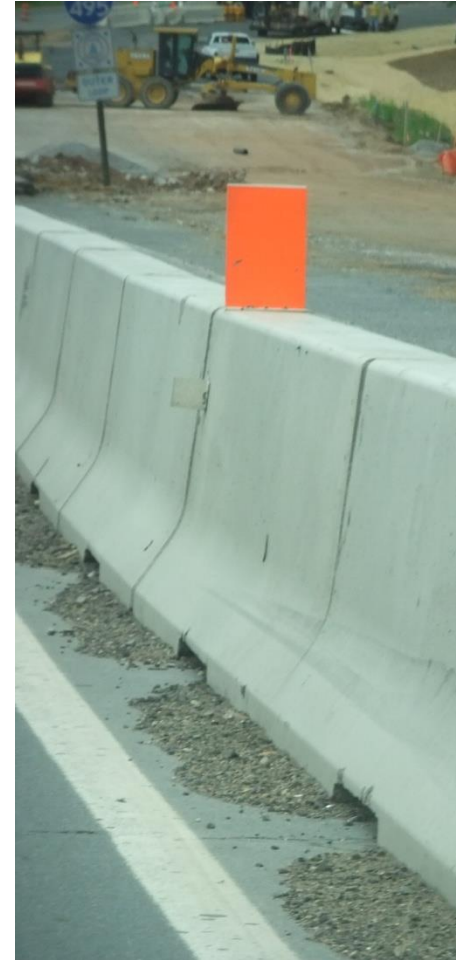
A. Temporary Traffic Barriers



- ◆ Prevent **penetration by vehicles** while minimizing injuries to vehicle occupants
- ◆ Provide **positive protection to:**
 - ◆ Workers
 - ◆ Highway users
 - ◆ Drop-offs
 - ◆ Roadside hazards

Barrier Selection Factors

1. Clear zone
2. Dynamic deflection
3. Flare rates
4. Length of need (LON)
5. Crashworthy end terminal
6. Speed
7. Others



Types of Temporary Traffic Barriers

1. Concrete
2. Ballast-filled
3. Anchored
4. Mobile
5. Movable
6. Steel



Barrier selection is based on its application and its deflection! CHECK WITH YOUR STATE!

B. Truck-Mounted Attenuators

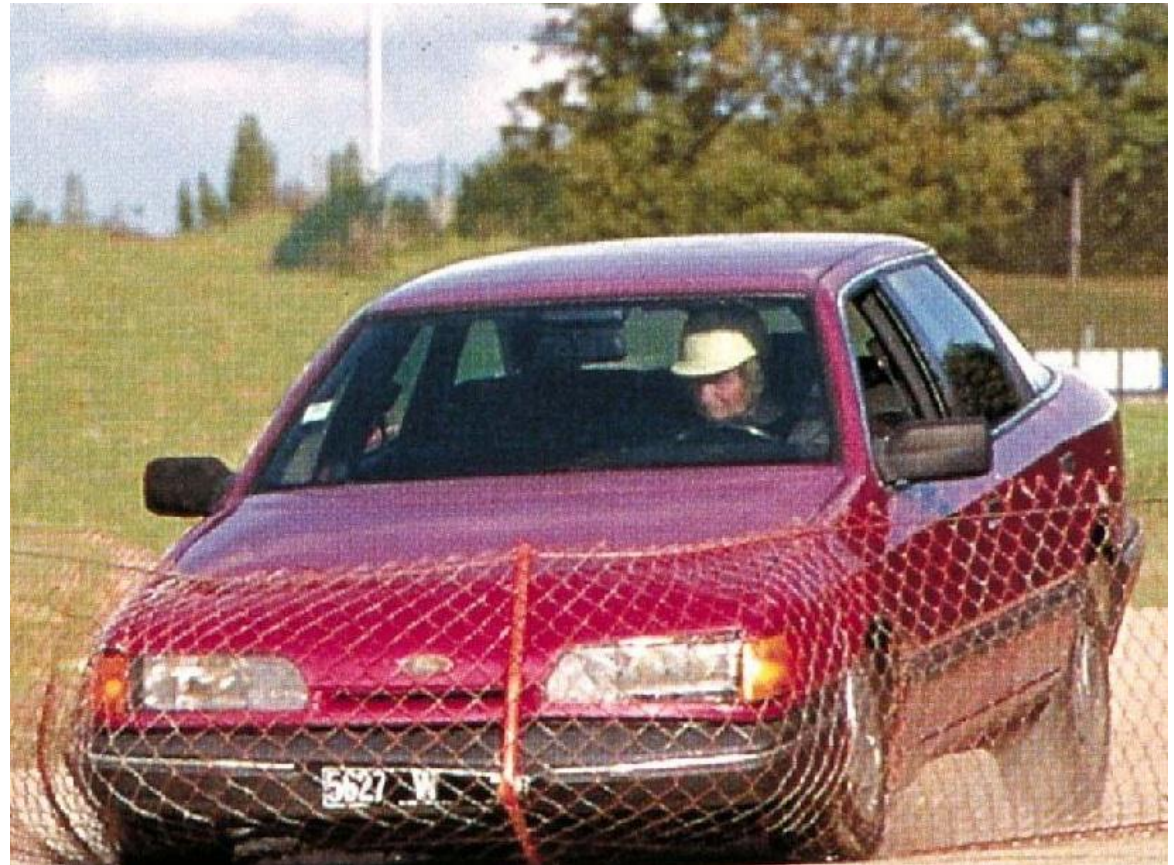


- ◆ Energy-absorbing devices attached to the rear of shadow trailers or trucks

115

C. Vehicle-Arresting Systems (VAS)

- ◆ Not in 2009 MUTCD
- ◆ Section 6F-83 of 2003 MUTCD
- ◆ STILL PERMITTED!



Minimizing Worker Exposure Through the Use of Positive Protection and Other Strategies

-MODULE 4- Other Exposure & Traffic Control Measures



SAFER ROADS SAVE LIVES



Module Objectives

- ◆ Discuss “other” ***work zone safety management*** measures and strategies:
 - A. *Exposure Control Measures*
 - B. *Other Traffic Control Measures*
 - C. *Uniformed Law Enforcement Officers*

Why “Other” Safety Management Measures And Strategies?

- ◆ *Positive protection devices may not be feasible*
- ◆ Barriers are hazards!
- ◆ Other alternatives that should be considered
- ◆ More cost-effective
- ◆ Perhaps a combination of strategies works better
- ◆ Strong reference to other exposure control measures in Subpart K

A. Exposure Control Measures

- ◆ Try to improve safety by
 - ◆ Eliminating or reducing traffic through the work zone, or
 - ◆ Diverting traffic away from the work space



Exposure Control Measures

1. Full road closures
2. Ramp closures
3. Median crossovers
4. Full or partial detours or diversions
5. Protection of work zone setup and removal operations using rolling road blocks
6. Night work
7. Accelerated construction techniques

B. Other Traffic Control Measures

- ◆ Should be given appropriate consideration for use in work zones to reduce work zone crashes and risks and consequences of motorized traffic intrusion into the work space
- ◆ Not mutually exclusive
- ◆ Should be considered in combination as appropriate

C. Uniformed Law Enforcement Officers

◆ Can:

◆ Affect driver behavior, helping to maintain appropriate speeds and

◆ Improve driver alertness

◆ May provide:

◆ Presence

◆ Enforcement

◆ They also need to be trained and protected!



Minimizing Worker Exposure Through the Use of Positive Protection and Other Strategies

-MODULE 5- Making Decisions



SAFER ROADS SAVE LIVES



Module Objectives

- ◆ Discuss the basis for available decision and assessment tools
- ◆ Discuss some existing assessment processes
 - ◆ Including this state's
- ◆ Apply a positive protection assessment (decision-making) process
- ◆ Discuss/Apply an interactive Excel-based PP assessment tool

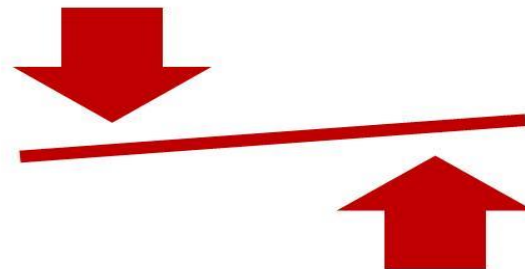
PP Guidelines: What are the States Doing?

- ◆ Several require barriers to protect **drop-off** conditions or fixed hazards
- ◆ PP guidelines beyond that particular condition are fairly limited



Is This a Problem?

- ◆ Some states apply a drop-off or fixed hazard criteria without considering other factors such as worker exposure!
- ◆ Much is left to the designer's engineering judgment!
- ◆ Limited assessment processes



Example 1:

Colorado DOT PP Guidelines:

*“An Engineering Study is a process which will **integrate data, analysis, judgment, and creativity** to determine the best construction strategy for a given scenario.”*

*“An Engineering Study **does not take the place of good engineering judgment**, but should be used in conjunction with engineering judgment to guide the decision-making process.”*

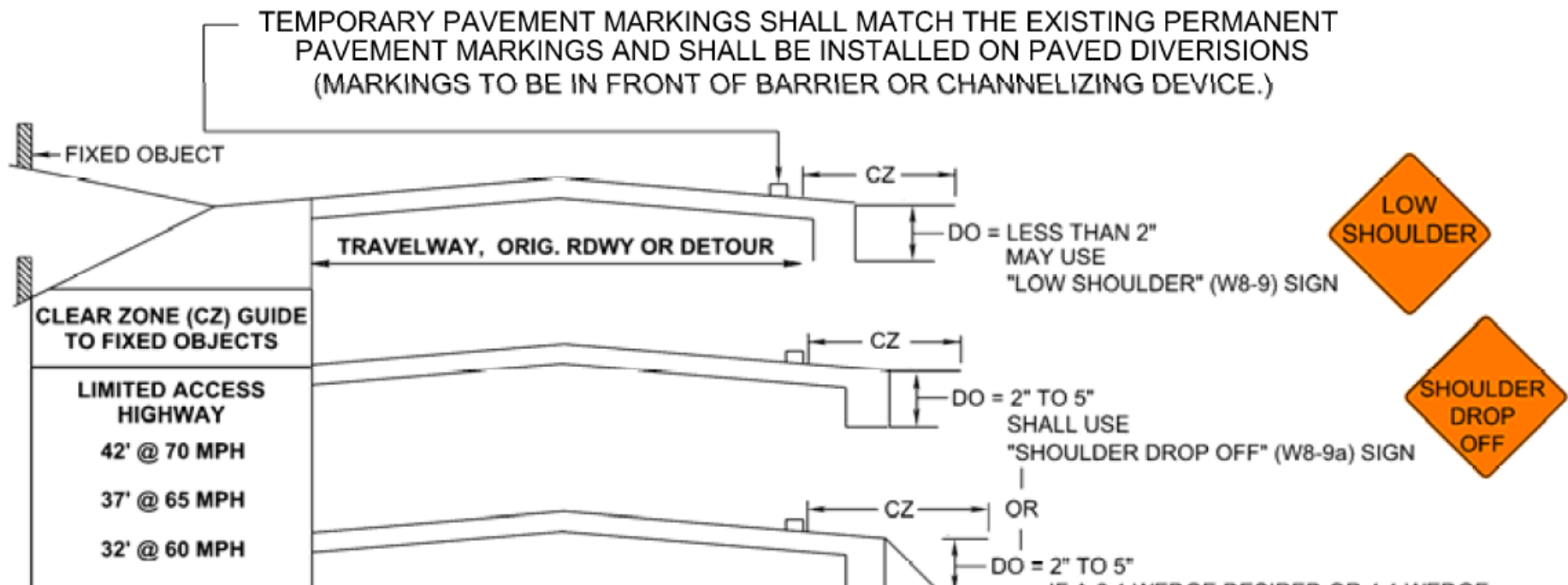
Example 2:

North Carolina DOT PP Guidelines:

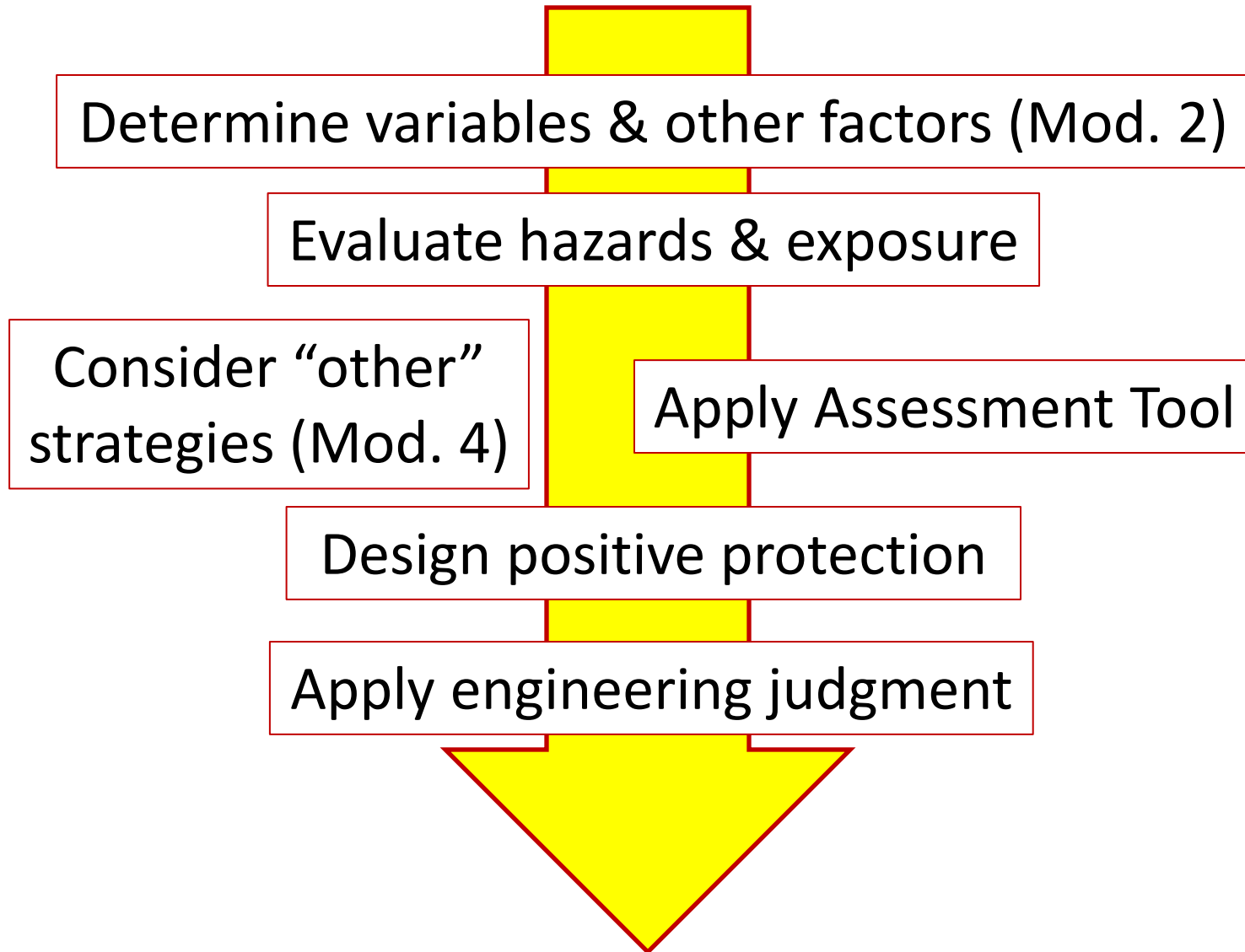
*“The Engineering Study performed to determine the need for positive protection **shall take into consideration** clear zone distances, roadway geometry, anticipated construction year traffic volumes, traffic speeds, roadside geometry, **workers safety, pedestrian safety, etc.**”*

Example 3: VDOT's Clear Zone & Drop-Off Chart

CLEAR ZONE TO A FIXED OBJECT & DROP-OFF REQUIREMENTS



Common Elements of The PP Selection Decision/Assessment Process



PP Assessment Tool – Development

- ◆ Evaluated existing PP assessment procedures
- ◆ Combined their best features
- ◆ Developed an interactive Excel-based PP Assessment Tool



PP Assessment Tool - Description

- ◆ **Composite** of several state processes
- ◆ Applies weights for various specific Roadway and Project factors assigned by user
- ◆ **Aggregates values** yielding recommended action based on total score
- ◆ Objective, but **not “black box”** – **needs** engineering **judgment** for final decision

Applying the Tool to Real-World Examples – Scenario 1

Project description: Overlay project on freeway

- **ROADWAY CHARACTERISTICS:** Duration-13 days; Limited access; posted 65 mph; 75,000 vpd; 5% trucks; straight; no sight distance issues
- **PROJECT CHARACTERISTICS :** Day only; 2-3” drop-off (uneven lanes) for 200’; 4’ workers to traffic; device placement cost/benefit = install time vs. benefit too high; no escape path issues

Scenario 1 Decision/Discussion

- ◆ Use the assessment tool to aid in the decision whether to use or not use barrier as positive protection
- ◆ Would other exposure reduction measures be more cost-effective and beneficial?



Assessment Tool

Minimizing Worker Exposure Through the Use of Positive Protection and Other Strategies

-MODULE 6- Decision- Making Scenarios



SAFER ROADS SAVE LIVES



Module Objectives

- ◆ Apply the PP flow chart and assessment tool to various scenarios
- ◆ Present a PP matrix for various scenarios

Key Decision Points

Moving?

- Roll-ahead distance?

- TMAs
- Steel barrier
- Mobile barrier

Stationary?

- Short duration?
- Short-term?
- Intermediate-term?
- Long-term?

- Barriers
- Vehicle-arresting systems

Moving Operations: Adequate Roll-Ahead Distance?

YES

- *Shadow vehicles w/TMAs*
- *Steel Barrier*

NO

- *Steel Barrier*
- *Mobile barrier*

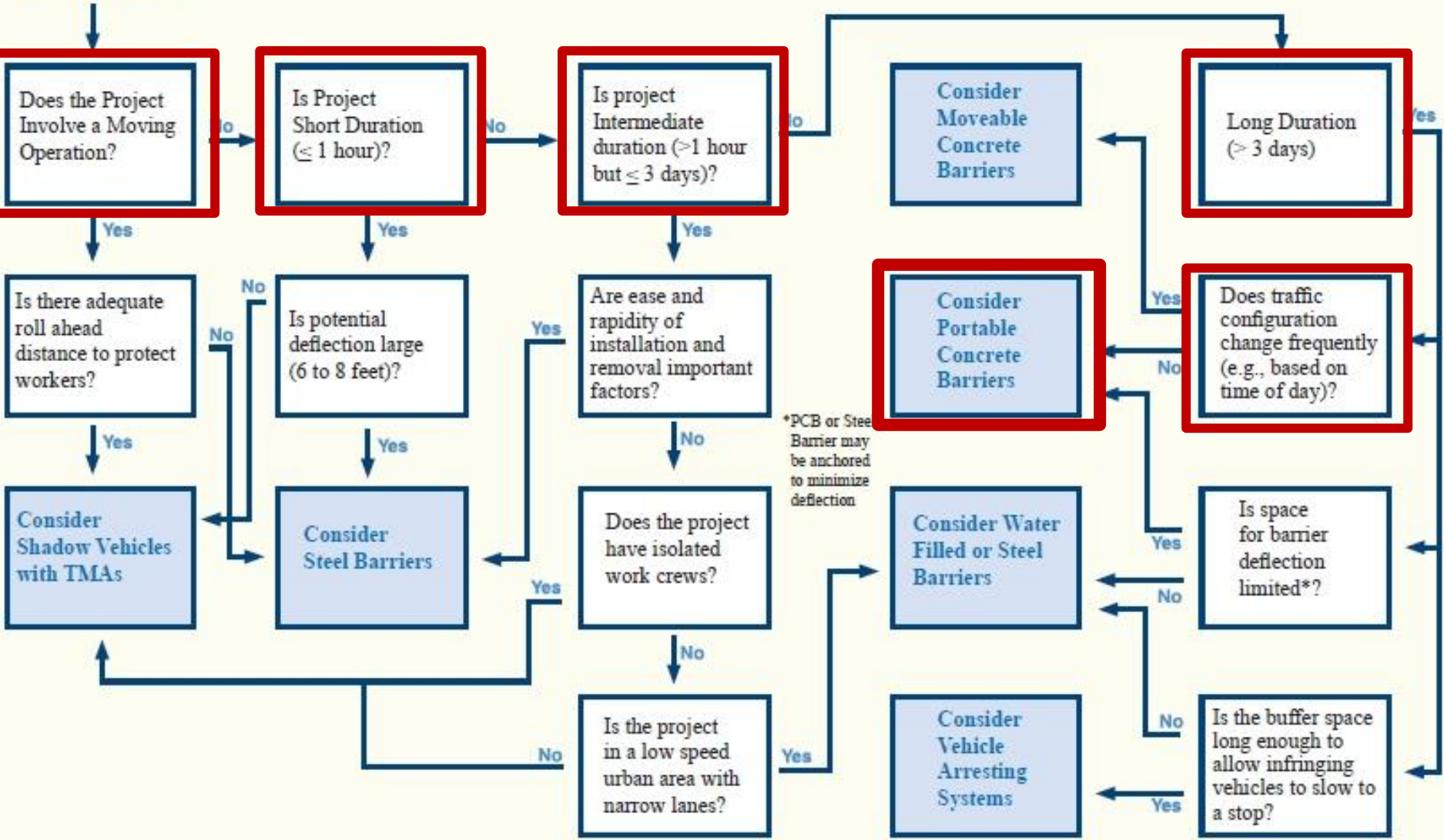
Positive Protection Selection Matrix

<u>Work Type or Location /Work Duration</u>	<u>LT</u>	<u>IT</u>	<u>ST</u>	<u>SD</u>	<u>M</u>
Paving	2	2	2	C/D	C
Grind inlay/overlay		2	2	C/D	C
Bridge construction	1			C/D	
Bridge rail replacement	2	2	3	C/D	
Roadway realignment	2			C/D	
Pavement widening	3			C/D	C
Culvert/pipe installation	3	3	3	C/D	
Shoulder work	3	3		A	A
Open excavation	1	2	3, B		
Pothole patching				A/D	A/D
Sweeping					C
Guardrail/Barrier repair			B	D	B
Crack sealing			B	C	C
Ramp closure	1	2	3		
Lane closure	1	2	3		A
Pavement marking					A
Bridge inspection					C
Overhead Sign Repair/Replacement	2	2	3	C/D	

1 = Barrier strongly recommended
 2 = Barrier should be considered
 3 = Barrier optional
 A = TMA strongly recommended
 B = TMA should be considered
 C = TMA
 D=Mobile barrier/arrestor

LT = Long-Term
 IT = Intermediate-Term
 ST = Short-Term
 SD = Short Duration
 M = Mobile

START HERE



Minimizing Worker Exposure Through the Use of Positive Protection and Other Strategies

-MODULE 7- Workshop



SAFER ROADS SAVE LIVES

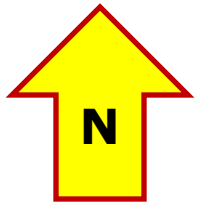


Module Objectives

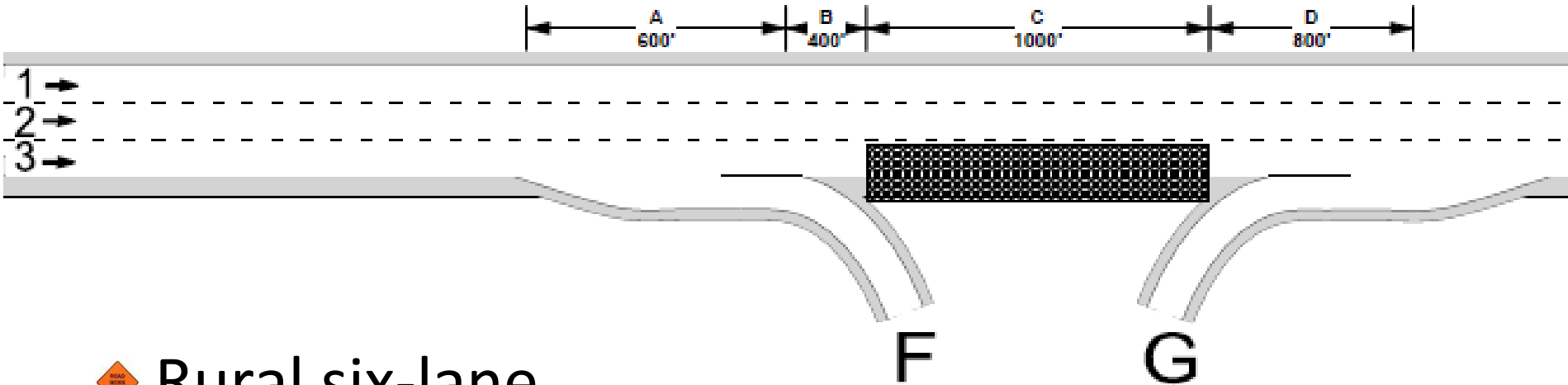
- ◆ Apply the concepts learned to real-world scenarios
- ◆ Present recommendations to class

Workshop Scenarios

- ◆ Working as a group, for the three scenarios given, assess the need for positive protection devices and/or other exposure control measures
- ◆ Make a group recommendation for each
- ◆ Assign a group leader to present your recommendation to the class



Highway Facility



- ◆ Rural six-lane interstate freeway
- ◆ EB right lane closure
- ◆ 65 mph

- ◆ 12-ft lanes
- ◆ Ramps must remain open
- ◆ Light volume

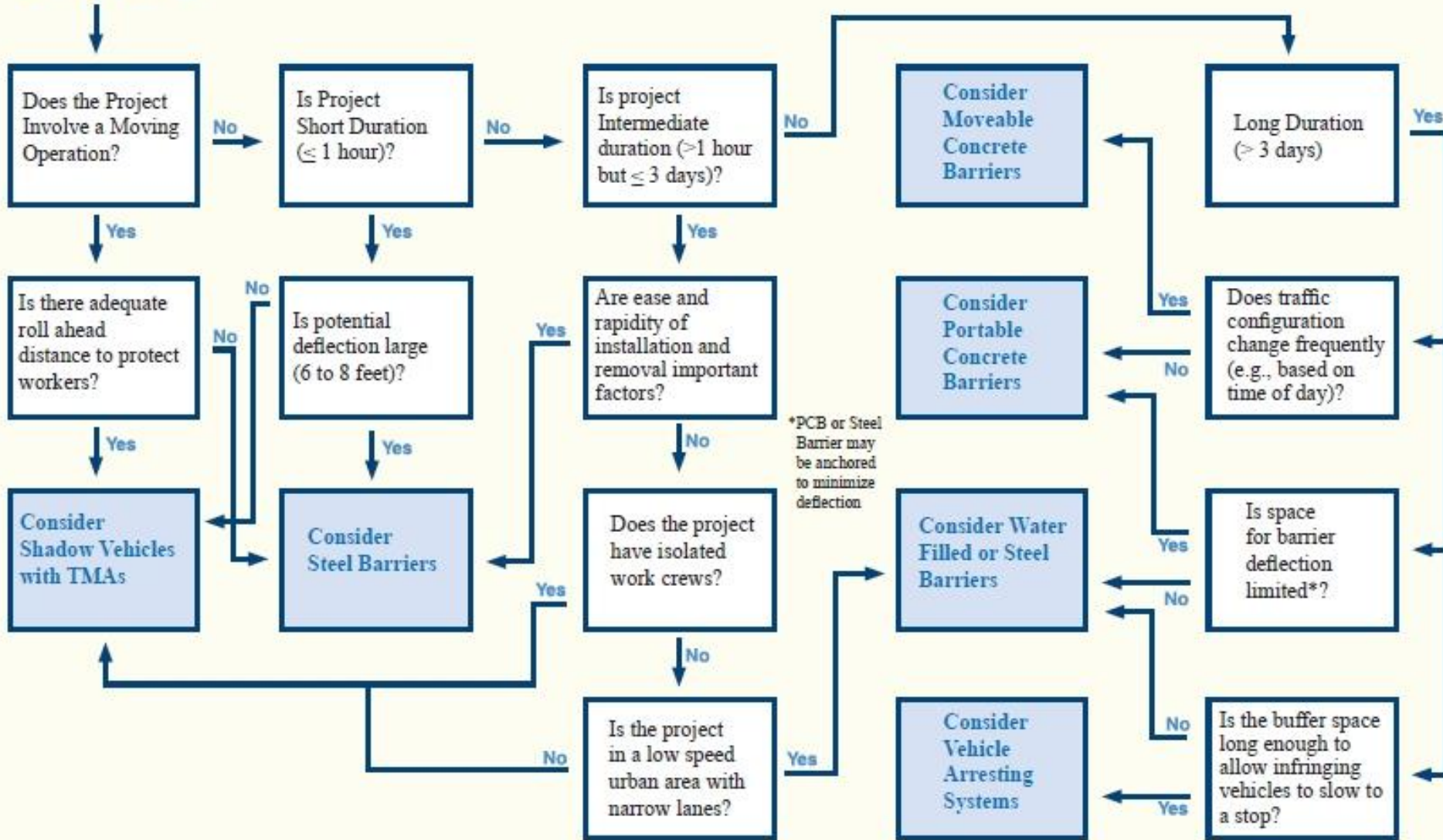
Three Scenarios

	1	2	3
Type	Full Depth Patching	Milling and Resurfacing	Bridge Inspection
Duration	2 weeks	6 hours (nighttime)	1 hour (up to 3)
Drop-off	8 inches	3 inches	None
Workers	2 feet from traffic	2 feet from traffic	On shoulder

For Each Scenario, Document the Following:

- ◆ Decision process for positive protection use or non-use
- ◆ Type of PP used, if any – in some cases, multiple types may be utilized
- ◆ Reasons for type(s) utilized and reasons why others were not used or no PP was used
- ◆ Any agency policies on positive protection re: duration, drop-off, speed, etc.
- ◆ Other recommended Exposure Control Measures

START HERE



Minimizing Worker Exposure Through the Use of Positive Protection and Other Strategies

-MODULE 8- Closing



SAFER ROADS SAVE LIVES

