Work Zone Safety & Traffic Control

June, 2020

Wyoming

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&

Austin Woody

Wyoming Technology Transfer Center

WY T2 LTAP

Local Technical Assistance Program

Housekeeping

- Cell phones off/silent
- No texting
- Restroom location
- Emergency exits
- Breaks
- Refreshments
- Ending time

About Your Instructor:

Bart Evans

Wyoming Technology Transfer Center

WY T2 LTAP

Local Technical Assistance Program

Self-Introductions

- Name
- Employer
- City/State
- **Any experiences/ anecdotes with flagger operations?**

Course Outline

Cell phones on vibrate

1) Introduction and Risks
2) Principles of WZTC
3) Manual on Uniform Traffic Control Devices
4) Traffic Control Devices
5) Elements of the Work Zone
6) Work Zone Setup and Takedown
7) Mobile and Short Duration Operations
8) Urban Work Zones and Utility Work
9) Pedestrians, Bicycles and ADA
10) Driver Characteristics

Course Goals

- Improved understanding of work zone operations and risks…and how to make work zones safer
- Know how to set up a work zone
  - Layout and the MUTCD
  - Traffic control devices
- Know how to be a flagger
- *Are you making any mistakes on a routine basis?*

Traffic Control is Important Because:

- ***People die***
- People are injured
- Money is lost
- You and your organization can be sued
- Your agency's image is affected

Responsibilities of Traffic Workers

Know how to do the job right!!

- His/her own safety
- Safety of other workers
- Safety of the driving public
- Safety of pedestrians and bicyclists

Distracted drivers
Workers exposed to
Unknown condition
Confused drivers
We get too comfortable.
SPEED LIMIT 65
SPEED LIMIT 55

WZTC Statistics

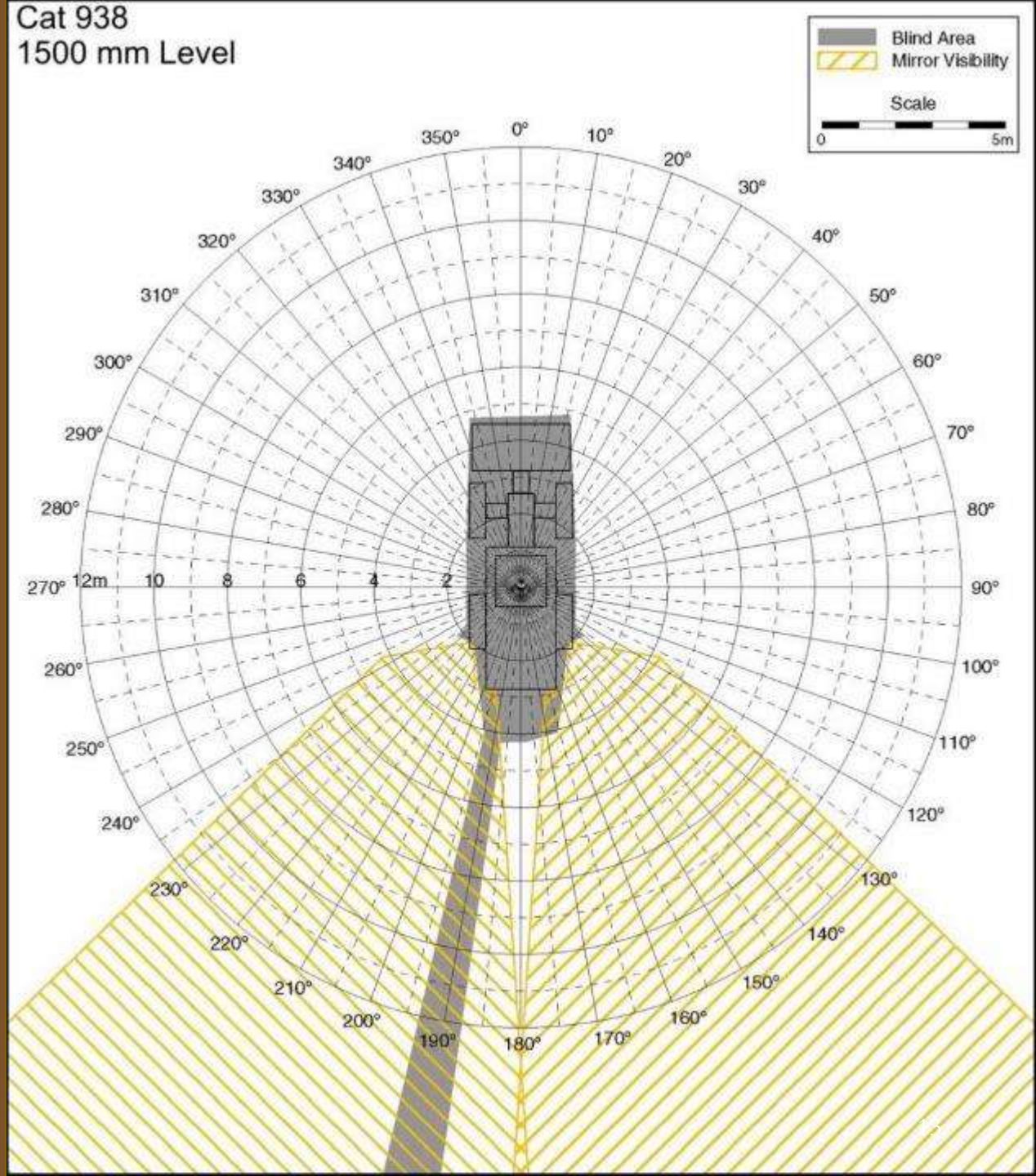
- About ¼ of fatalities involved large trucks
- Rear End collisions are most common
- ***About 85% of fatalities are motorists***

Most Common Worker Fatalities

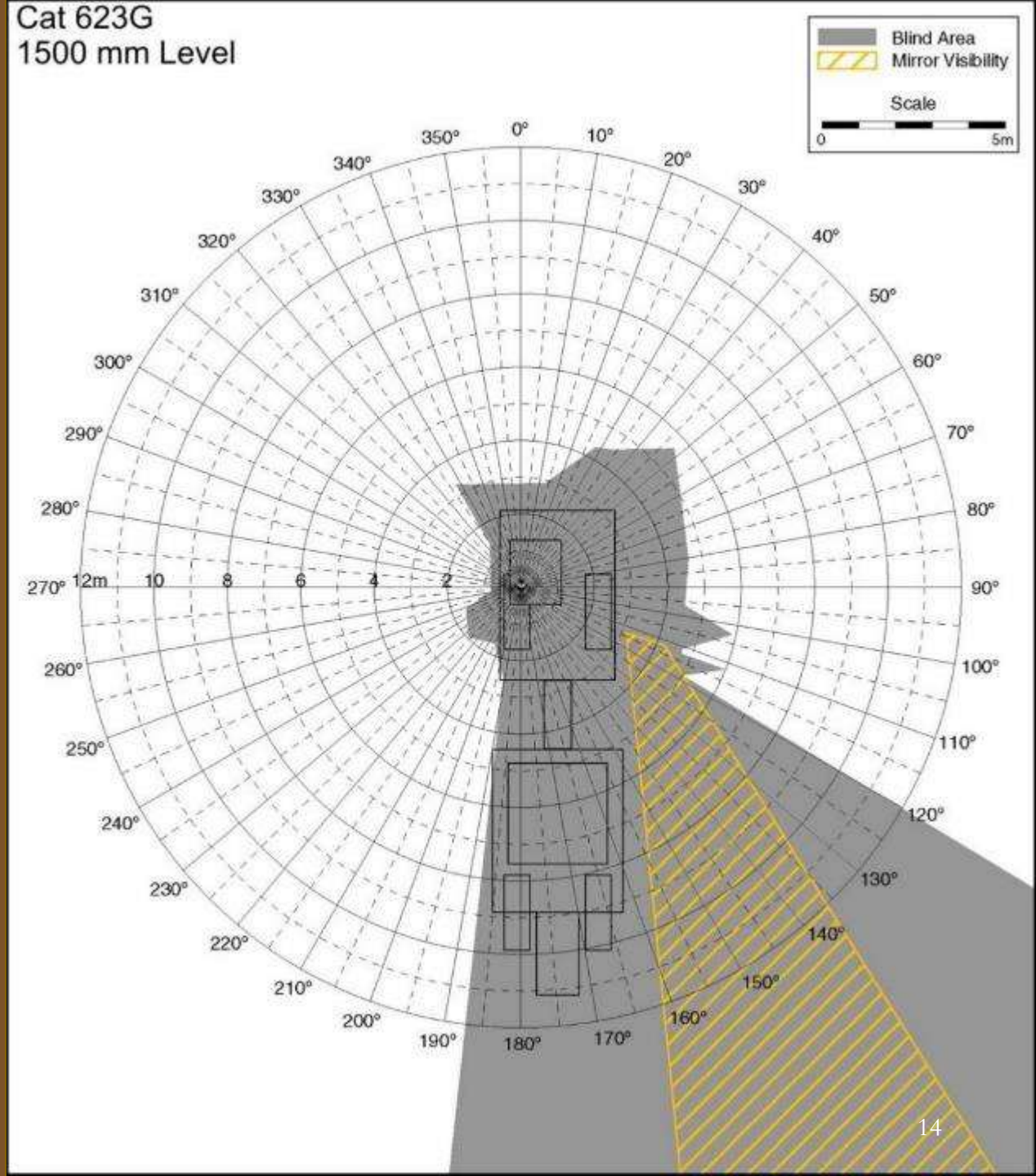
- ⅓ worker killed in work zone vehicle
- ⅓ worker on foot hit by traveling public
- ⅓ worker on foot hit by work zone vehicle

Train everyone to watch for backing trucks!!!

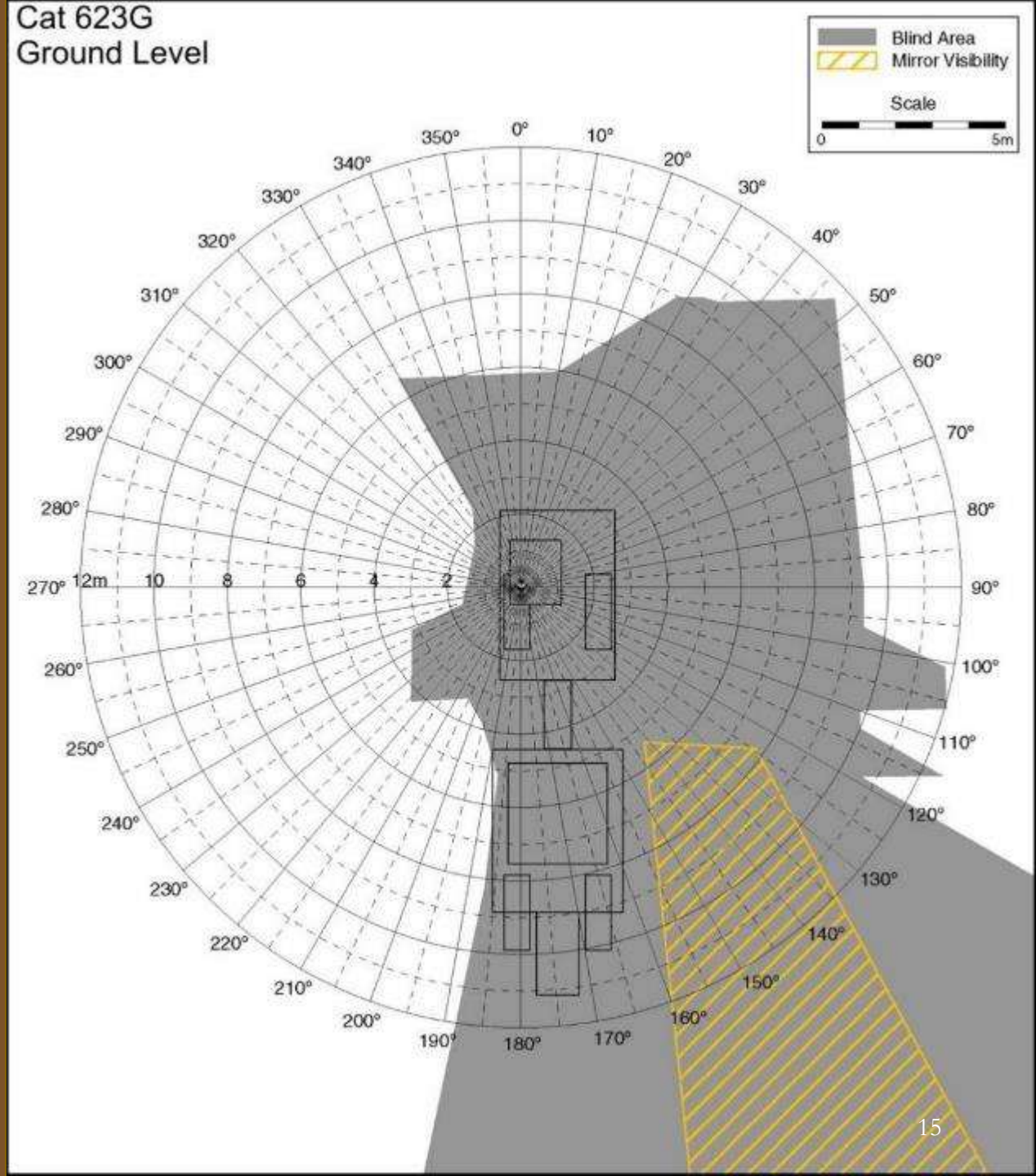
Blind Spots at 5’



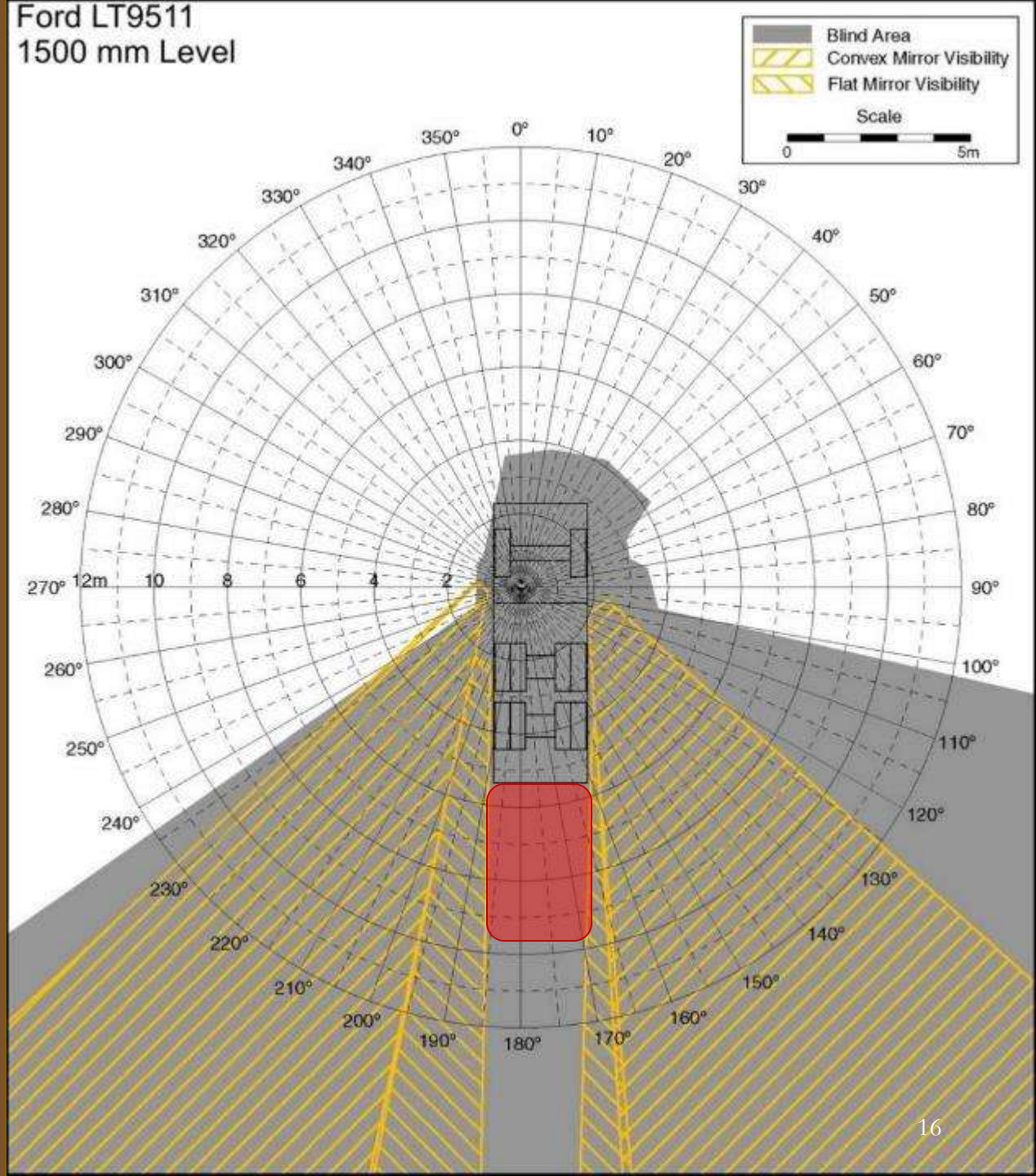
Blind Spots at 5’



Blind Spots at ground level



Blind Spots at 5’



Recent Injuries

- Hit by teenager while putting up signs in bad weather

Two men struck while putting up signs

CASPER – Two men putting up construction signs on Wyoming Highway 20-26 were injured at 6 a.m. Thursday when they were struck by a vehicle driven by a 19-year-old man., authorities said.

Police would not reveal Thursday the identities of the two men who were hit nor the driver of the vehicle that allegedly struck them.

Wyoming Highway Patrol Trooper Jim Armstrong said the two men were taken to the Wyoming Medical Center.

It was raining and snowing, he said, and the windshield wipers on the Toyota Land Cruiser that the teen-ager was driving were not working properly, Armstrong said.

The teen-ager was driving west on Highway 20/26 with his head sticking out of the driver's side window and did not see the sign company's truck nor the two men on the side of the highway, he said.

The Toyota hit the two men then hit the truck, according to Armstrong.

He said charges against the teen-age driver are pending.

If it's not safe,
shut it down.

Principles of WZTC

- Plan Ahead
- Minimize Traffic Disruption
- Clear and Positive Guidance
- Inspect and Maintain Devices
- Maintain Roadside Safety
- Training
- Public Relations

Plan Ahead

- Worker Safety
- Traveling Public's Safety

- WZTC integral part of project planning
- Consider Alternatives
  - Work plan and schedule
  - Traffic schemes
- Visualize traffic flows
- Communicate plans to the public

Minimize Traffic Disruption

- Shorten exposure time
  - Be prepared to do work quickly
  - Balance traffic control setup time with quality
- Avoid rush hour
- Consider user delays when planning
  - Will help safety by reducing road rage

Clear and Positive Guidance

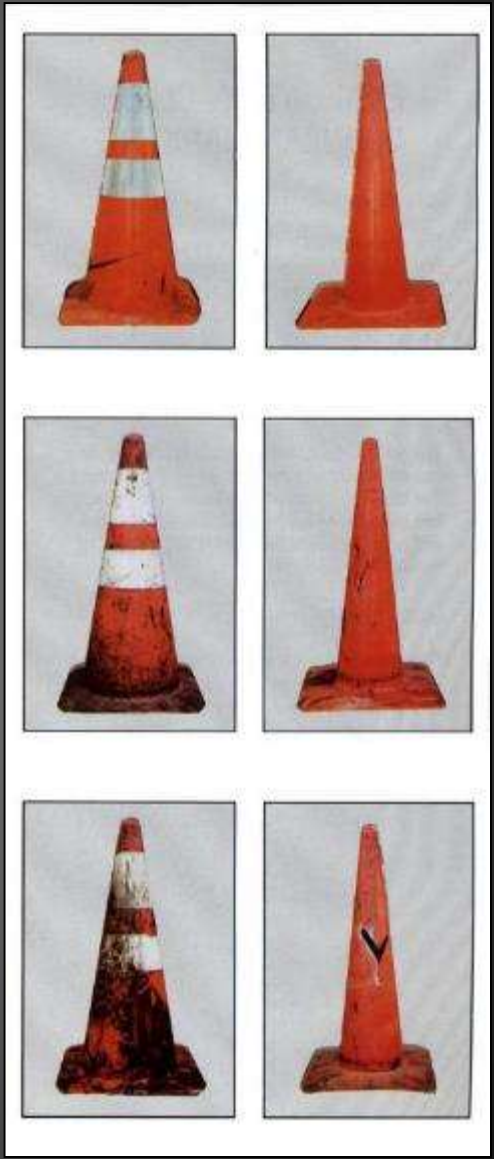
- Minimize motorists' decisions
- Don't give them choices
- Consistent, organized appearance
  - Channelizing devices straight, evenly spaced
  - Signs clean, placed straight and in good condition

Clear and Positive Guidance?

2

Inspect and Maintain Devices

- Equipment clean and in good condition
- Routinely inspect devices
  - Missing
  - Damaged
- Evaluate traffic control system
  - Look for changes in operations
  - Anticipate changes in operations
  - Adapt traffic control to changing conditions
- Nighttime inspection



Maintain Roadside Safety

- Don't use clear zone as storage
- Don't use buffer space as storage
- Make the work zone as forgiving to driver error as possible
- Watch for:
  - Dangerous objects adjacent to traffic
  - Shoulder dropoffs
  - Trenches

Training

- Know your job
- Be sure others are knowledgeable about their jobs

Public Relations

- People are more forgiving if they know in advance about delays and inconvenience
- Notify business owners
  - Include them early in the planning stages
- TV and radio spots for big projects
- Flyers or knock on doors for smaller projects

Use the PLAN Method

Preview

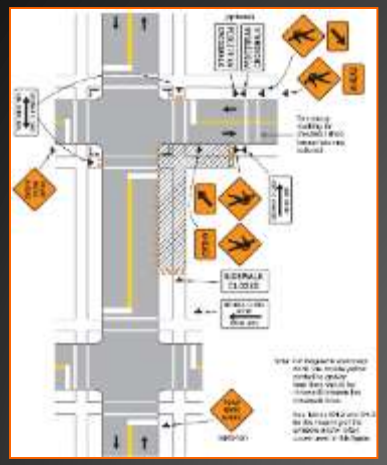
Layout

Analyze

Navigate

PreviewLAN

- Look for alternate ways to do the work
- Get proper permissions
- Determine type of road and location
- Look for potential problem areas



PLayoutAN

- Diagram your options
  - Consider work
  - Consider traffic flows
  - Consider schedules
- Select the best option

PLAnalyzeN

- Make the needed adjustments
  - Depends on the type of road
  - Consider the motorists' needs and desires
- Assemble necessary Traffic Control Devices
  - Bring extras
    - Unforeseen circumstances
    - Damaged TCDs

PLANavigate

- Drive through
  - Analyze
  - Inspect
    - Missing, moved, or damaged traffic control devices
- Nighttime
  - It always looks different at night

Inspection

- Pre-construction conference
  - MUTCD
  - Standard plans
  - Project plans
- Initial work zone inspection
- Driver's view
- Roadside view
- Inspection Log

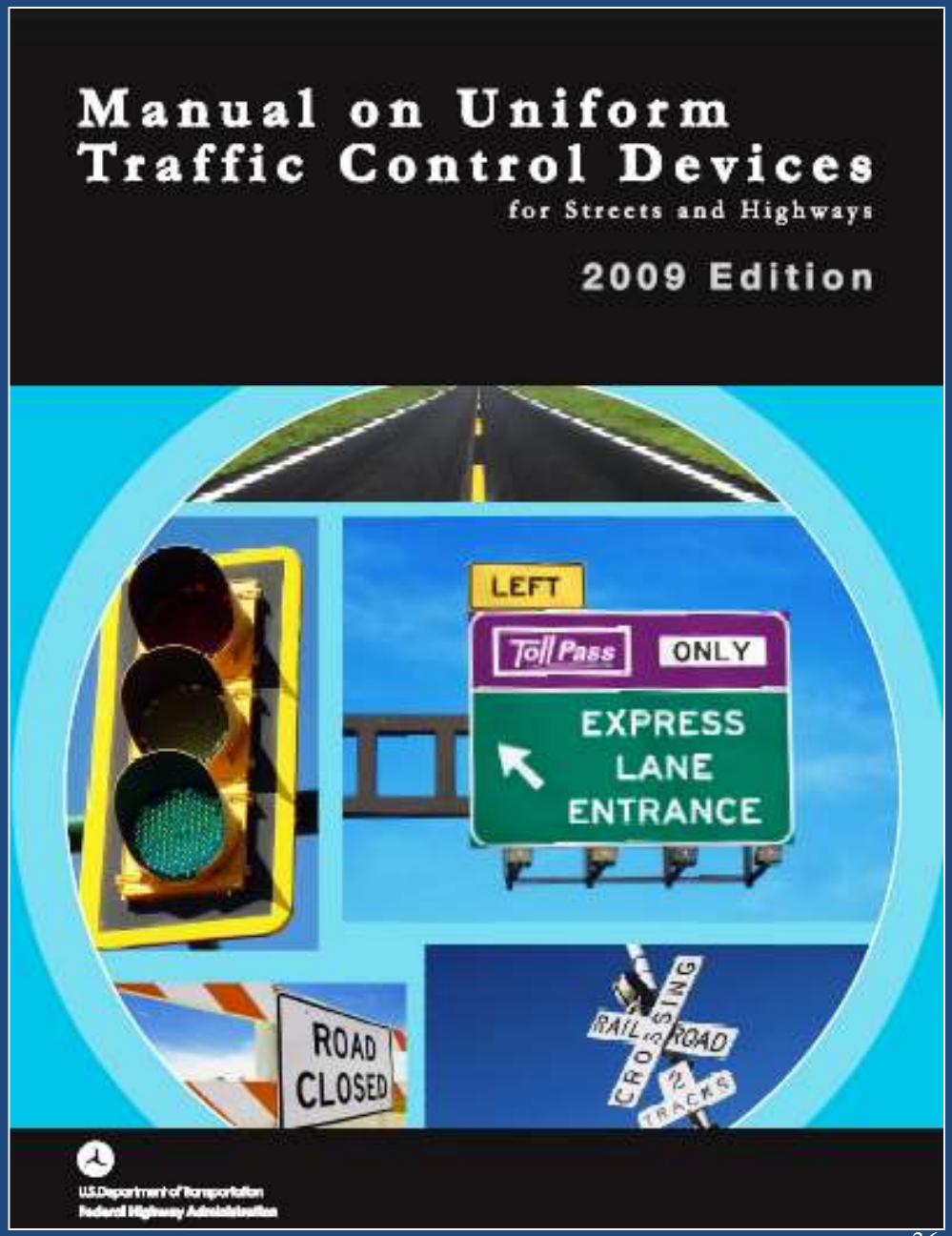
Foreman's Daily Report

- Date, Time, Location, Personnel, Activities, Equipment
- List TA (typical applications)
  - Describe and justify any modifications: *Guidance*
- Traffic Control Devices
- Times for setup, takedown, and major changes
- List inspections
  - Time, areas covered, observations, photos
  - Deficiencies and *Actions Taken*
- Describe any incidents or accidents: photos

Comments?
Questions?

MUTCD

- ***The Law***
  - NOT what I or someone else tells you
- Owned by lawyers
- Part 6: Temporary Traffic Control



MUTCD 2009 Edition - Knowledge - FHWA MUTCD - Windows Internet Explorer

http://mutcd.fhwa.dot.gov/kno_2009.htm

fhwa mutcd

4

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Manual on Uniform Traffic Control Devices (MUTCD)

fhwa mutcd

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2009 Edition
Color Specifications
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Pav
Tra
FAQ

Tec

Peer-to-Peer Program
Discussion Area
MUTCD Team

Resources

23 CFR 655
Official Rulings
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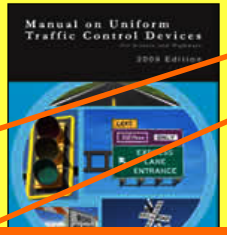
State MUTCD's & TCD Info
FHWA Contacts
Related Links
Federal Register

Knowledge

Knowledge

2009 Edition, dated December 200

Current MUTCD Edition



The most current version of the MUTCD is the **2009 Edition, dated December 2009**. Links to previous versions are listed below. For historical reference and to know what was in effect for a given date, these previous versions will be maintained on this Web site.

The official version of the **2009 MUTCD** is the PDF version.

The 2009 MUTCD may also be viewed in HTML format, which accessible to individuals with disabilities, per Section 508 of the Rehabilitation Act. **Disclaimer:** While every effort has been made to assure consistency between the PDF and HTML files posted on the MUTCD Web site, it is possible that the HTML files may not be totally identical in content to the PDF files. The PDF files constitute the official version of the MUTCD and always take precedence over any potentially conflicting MUTCD text or figures that may occur in the HTML files.

The official version of the **2009 MUTCD** is the PDF version.

- A document showing the changes in the MUTCD text from the 2003 Edition to the 2009 Edition, using strikeouts and underlining, is available in PDF (2.5MB) and HTML.
- A document listing the changes in the MUTCD figures from the 2003 Edition to the 2009 Edition is available in PDF (99KB) and HTML.
- A document listing the changes in the MUTCD tables from the 2003 Edition to the 2009 Edition is available in PDF (41KB) and HTML.
- PowerPoint presentations on the major changes are available on this Web site at http://mutcd.fhwa.dot.gov/ser-Training.htm.

List of Known Errors in the 2009 Edition

- List of Known Errors in the 2009 MUTCD, updated 3/3/2011 (PDF version) (90KB)
- List of Known Errors in the 2009 MUTCD, updated 3/3/2011 (HTML version)

NOTE: FHWA intends to correct these errors via a future rulemaking action. This list of known errors is provided solely for the information of MUTCD users and does not constitute changes to the MUTCD at this time.

Previous MUTCD Editions

2003 Edition with Revisions 1 and 2

http://mutcd.fhwa.dot.gov/pdfs/2009/pdf_index.htm

Internet 100%

MUTCD*

- **Standard: This *shall* be done, no choice.**
- Guidance: This *should* be done unless engineering judgment indicates otherwise.
  - ***Guidance statements are almost like* Standards *in court.***
- Option: This *may* be done if the practitioner thinks it should be.
- Support: These statements tell you what is going on, without any advice, recommendation, or requirement.

***More lawyers have MUTCDs than engineers…**

Typical Applications

Notes for Figure 6H-27—Typical Application 27
Closure at the Side of an Intersection

Guidance:

1. *The situation depicted can be simplified by closing one or more of the intersection approaches. If this cannot be done, and/or when capacity is a problem, through vehicular traffic should be directed to other roads or streets.*
2. *Depending on road user conditions, flagger(s) or uniformed law enforcement officer(s) should be used to direct road users within the intersection.*

Standard:

3. **At night, flagger stations shall be illuminated, except in emergencies.**

Option:

4. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
5. For short-duration work operations, the channelizing devices may be eliminated if a vehicle displaying high-intensity rotating, flashing, oscillating, or strobe lights is positioned in the work space.
6. A BE PREPARED TO STOP sign may be added to the sign series.

Guidance:

7. *When used, the BE PREPARED TO STOP sign should be located before the Flagger symbol sign.*
8. *ONE LANE ROAD AHEAD signs should also be used to provide adequate advance warning.*

Support:

9. Turns can be prohibited as required by vehicular traffic conditions. Unless the streets are wide, it might be physically impossible to make certain turns, especially for large vehicles.

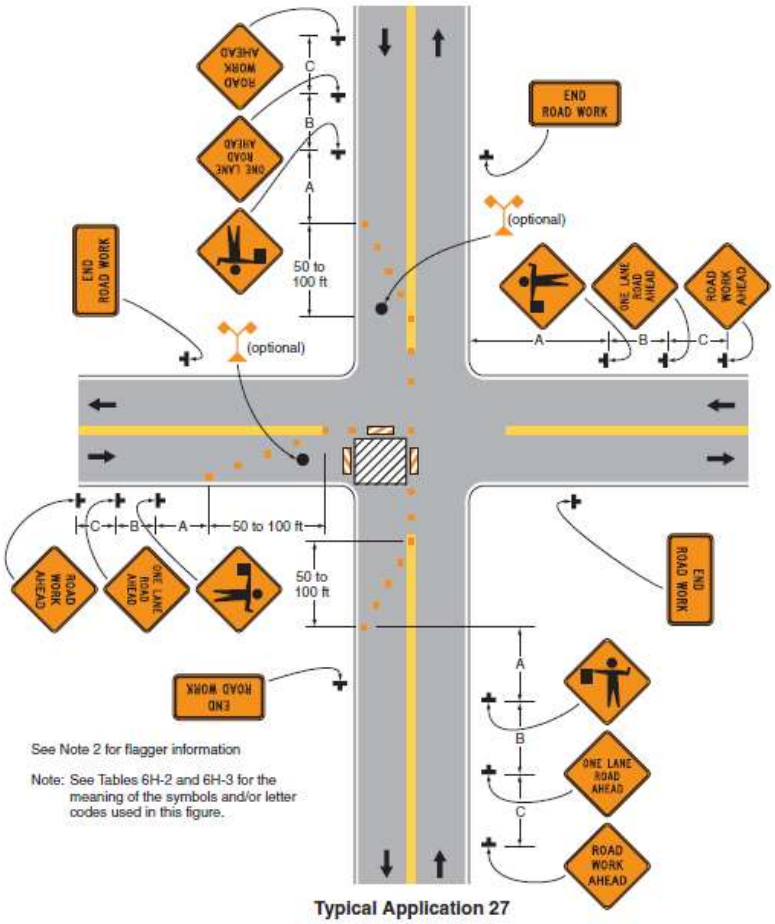
Option:

10. Vehicle hazard warning signals may be used to supplement high-intensity rotating, flashing, oscillating, or strobe lights.

Standard:

11. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity rotating, flashing, oscillating, or strobe lights.**

Figure 6H-27. Closure at the Side of an Intersection (TA-27)



Typical Application 27

Vests are mandatory for everyone.

Section 6D.03 <u>Worker Safety Considerations</u>

Standard:

All workers, including emergency responders, within the right-of-way who are exposed either to traffic (vehicles using the highway for purposes of travel) or to work vehicles and construction equipment within the TTC zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI…

Traffic Control Devices (TCD)

- Essential to highway safety
- Recognized subconsciously
- Motorists rely on them

- **Signs**
- **Channelizing devices**
  - **Cones**
  - **Tubular markers**
  - **Barricades**
- **Warning lights**
- **Pavement markings**
- **Others**

Requirements of TCDs

- Fulfill a need
- Command attention
- Convey a clear and simple message
- Command respect
- Give adequate time for response

MEN

Uniformity through standardization promotes:

- Recognition and understanding
- Consistent interpretation
- More rapid driver response
- Motorists' respect
- Reduced traffic control cost

Traffic Control Devices must be Uniform.

- Design (What?)
- Application (When?)
- Location (Where?)

Immediate recognition?

Types of Signs

- Regulatory
- Warning
- Guide

Regulatory Signs

- Use must be authorized by proper officials
- Check with proper agencies
- Watch for conflicts with existing signs

Warning Signs

- Warn drivers of potentially dangerous conditions
- Orange in work zones, yellow in permanent applications
- Placed far enough in advance

Guide Signs

- Give travelers information on
  - Destinations
  - Motorist services
  - Direction
  - Detour routes

Sign Colors

Red – Prohibition/Regulatory

Black and White - Regulatory

Yellow – General Warning

Orange – Construction/Maintenance

Blue – Motorist Services Guidance

Green – Directions

Brown – Recreational/Cultural Interest

FYG – Pedestrian/Bicycle/School

Coral – Incident Management

Sign Shapes

Visibility

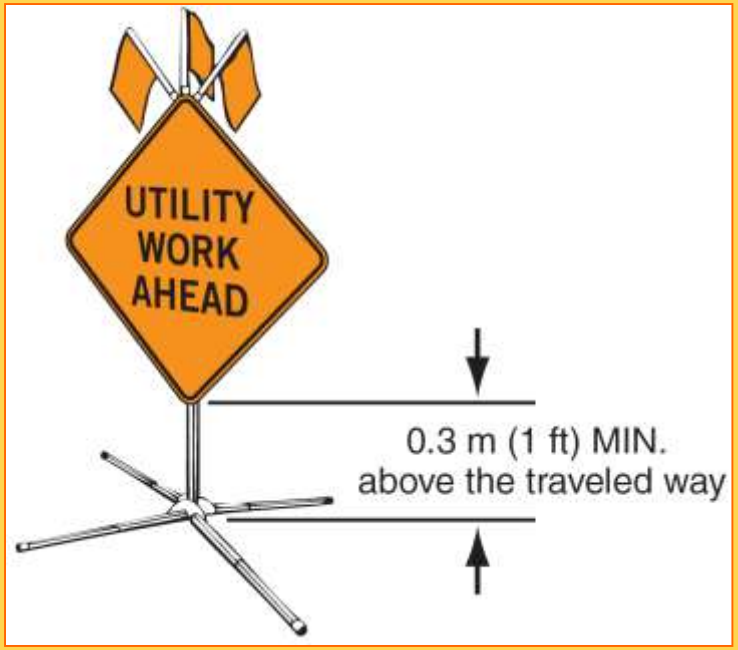
- Key to both…
  - Effective communication
  - Safety

Improve Visibility

- Emergency flashers
- Flashing strobe lights
- Rotating beacons
- Flags
- Type III barricades
- Retroreflective vehicle markings
- Place high enough to be seen over traffic

Sign Height Clearances

- Post mounted:
  - 5 ft. for rural areas
  - 7 ft. for urban areas
- 1 ft. for temporary supports

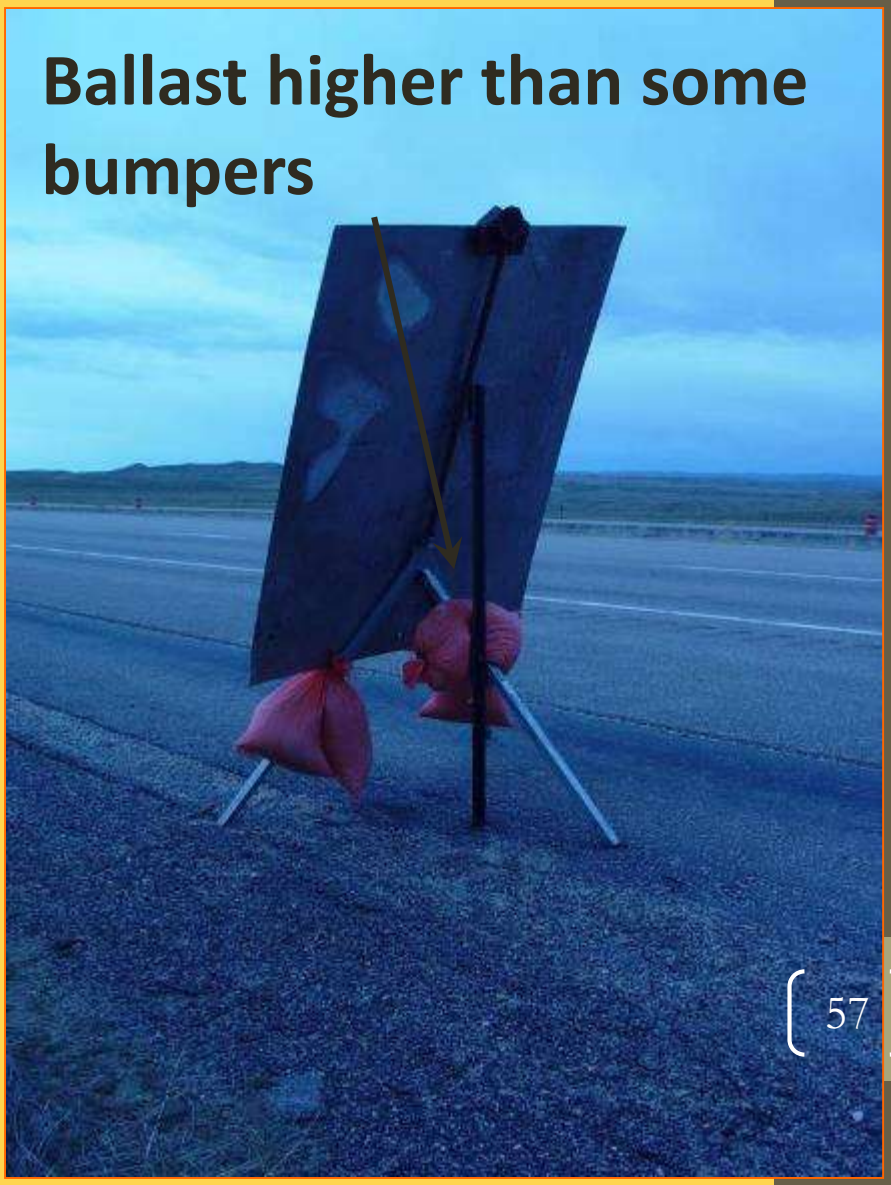


From bottom of sign to the elevation of the pavement

What's the problem?

Proper Ballast

Poor Ballast

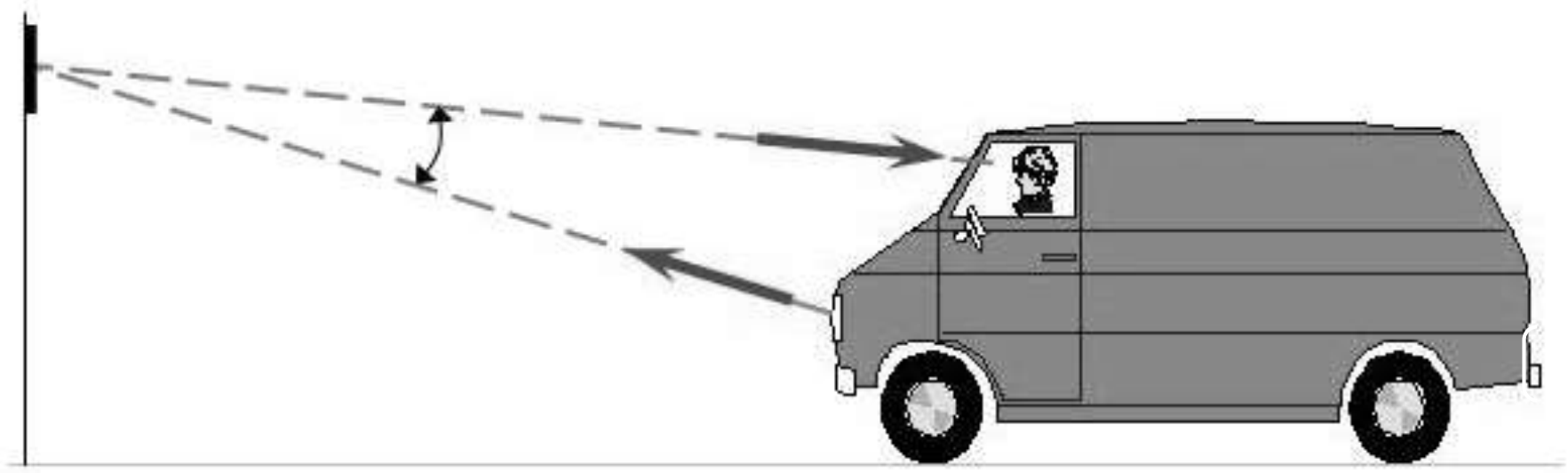


Signs Used at Night

- Must be either:
  - Retroreflective *or*
  - Illuminated
- Shapes and colors must be the same as during the day
- Twist to prevent glare

Retroreflectivity and Vehicle Type

- Higher vehicles
  - Less visible retroreflected light



Channelizing Devices

- Direct traffic from one lane to another
  - Guide travelers along a safe path
- Can be hazards themselves
  - Warning signs are needed
- Retroreflectorized for night use
- Cones, grabber cones, wands/candles/tubular markers, drums, barricades, vertical panels

Cones and Tubular Markers

- Compact and lightweight
  - Small target value
  - Do not damage vehicles that hit them
- Require constant attention
  - Avoid using them in unattended work sites

Grabber Cones

- Double or even triple base them for maximum stability in high winds

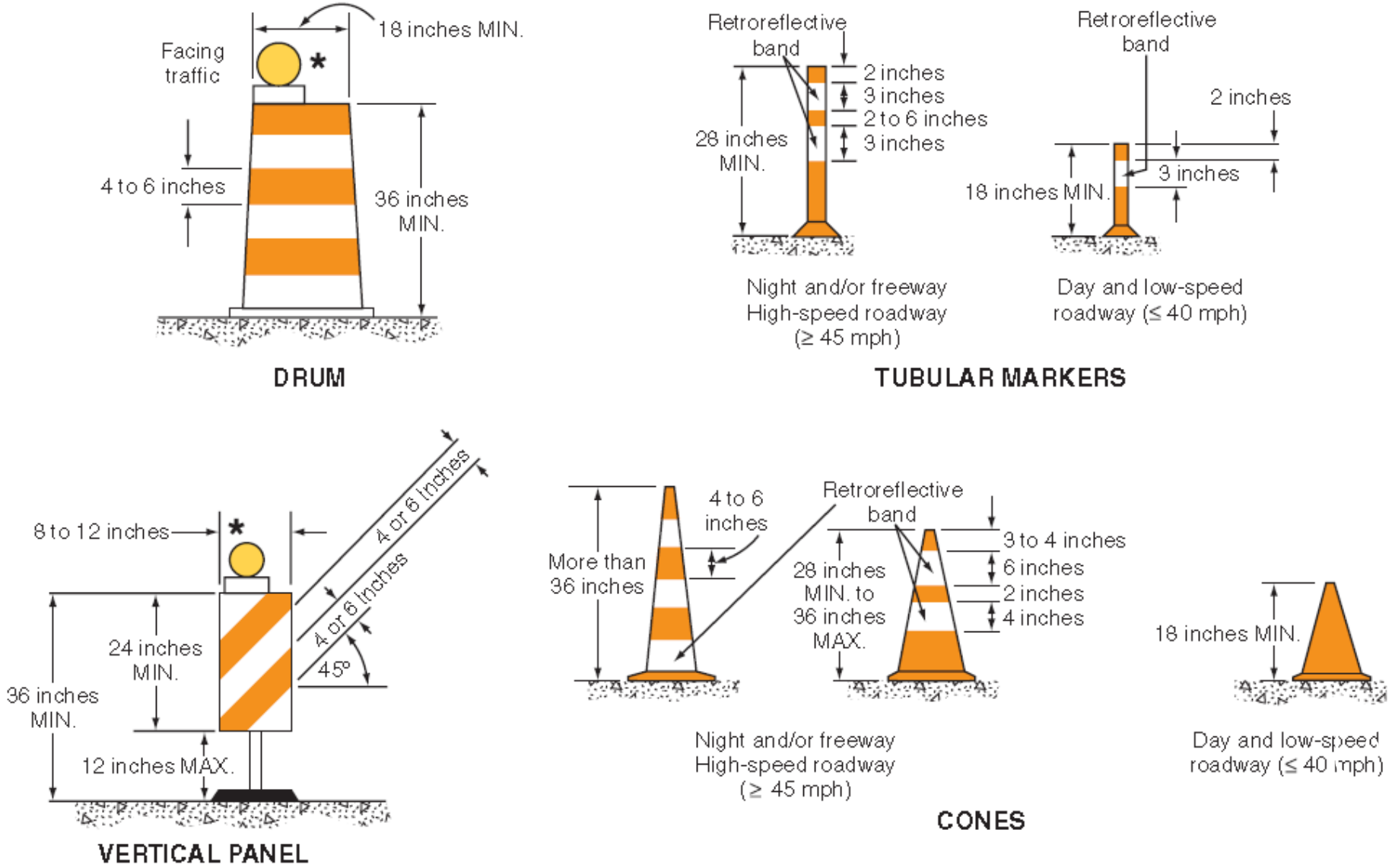
Drums

- Command more respect than cones
- More target value
- More difficult to install and store

Vertical Panels

- Can be used when space is tight

Figure 6F-7. Channelizing Devices

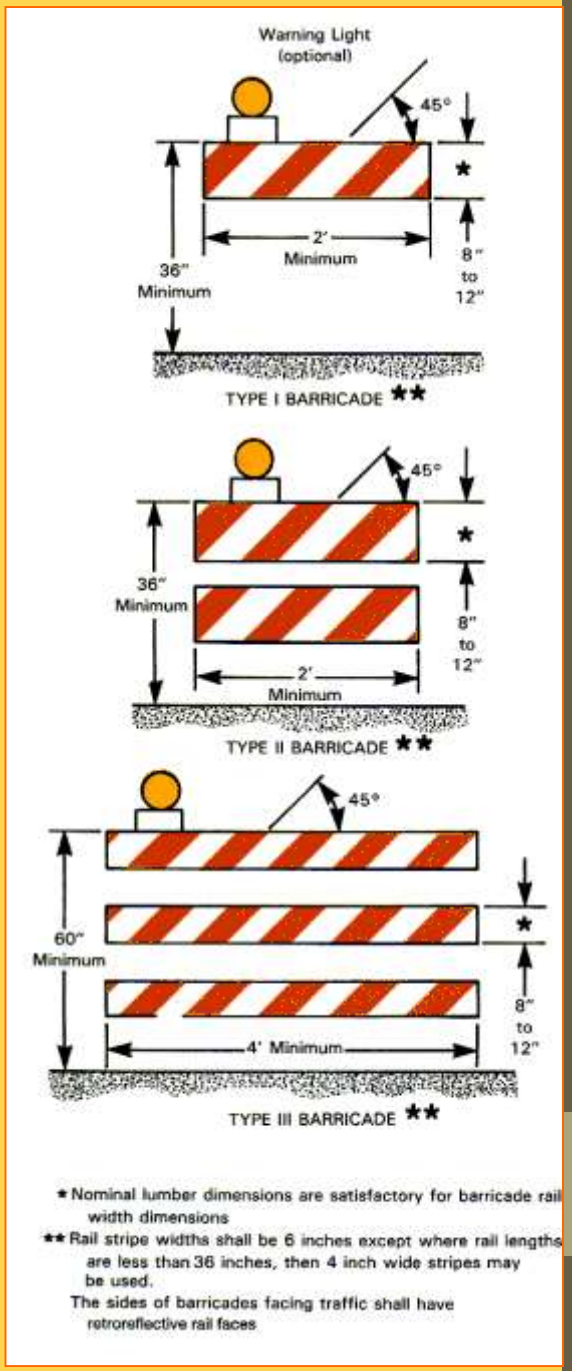


Barricades

- Usually used to
  - Close or restrict the right-of-way
  - Channelize traffic
  - Mark hazards
  - Mount signs on
- May damage vehicles when hit

Barricades: Types

- Type I (single rail)
  - Low speeds
- Type II (double rail)
  - High speeds
- Type III (triple rail)
  - Road closures



Proper Ballast on Barricades

Warning Lights

- Type A
  - Low intensity flashing
  - Effective at night

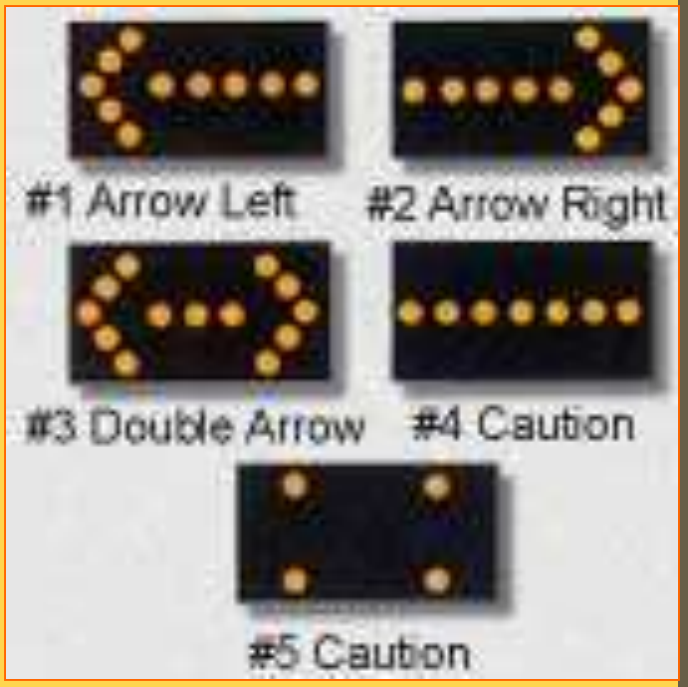
- Type B
  - High intensity flashing
  - Effective both day and night

- Type C
  - Steady burn, for delineation

"High-Level Devices"

- **Supplement** other devices in heavy urban traffic
  - Arrow panels
  - Portable changeable message signs
  - Portable traffic signals

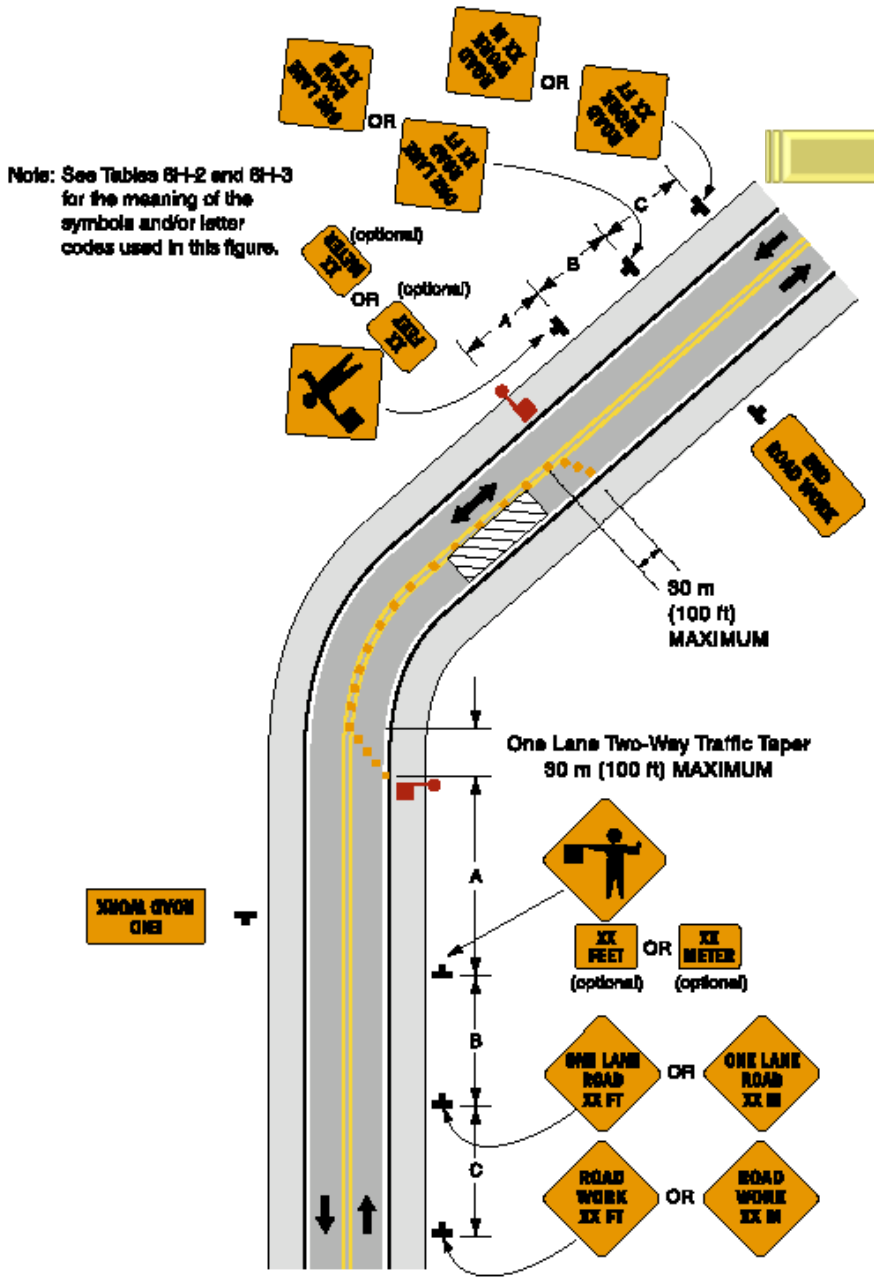
Arrow Panels



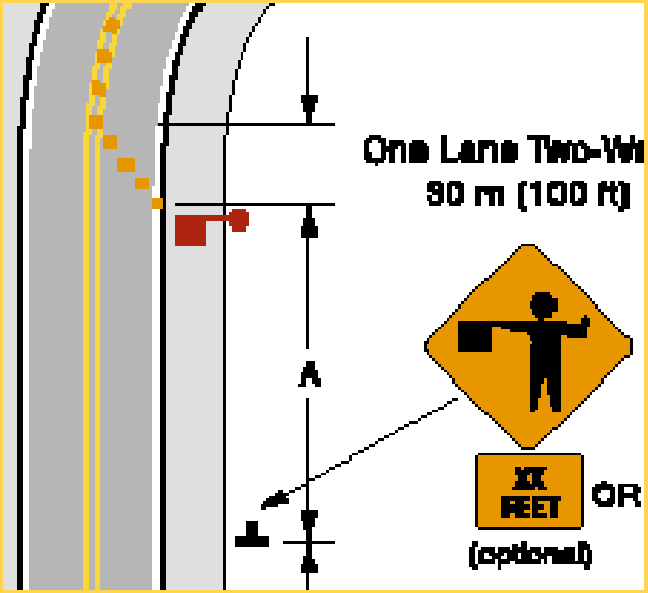
- Use **IN ADDITION** to
  - Signs
  - Channelizing devices
- Must direct traffic into the proper lane
- **Never use an arrow display to direct traffic into opposing lanes**
- Never use on two-lane roads with flaggers

Lane Closure on Two-Lane Road Using Flaggers

Figure 6H-10. Lane Closure on Two-Lane Road Using Flaggers (TA-10)



Typical Application 10



No arrow panels!!

Incorrect Use of Arrow Panel…

Portable Changeable Message Signs

- Make sure messages are correct
  - See MUTCD for acceptable abbreviations
- Display messages
  - Unexpected traffic situations
  - Rerouting
- Can be effective on any road

Portable Signals

- **Good for…**
  - **Controlling traffic when both directions need to use the same lane**
  - To stop both directions of traffic
  - Must meet ALL REQUIREMENTS of the local road authority
    - Properly designed and timed

Crash Cushions

- Protect motorists from
  - Exposed ends of barriers
  - Fixed objects
  - Shadow vehicles
  - Other hazards

Truck Mounted Attenuators (TMA)

Pavement Markings

- White
  - Separates flow in the same direction
  - Marks the pavement edge
- Yellow
  - Separates flow in opposite directions

How do you remove pavement markings?

- By any method that completely removes the marking and the glass beads and does not leave a scar that could be misleading
  - Sandblasting
  - Grinding, etc.

Which Path to Follow?

Is Black Paint Allowed?

Better yet, use 'tabs'

(temporary raised pavement markers)

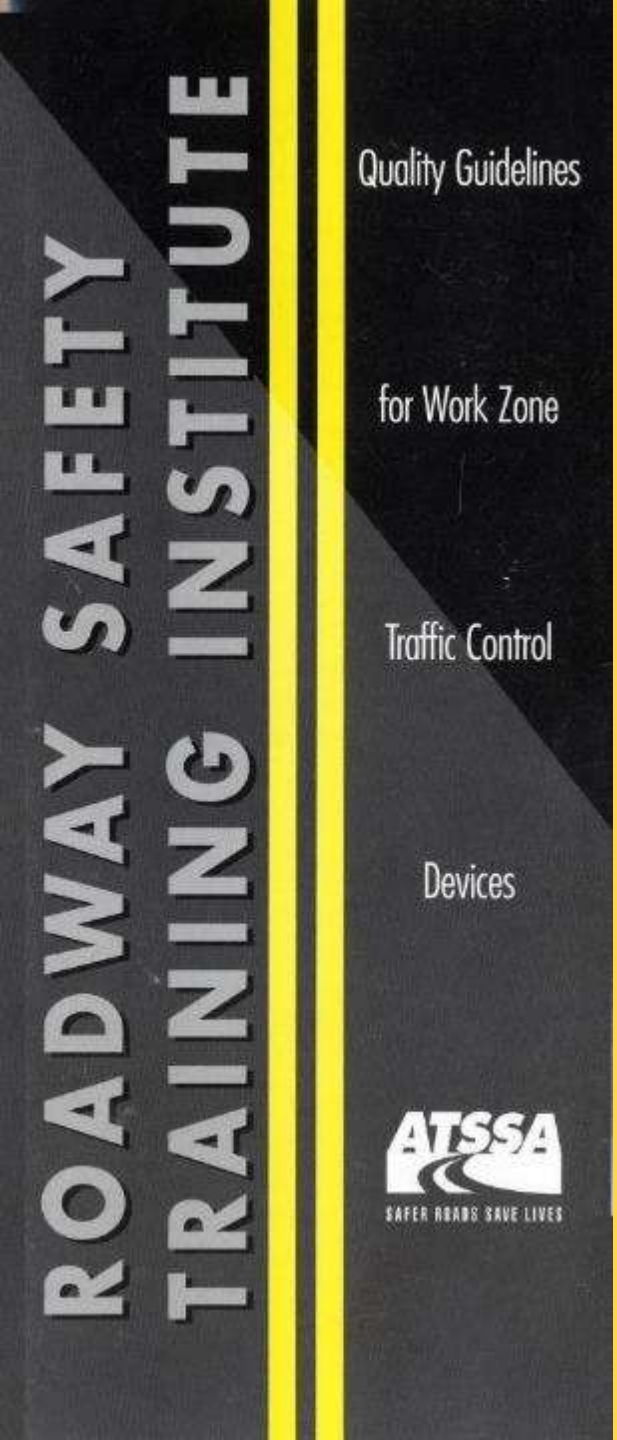
Crashworthiness: NCHRP 350

(soon the Manual for Assessing Safety Hardware)

- Structural Adequacy
  - Redirect vehicle
  - Stop vehicle
  - Allow vehicle through feature
- Occupant Risk
- Vehicle Trajectory

Maintenance

- Devices should be cleaned regularly
- Regular inspections
- Replace worn out devices
- Look for devices that get hit



Acceptable

Marginal

Unacceptable

Where's the Traffic Control?

Traffic Control Devices: *Summary*

- The best way to communicate a clear message
- Can be extremely effective if used properly
- Help you make the work site as safe as possible
- Follow standards for uniformity

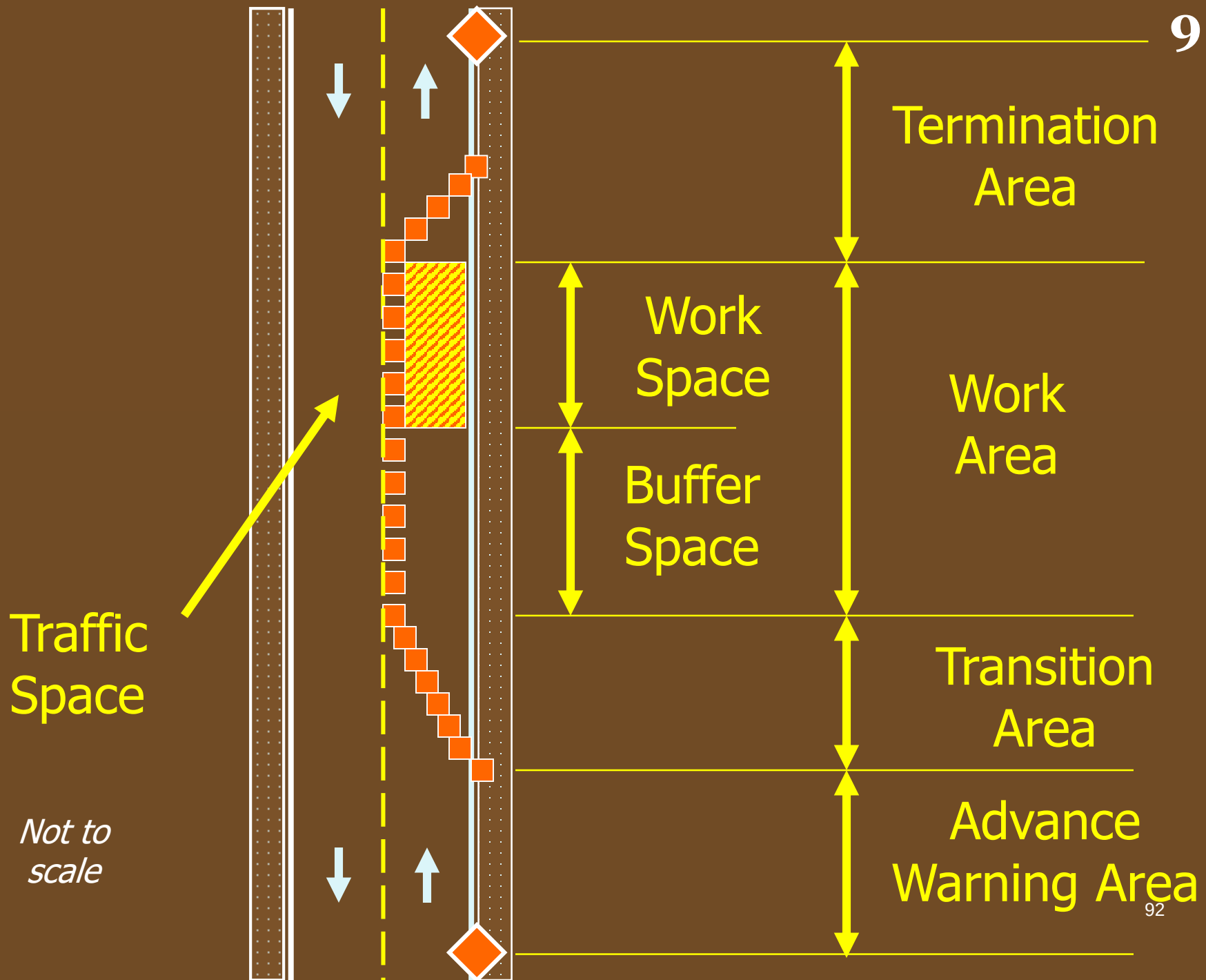
Any Questions?
Anything to Add?

Elements of the Work Zone

Layout, Setup and Takedown
Mobile and Short Duration Operations
Urban and Utility Work
Pedestrians, Bicycles and ADA

Goals

- Minimize traffic delays
- Maximize safety of:
  - Workers
  - Motorists
  - Pedestrians
  - Bicyclists

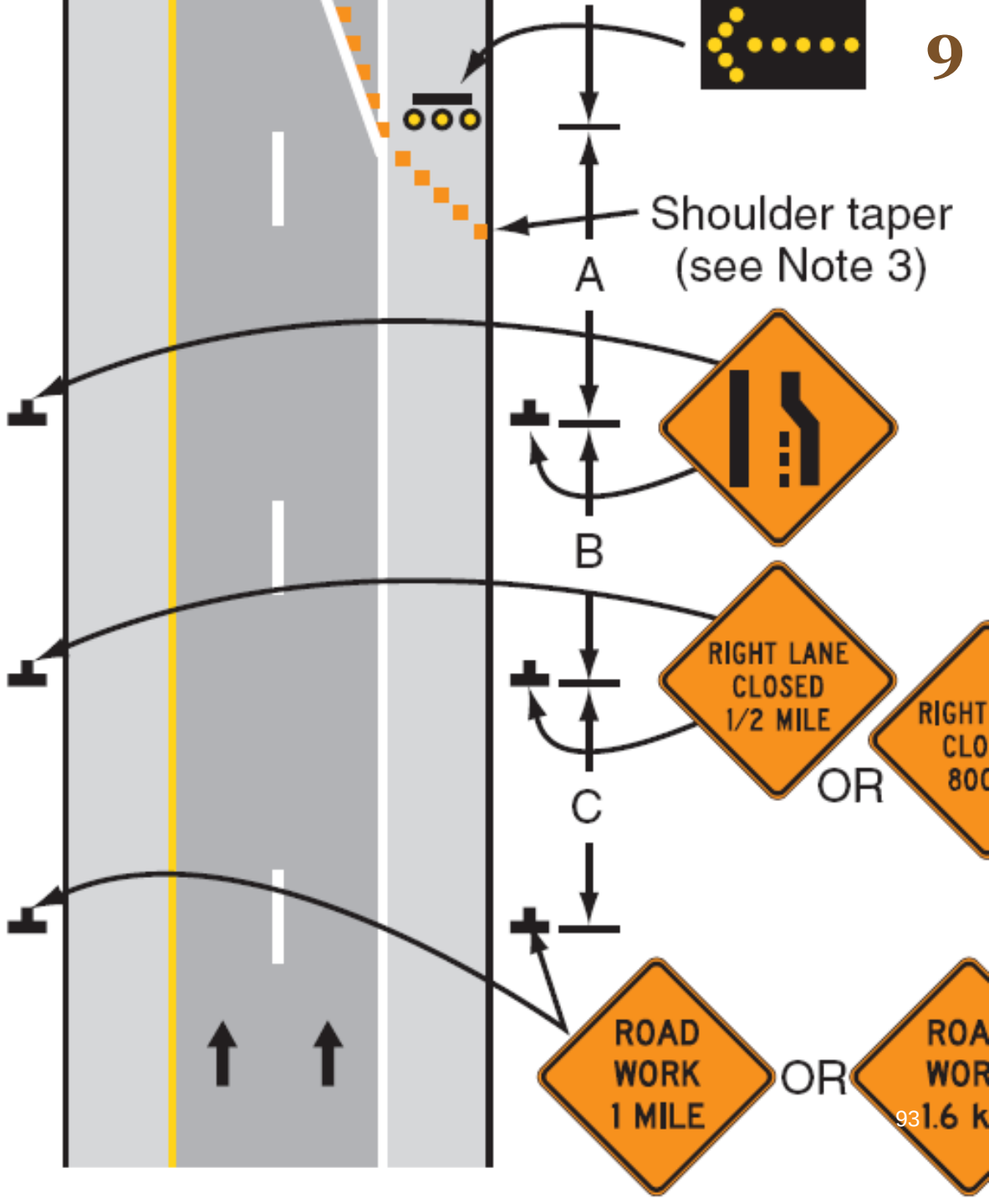

Termination Area
Work Space
Buffer Space
Work Area
Transition Area
Advance Warning Area
Traffic Space
Not to scale

Advance Warning

Get Out!!!

Fire!!!

Hey, You!!!



Advance Warning Area Sign Spacing

Table 6C-1. Suggested Advance Warning Sign Spacing

Road Type	Distance Between Signs		
	A	B	C
Urban (low speed)	100	100	100
Urban (high speed)	350	350	350
Rural	500	500	500
Freeway	1,000	1,500	2,640

Sign Spacing also on T C Plans, and/or States/Typical Drawings

Transition Area

- Area where motorists are directed out of their normal path.
  - Tapers
  - Flaggers
  - Pilot car

Flagger Location

- Location of Work
- Visibility to Drivers
- Escape Route

Section 6E.08 <u>Flagger Stations</u>

Standard:

Flagger stations shall be located such that approaching road users will have sufficient distance to stop at the intended stopping point.

Flagger Location

- At the beginning of the taper

Flagger Location: Visibility

- Visible for *at least* 500'
  - more if conditions warrant
- Not near vehicle
- Not near workers

Flagger Location: Escape Route

- Stand on shoulder, away from obstructions
  - Guardrails, bridge ends, barricades, trees, bushes
  - Vehicles

Never in the path of oncoming traffic!!![10]

Flaggers and Flags

Section 6E.03 <u>Hand-Signaling Devices</u>

Guidance:

The STOP/SLOW paddle should be the primary and preferred hand-signaling device because the STOP/SLOW paddle gives road users more positive guidance than red flags. Use of flags should be limited to emergency situations.

Get their attention…but don't be a cheerleader.

Document: Why are you using flags? Flaggers should be instructed <u>not</u> to give possibly confusing signals.

Channelizing Device Spacing and Taper Lengths

Channelizing Device Spacing

- Spacing: Rule of Thumb
  - For tapers, the speed in feet
  - For tangents, twice the speed in feet
- *For example:*
  - *On the Interstate at 75 mph, space drums at 75' on the taper and 150' on the tangent*
  - *In an urban situation, space the cones at 25' on the taper and 50' on a tangent*

Merging Taper

- Length of taper is ‘L’ ft
- Regulatory signs tell drivers what to do

Table 6H-4. Formulas for Determining Taper Lengths

Speed Limit (S)	Taper Length (L), ft
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or more	$L = WS$

L = taper length in feet
W = width of offset in feet
S = posted speed limit, or off-peak 85th percentile speed, or the anticipated operating speed in mph

Example Calculation of "L"

- Given:
  - Urban arterial street
    - 30 mph speed limit
  - Closing one twelve-foot lane
  - W = 12
  - S = 35

$$L = \frac{WS^2}{60} = \frac{12 \times 35^2}{60} = 245$$

Types of Tapers

Merging Taper, L

Downstream Taper, L/2

Shifting Taper, L/2

Shoulder Taper, L/3

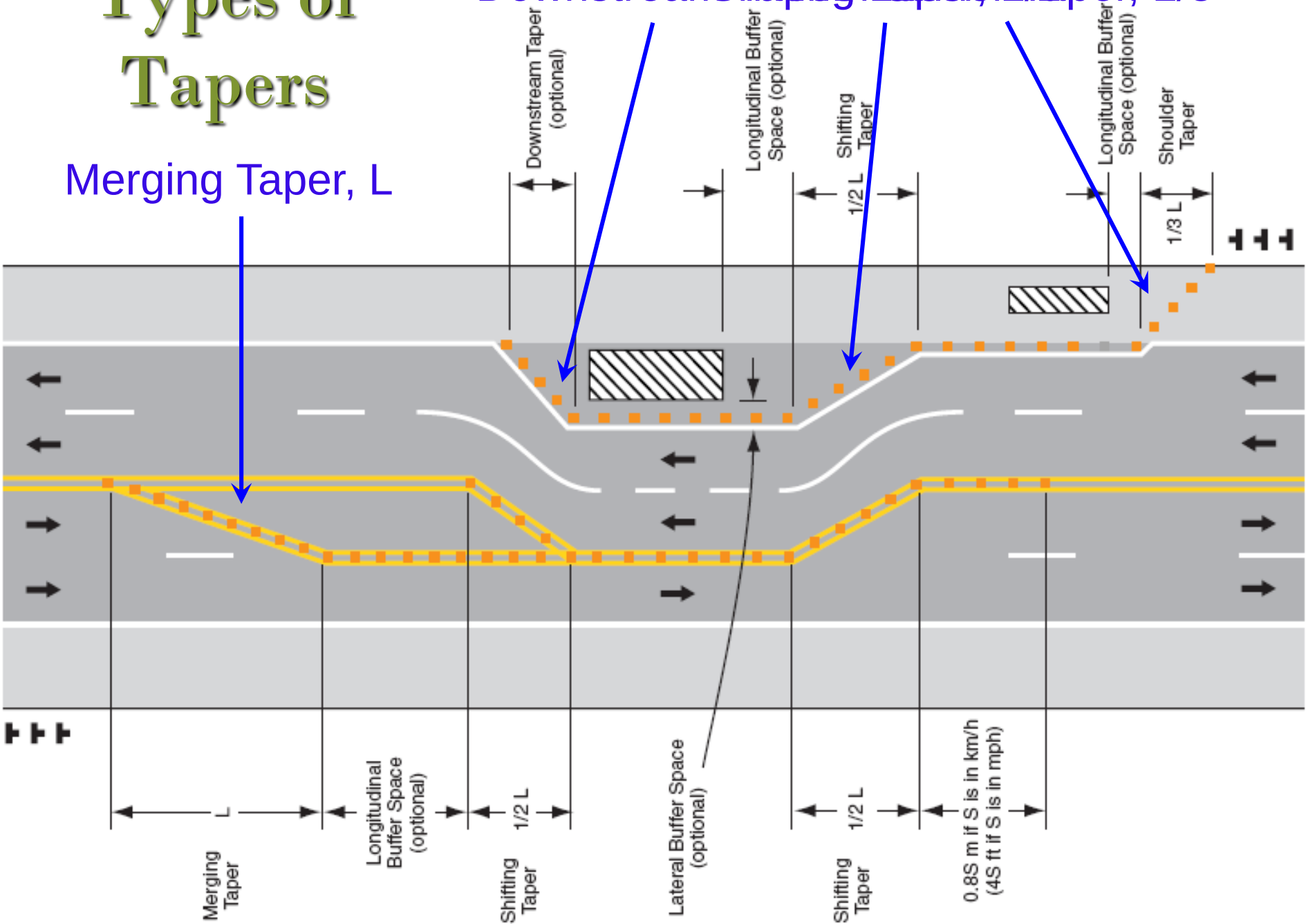
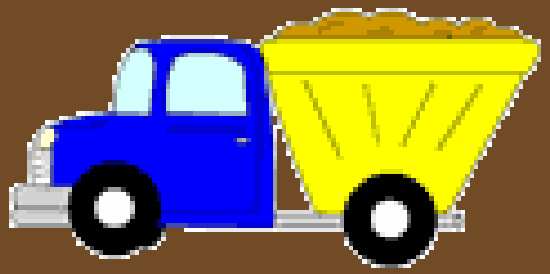


Table 6C-3. Taper Length Criteria for Temporary Traffic Control Zones

Type of Taper	Taper Length (L), ft
Merging Taper	at least L
Shifting Taper	at least L/2
Shoulder Taper	at least L/3
One-Lane, Two-Way Traffic Taper	100 ft *maximum*
Downstream Taper	100 ft per lane



Activity Area

- Work Space
  - Area set aside for work, equipment, materials
- Traffic Space
  - Area where motorists, pedestrians, and bicycles move past the work space
- Buffer Space

Buffer Space MUTCD Section 6C.06 Activity Area

- Buffer spaces, though optional, are highly desirable
  - Provide ***recovery area*** for errant vehicles
  - May be lateral or longitudinal
- Do NOT store equipment or materials in the buffer space
- Buffer Space length: from ***Table 6C-2***
  - ***Consider 'roll-ahead' distance***

Speed, mph	20	30	40	50	65	75
Distance, ft	115	200	305	425	645	820

Termination Area

- Return traffic to normal
  - End Road Work
  - Resume speed limit
- Maintains respect of drivers

Comments? Questions?

Work Zone Set Up and Take Down

The most dangerous part of the job.

Preparation

- Confirm work schedule
- Verify that enough people are available
- Assemble necessary equipment
  - Include extras of commonly needed signs

- Consider emergency plans
  - Notify Public and Emergency Personnel

Placement

- Know the layout beforehand
- Observe the traffic before beginning setup
- Beware of
  - Obstructions
  - Reduced visibility

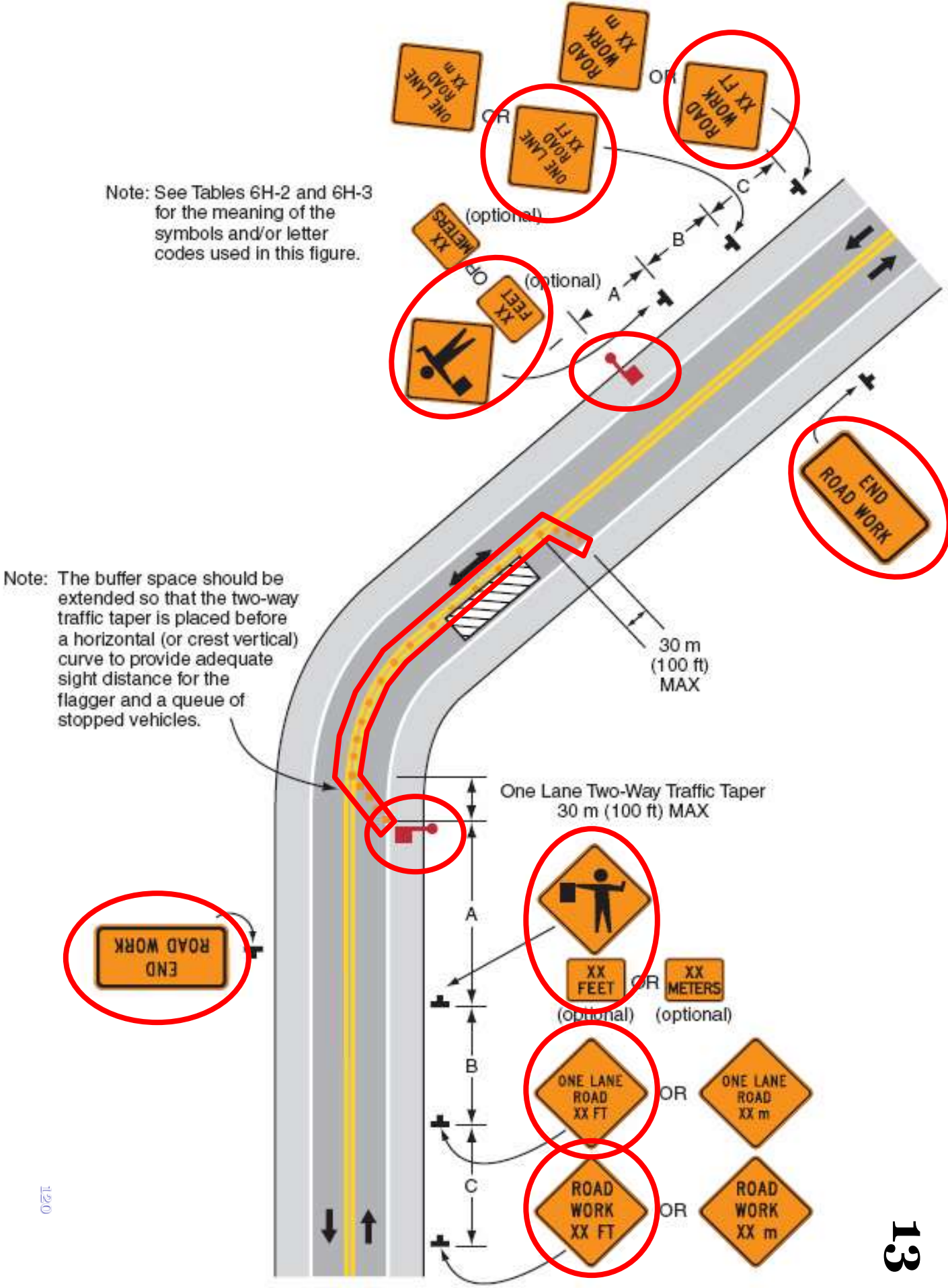
Be Prepared

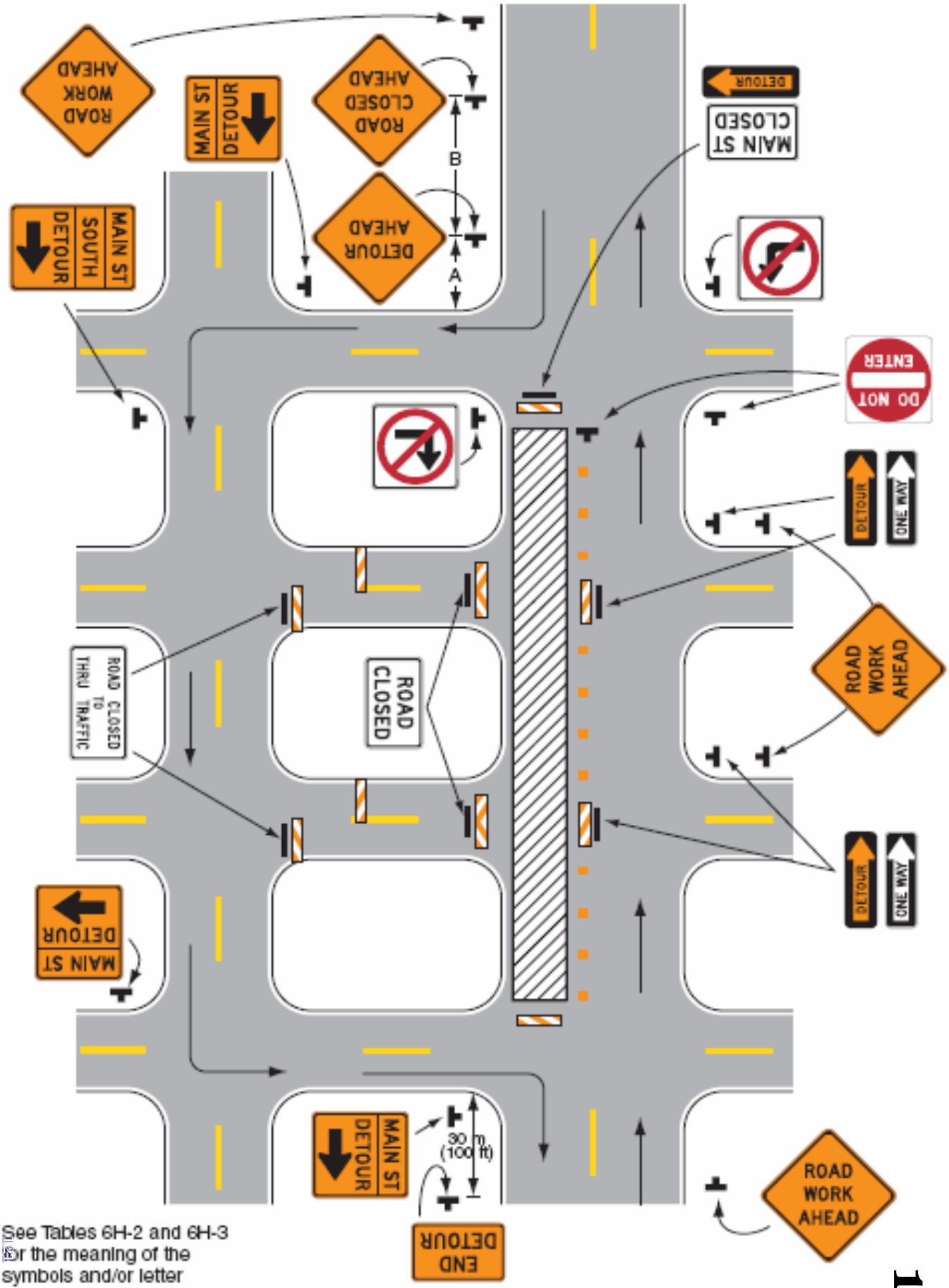
13

Be Prepared

Set Up

- Setup signs and devices with flow of traffic
  - Start farthest from work area
  - Handle opposing traffic first
    - Traffic with greatest conflicts with work zone
  - Except for detours
- If you're going to tear down the TC then set it up the next day, mark device locations


Note: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.
ROAD WORK XX m
OR
ROAD WORK XX FT
ONE LANE ROAD XX m
OR
ONE LANE ROAD XX FT
(optional)
XX METERS
OR
XX FEET
(optional)
A
B
C
END ROAD WORK
Note: The buffer space should be extended so that the two-way traffic taper is placed before a horizontal (or crest vertical) curve to provide adequate sight distance for the flagger and a queue of stopped vehicles.
30 m
(100 ft)
MAX
One Lane Two-Way Traffic Taper
30 m (100 ft) MAX
END ROAD WORK
XX FEET
OR
XX METERS
(optional)
(optional)
ONE LANE ROAD XX FT
OR
ONE LANE ROAD XX m
ROAD WORK XX FT
OR
ROAD WORK XX m



Note: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.

Typical Application 19

Navigate & Evaluate

- Look for potential hazards
- Make sure flaggers are visible
- Make sure work area is large enough
- Make sure buffer zone is adequate
- Consider "What Ifs?"
  - Job takes longer than planned
  - Ambulance needs to get through
  - Motorist error
    - Ignore flagger
    - Drive through cones
- OBSERVE TRAFFIC FLOW!!!

Maintenance

- Periodic checks
  - Everything in place?
  - Everyone safe?
  - Flaggers getting enough relief?
  - Any areas that could be improved?
  - Any close calls?
    - Skid marks?

Take Down

- Be prompt!!!
  - Traffic control without ongoing work breeds disrespect for every work zone, not just yours
- Take down against traffic
  - Except detours

Questions?
Comments?

Mobile and Short Duration Operations

- Mobile Operations
  - Litter pick up
  - Spraying
  - Cleaning and repairing delineators
- Short Duration Operations
  - Evaluation, testing, and sampling
  - Throw and go pothole repair
- Moving Operations
  - Snowplowing
  - Street Sweeping
  - Mowing
  - Blading gravel roads
  - Striping
- Others…

Fundamental Aspects

- Visibility
  - Vehicles well lit with high intensity lights
  - Sight distance
  - Arrow Panels
- Shadow Vehicles
  - Most mobile operations require one
    - Snowplowing and street sweeping are exceptions
  - Truck Mounted Attenuators
- **PLAN**

MUTCD, **6G.02 Work Duration**

- Very little is **Standard**

D. Short duration is work that occupies a location up to 1 hour.

E. Mobile is work that moves intermittently or continuously.

MUTCD, **6G.02 <u>Work Duration</u>**

"Support:

During short duration work, it often takes longer to set up and remove the TTC zone than to perform the work…"

MUTCD, **6G.02 Work Duration**

"The increased time to place and remove these devices in some cases could significantly lengthen the project, thus increasing exposure time."

MUTCD, **6G.02 Work Duration**

"…simplified control procedures may be warranted for short-duration work. A reduction in the number of devices may be offset by the use of other more dominant devices…"

MUTCD, **6G.02 Work Duration**

"Devices that are larger, more imposing, or more visible can be used effectively and economically."

Strobe lights
Arrow panels

MUTCD, **6G.02 Work Duration**

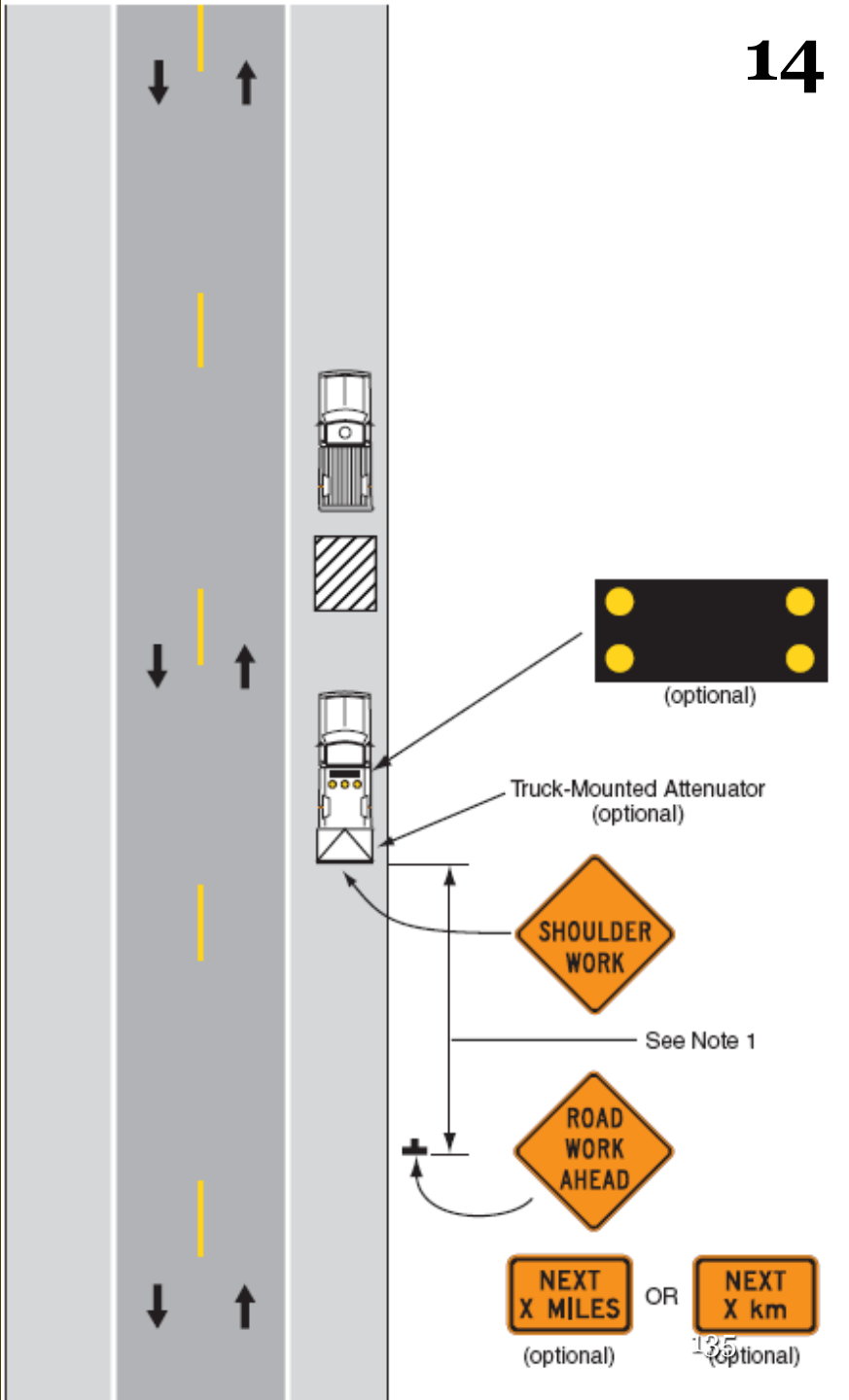
"When mobile operations are being performed, a shadow vehicle equipped with an arrow panel or a sign should follow the work vehicle, especially when vehicular traffic speeds or volumes are high."

MUTCD, **6G.02 <u>Work Duration</u>**

"…work during off-peak hours."

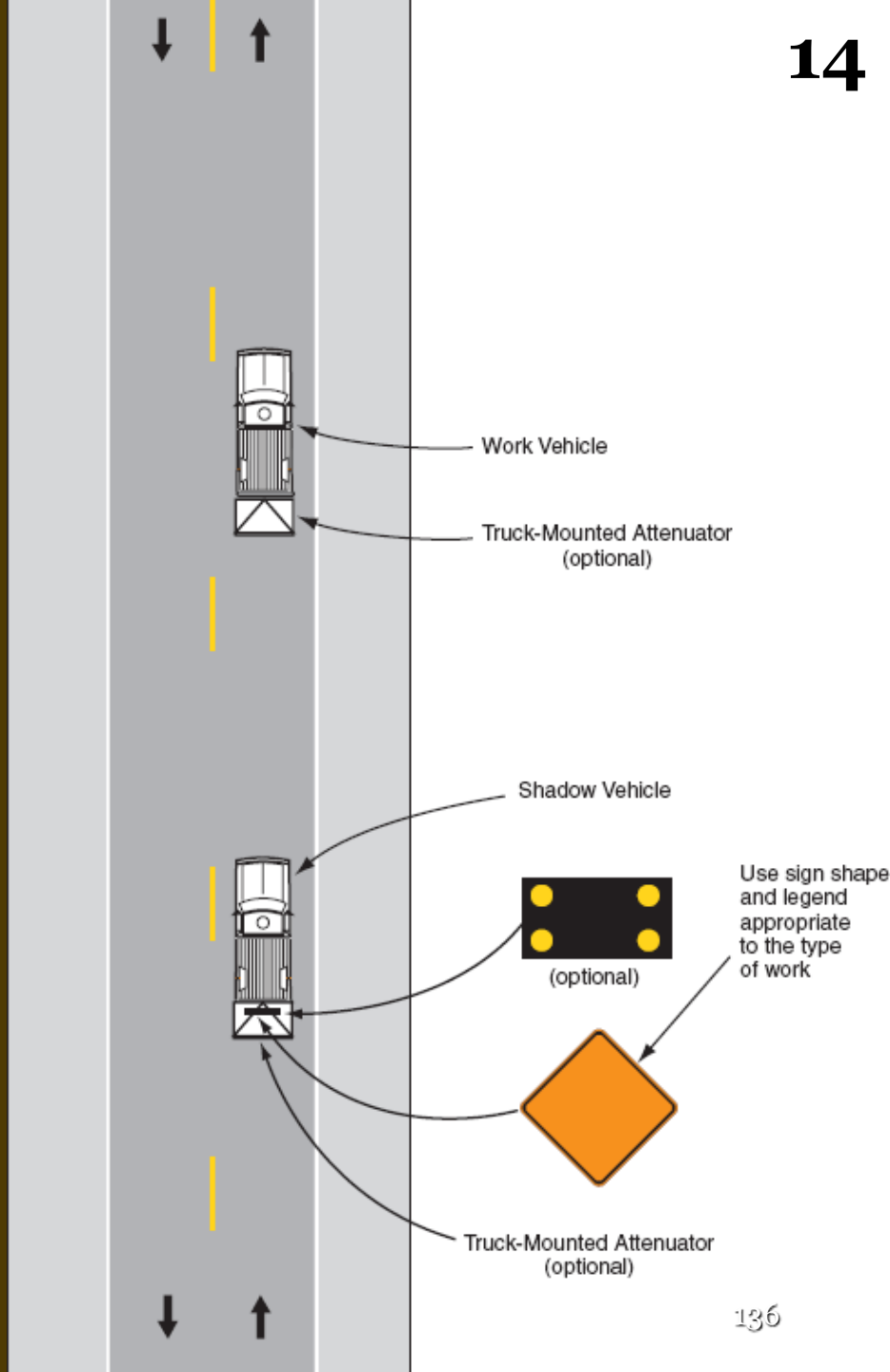
Short Duration or Mobile Operation on Shoulder
(TA-4, page 6H-13)

- If 2 to 5 miles from advance warning to operation, should use a distance plaque
- **Use high intensity lights, not just flashers**
- **If using arrow board, leave it in caution mode**
- Signs may be omitted if over one mile between stops
- Be aware of sight distance



Mobile Operations on 2-Lane Road
(TA-17, page 6H-39)

- **Signs visible when in use, but not when not in use**
- Pull over to let vehicles pass
- **Use high intensity lights, not just flashers**
- **If using arrow board, leave it in caution mode**
- Be aware of sight distance



MUTCD, Section 6C.11

Flagger Method of One-Lane, Two-Way Traffic Control

Guidance:

When a single flagger is used, the flagger should be stationed on the shoulder opposite the constriction or work space, or in a position where good visibility and traffic control can be maintained at all times. When good visibility and traffic control cannot be maintained by one flagger station, traffic should be controlled by a flagger at each end of the section.

PreviewLAN

- Risk Assessment
  - Setting up traffic control devices
  - Operation without traffic control devices
  - ***Don't underestimate crash costs***
- Sight Distance
- Traffic
  - Volumes
  - Speeds
  - Types
- Operation
  - Size
  - Time
  - Speed

PLayoutAN

- Have proper gear
  - Vests, hardhats, sunscreen, water…
- Traffic Control Devices
- Discuss spacing, logistics
  - Particularly with shadow vehicle drivers
  - Sight distance

PLAnalyzeN

- Analyze constantly
  - Situation is constantly changing
  - Can't **Navigate**, so need lots of **Analysis**
- Supervisor & Shadow vehicle driver
  - Note how traffic is getting through
  - Watch for close calls
  - Are vehicles getting slowed down easily?
  - Watch sight distance

The Elephants in the Corner

- When do we set up cones, signs, and so on?
- When do we put up one sign and a flagger?
  - Never?
- How much risk is acceptable?
  - Liability
  - Do it right or risk the consequences
- We should have sufficient people for traffic control, but what do we do when we don't?
  - Emergency incident management

Excuses…Ask a Lawyer

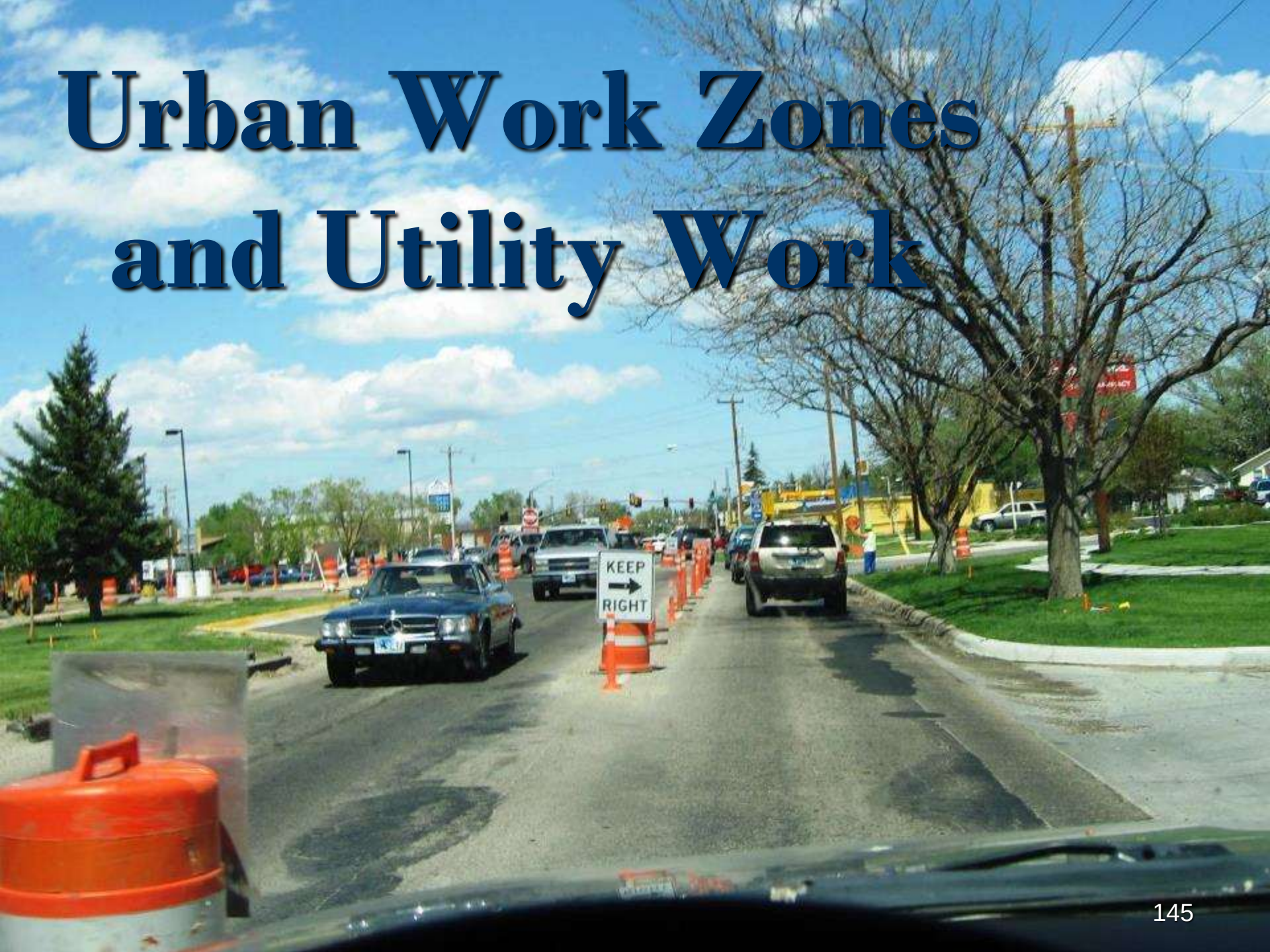
- Standards
  - No excuses
- Guidance
  - Greater risk involved in following the guidance
    - Risk could be to traveling public, to workers, or both.
    - Risk might be from not performing the work, but failure to adequately plan for the work could get you in trouble.
  - *"Not enough people," "Not enough equipment," "We were in a hurry," "I didn't know"* will make the plaintiff's attorney smile.

Mobile and Short Duration Operations: Summary

- Visibility
  - More than just flashers
  - Sight distance
- Advance Warning
  - Shadow vehicle
  - Constant vigilance
- Think "What If?"
  - Consider what you'll do if a vehicle doesn't slow down
  - Specially for shadow vehicle drivers

Comments? Questions?

Urban Work Zones and Utility Work



Advance Warning

Channelizing

- Control options
- Make changes clear

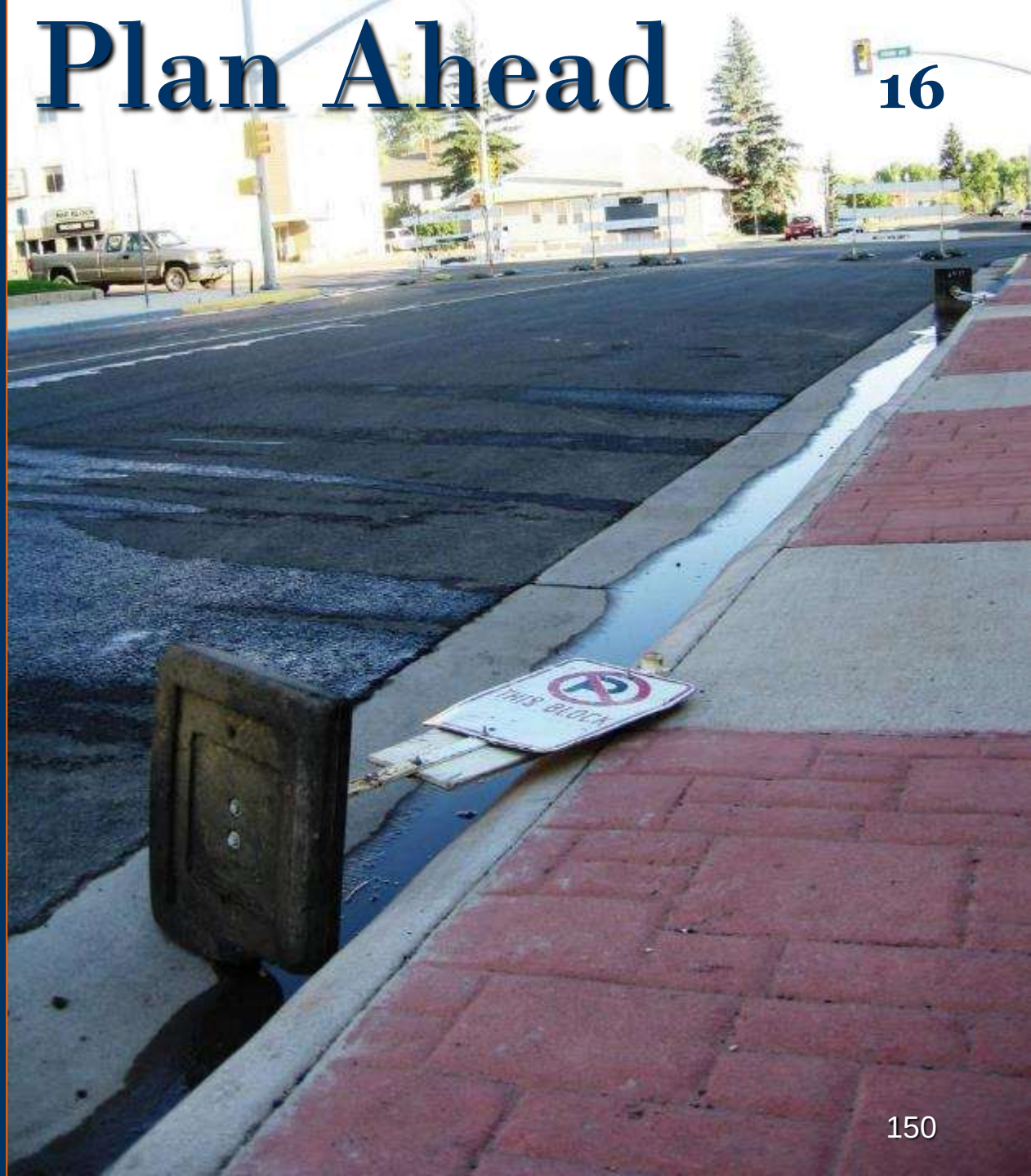
Channelizing

- Handling turning traffic

- Protect hazards

Plan Ahead

- Clear traffic before closing street
- Notify residents and business owners



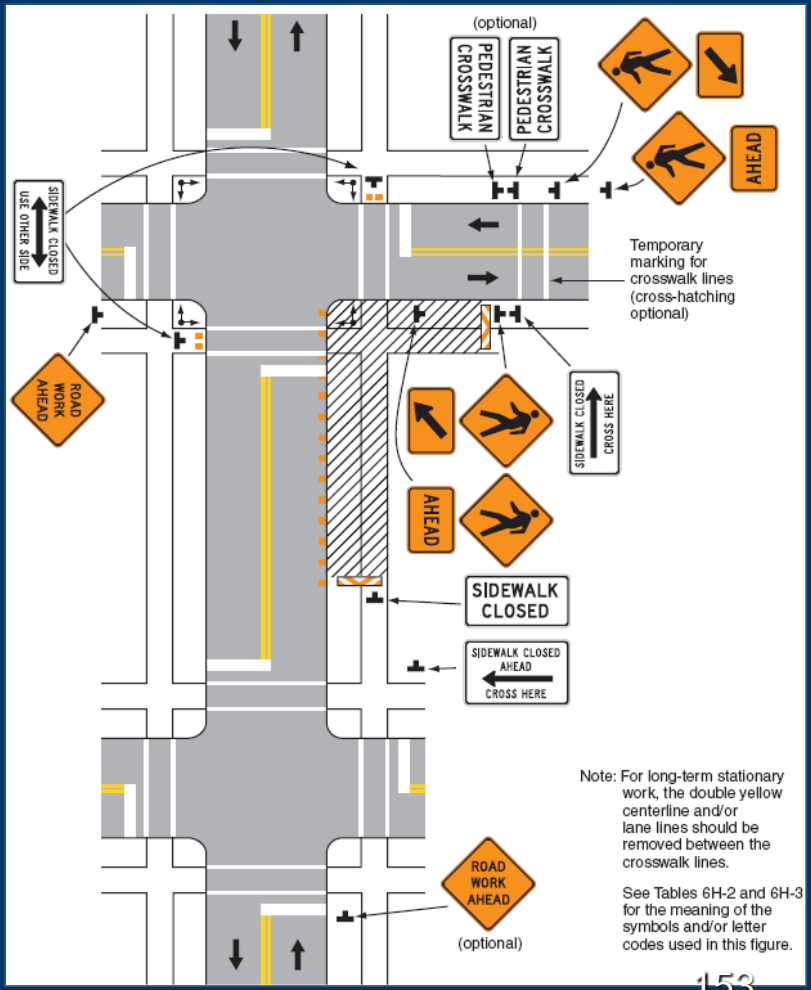
- Communicate with residents
  - Still need to have traffic control for them

Urban Work Zones

- Lane Closure
- Street Closure and Detour
- Intersections
- Overnight Work Zones

MUTCD: Typical Applications

- Initial layout
- May take elements of more than one
- Read the text for appropriate applications
- Compile list of TCDs
- Look for complicating factors



Lane Closure on a Minor Street (TA-18)

Standard:

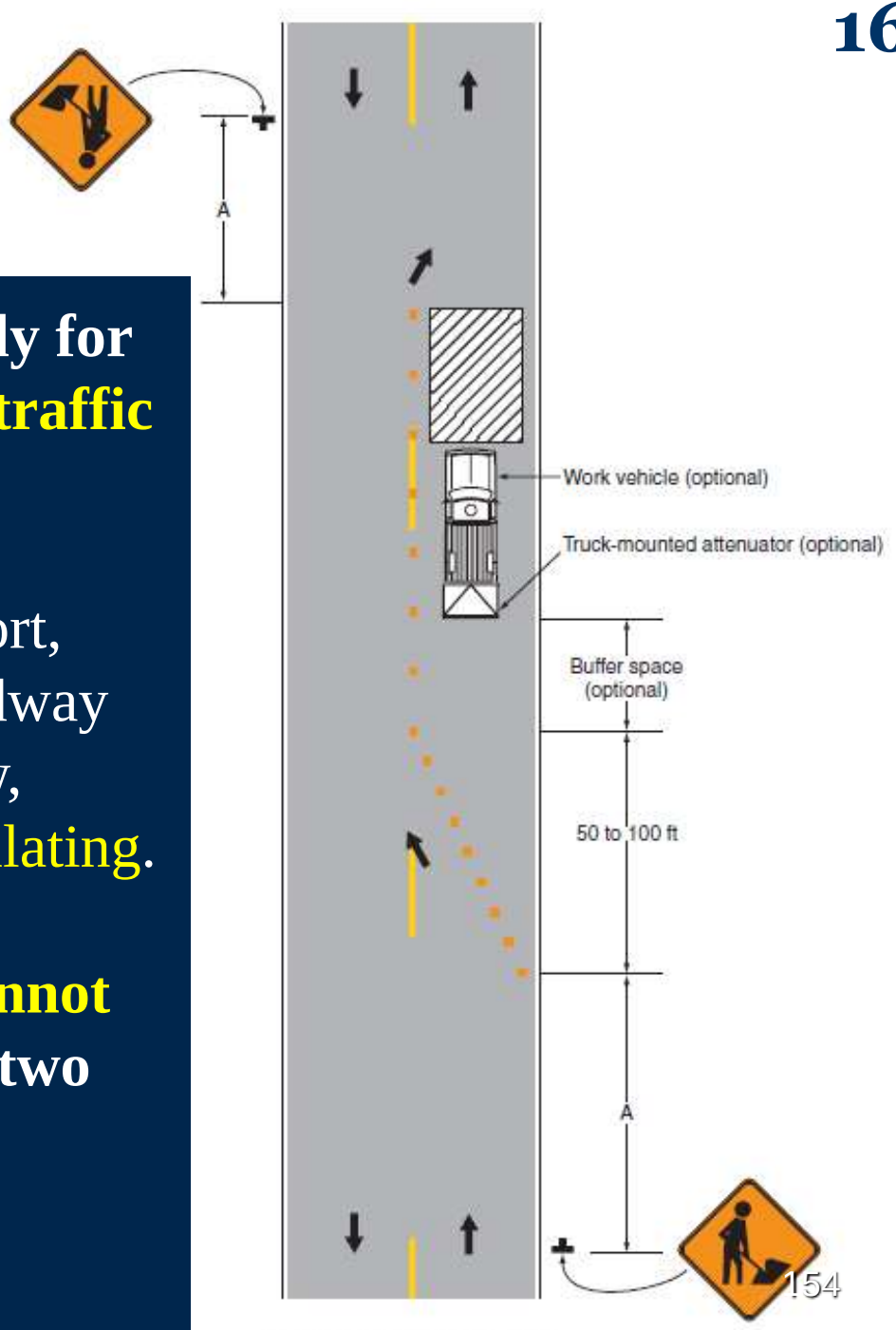
1. This TTC shall be used only for low-speed facilities having low traffic volumes.

Option:

2. Where the work space is short, where road users can see the roadway beyond, and where volume is low, vehicular traffic may be self-regulating.

Standard:

3. Where vehicular traffic cannot effectively self-regulate, one or two flaggers shall be used as illustrated in [TA-10].



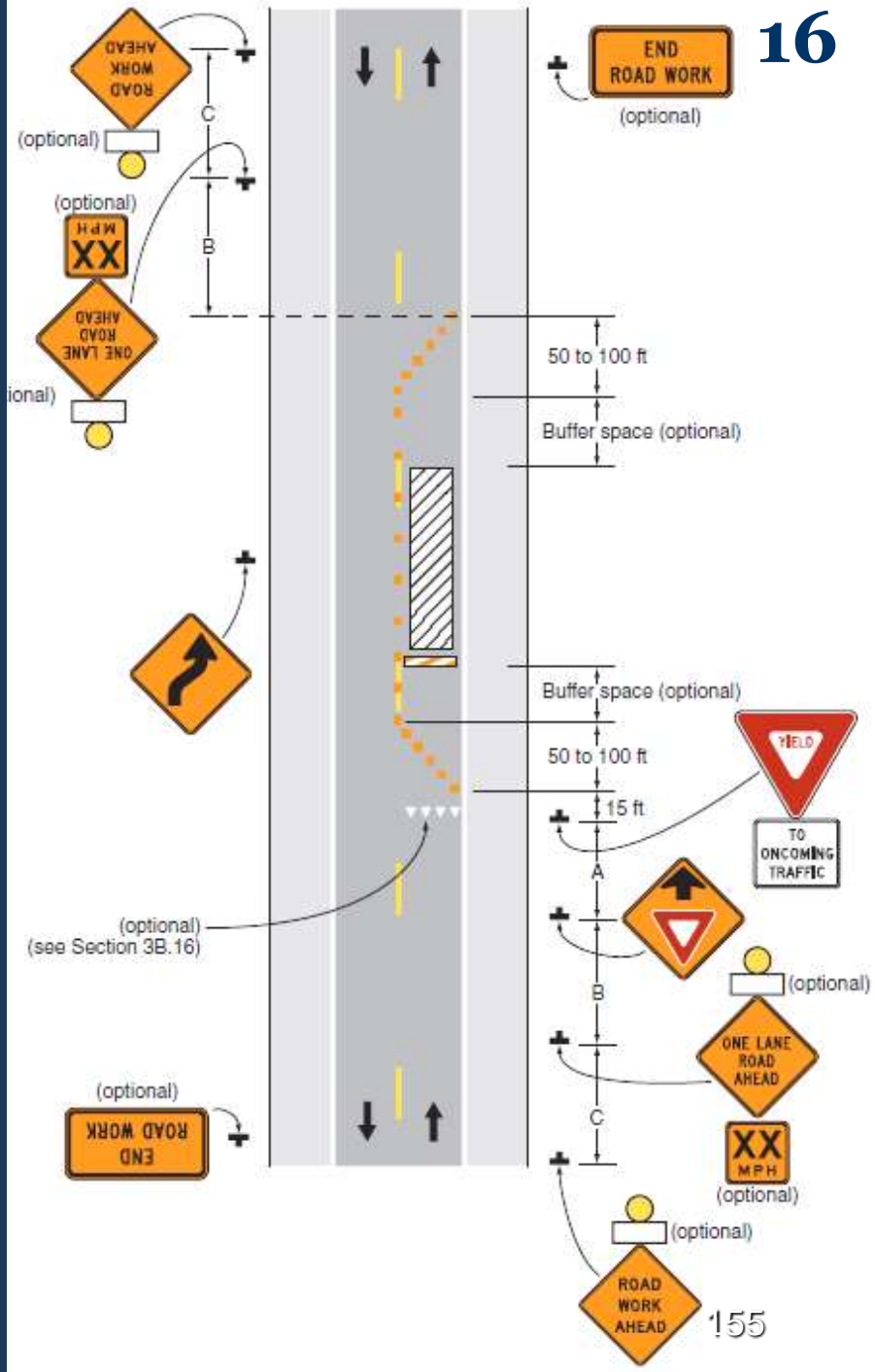
Lane Closure on a Two-Lane Road with Low Traffic Volumes (TA-11)

Option:

1. This TTC zone application may be used as an alternate to the TTC application shown in [TA-10] (using flaggers) when the following conditions exist:

   a. Vehicular traffic volume is such that sufficient gaps exist for vehicular traffic that must yield.

   b. Road users from both directions are able to see approaching vehicular traffic through and beyond the worksite and have sufficient visibility of approaching vehicles.

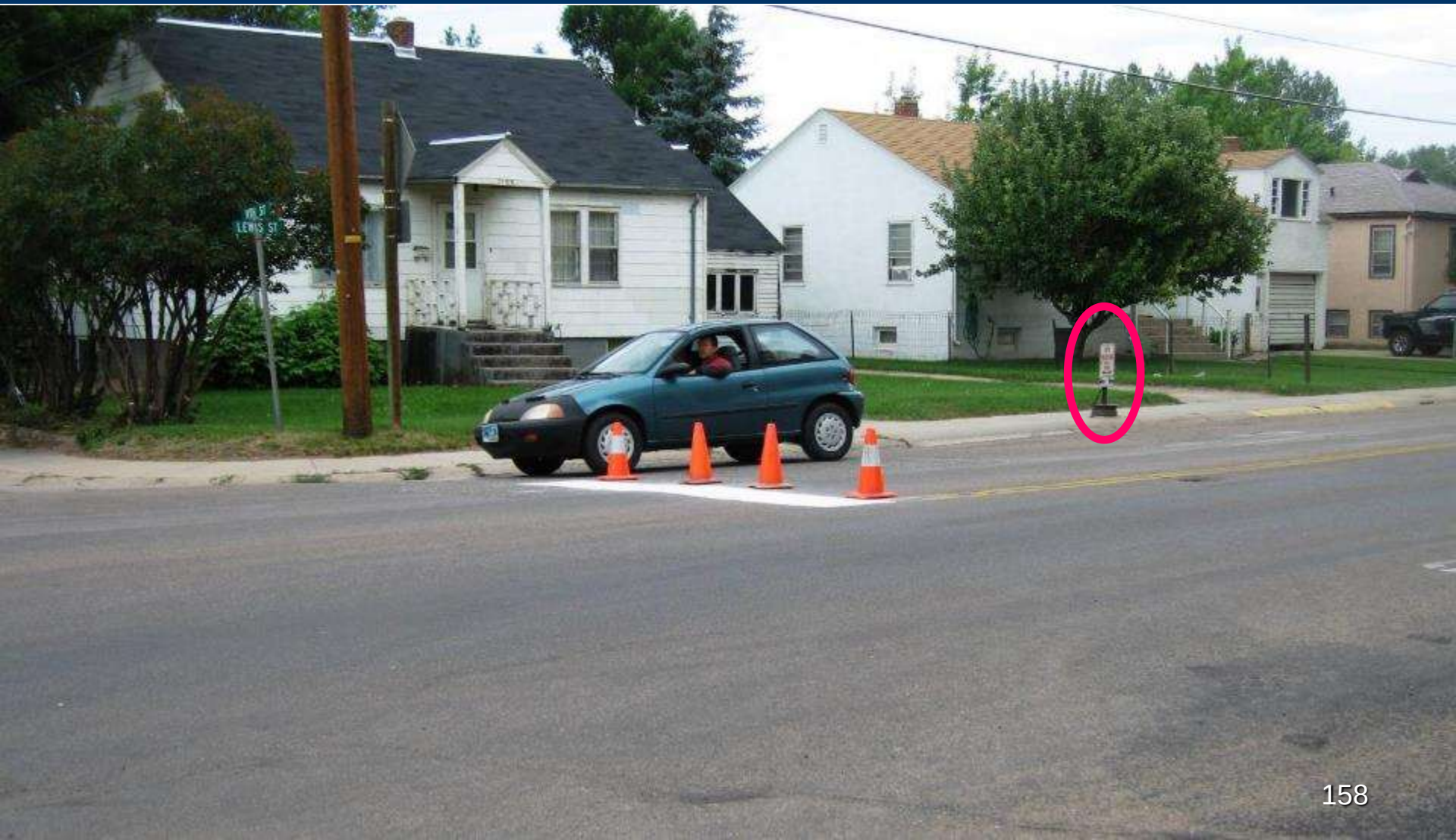


Lane Closure

- Low volume – acceptable?

- Divert traffic away from work zone

- No parking allows access



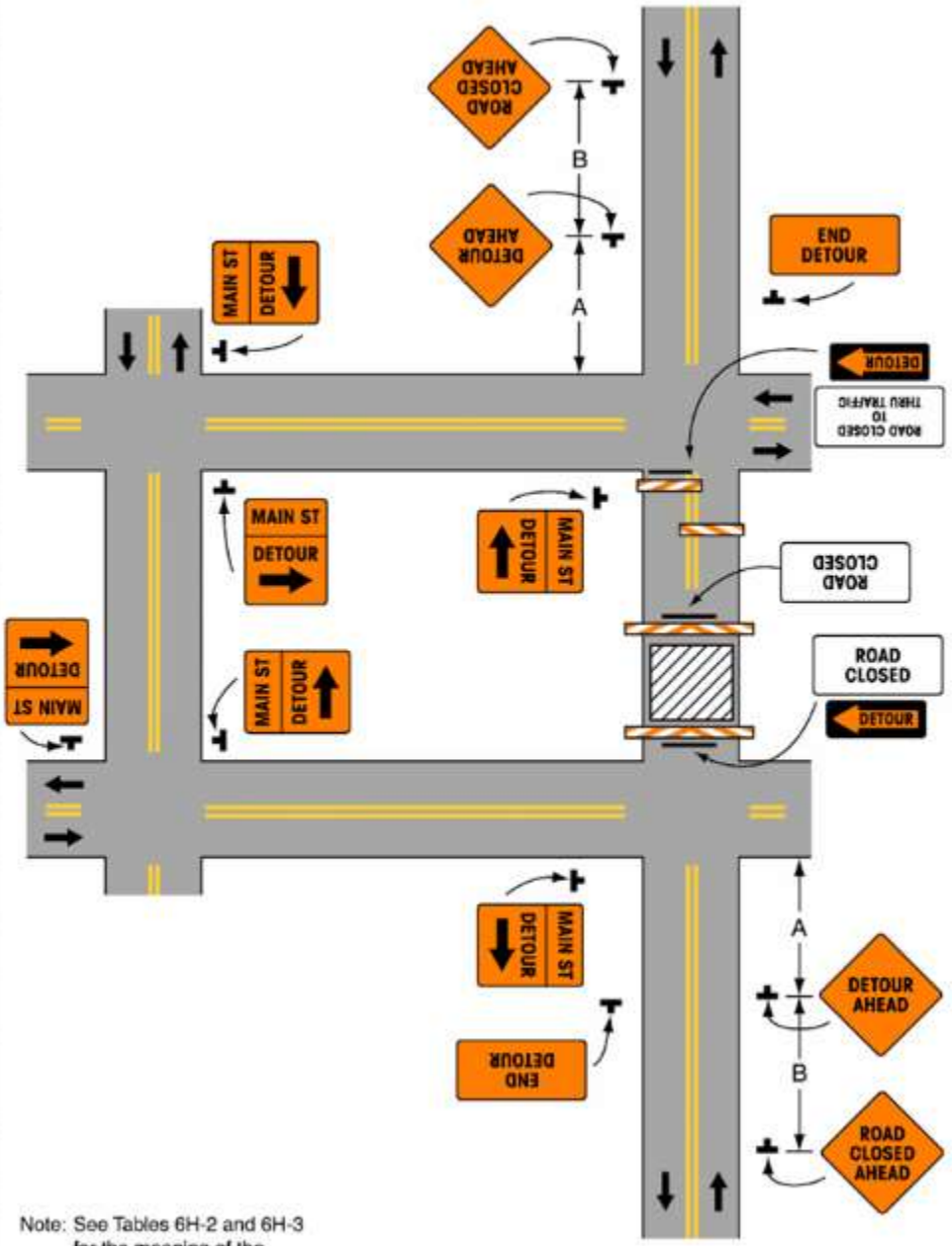
Street Closure

- Enough advance warning?
- Don't surprise drivers

TA-20 Detour for Closed Street

- …for streets without posted route numbers.
- Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
- A Detour sign with an advance arrow may be used in advance of a turn.

Figure 6H-20. Detour for Closed Street (TA-20)



Note: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.

Typical Application 20

Street Closure and Detour

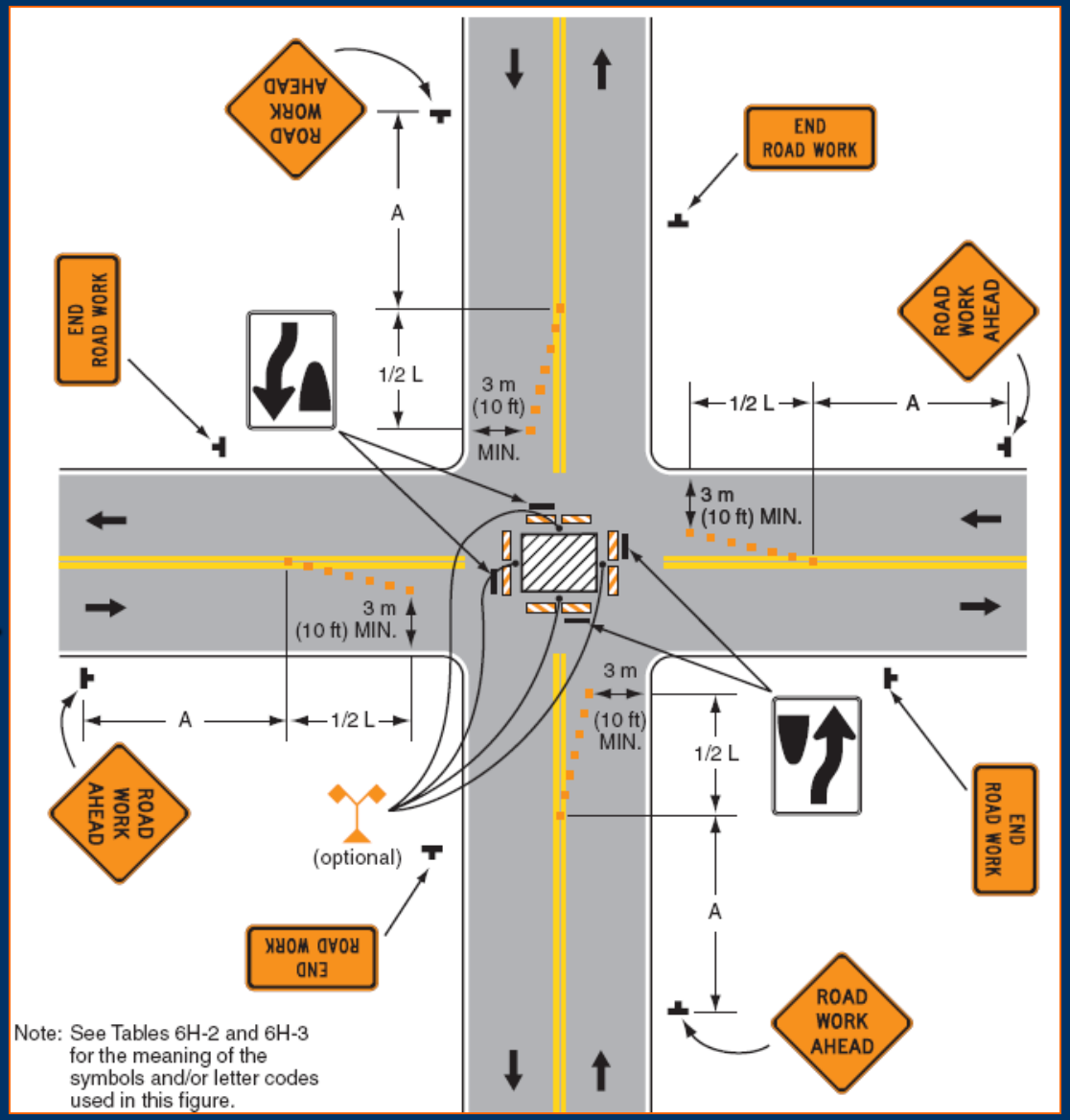
- Construction traffic entry and exit

Partial Street Closure

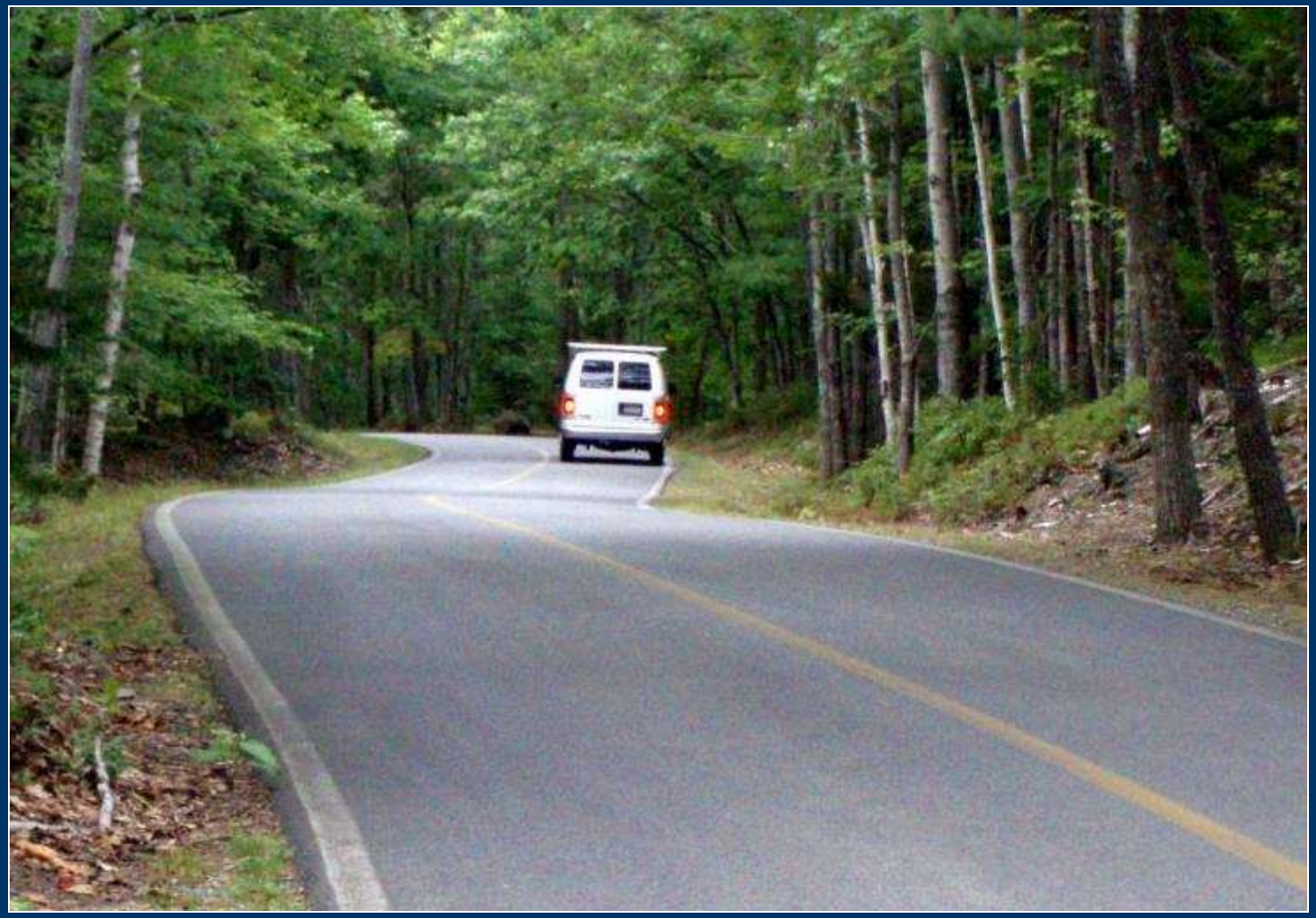
- Close to through traffic
- Allows residents access

Closure at Center of Intersection (TA-26)

- Lanes should be a minimum of 10’ wide.
- Left turns may be prohibited.
- Channelizing devices may be eliminated for short duration operations if traffic volume is low and high intensity lights are used.



Speaking of lane width…



Overnight traffic control

- Night inspection
- **Navigate**

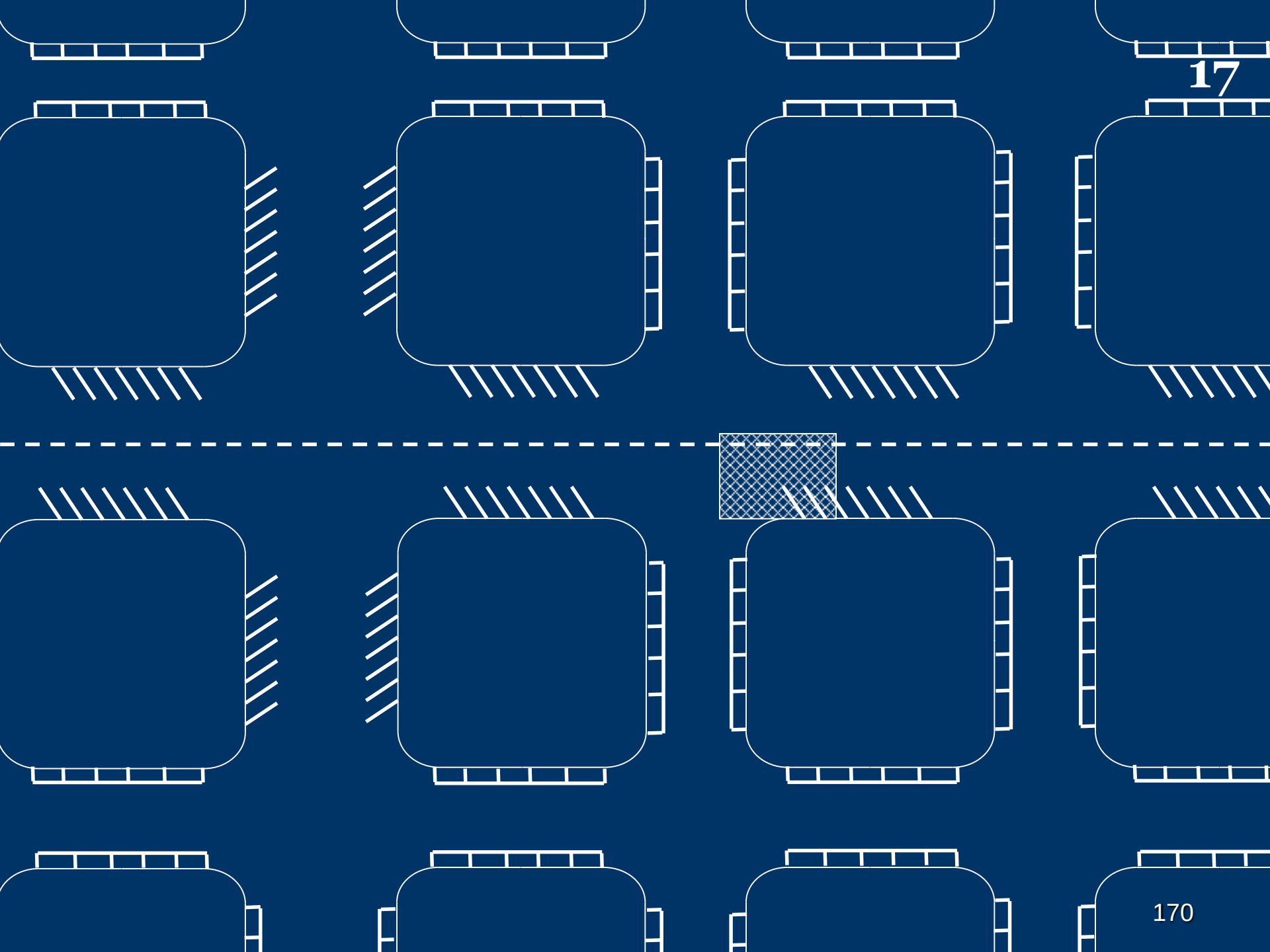
Nighttime Hazard???

Inspect, maintain, document

Questions? Comments?

Small Downtown

- Utility work in a downtown business district
- Will have to leave open trench overnight
- PLAN
  - Work plan
  - Layout
    - Traffic flows
    - Traffic Control Devices


17

Notes for Figure 6H-27—Typical Application 27
Closure at the Side of an Intersection

Guidance:

1. *The situation depicted can be simplified by closing one or more of the intersection approaches. If this cannot be done, and/or when capacity is a problem, through vehicular traffic should be directed to other roads or streets.*
2. *Depending on road user conditions, flagger(s) or uniformed law enforcement officer(s) should be used to direct road users within the intersection.*

Standard:

3. **At night, flagger stations shall be illuminated, except in emergencies.**

Option:

4. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
5. For short-duration work operations, the channelizing devices may be eliminated if a vehicle displaying high-intensity rotating, flashing, oscillating, or strobe lights is positioned in the work space.
6. A BE PREPARED TO STOP sign may be added to the sign series.

Guidance:

7. *When used, the BE PREPARED TO STOP sign should be located before the Flagger symbol sign.*
8. *ONE LANE ROAD AHEAD signs should also be used to provide adequate advance warning.*

Support:

9. Turns can be prohibited as required by vehicular traffic conditions. Unless the streets are wide, it might be physically impossible to make certain turns, especially for large vehicles.

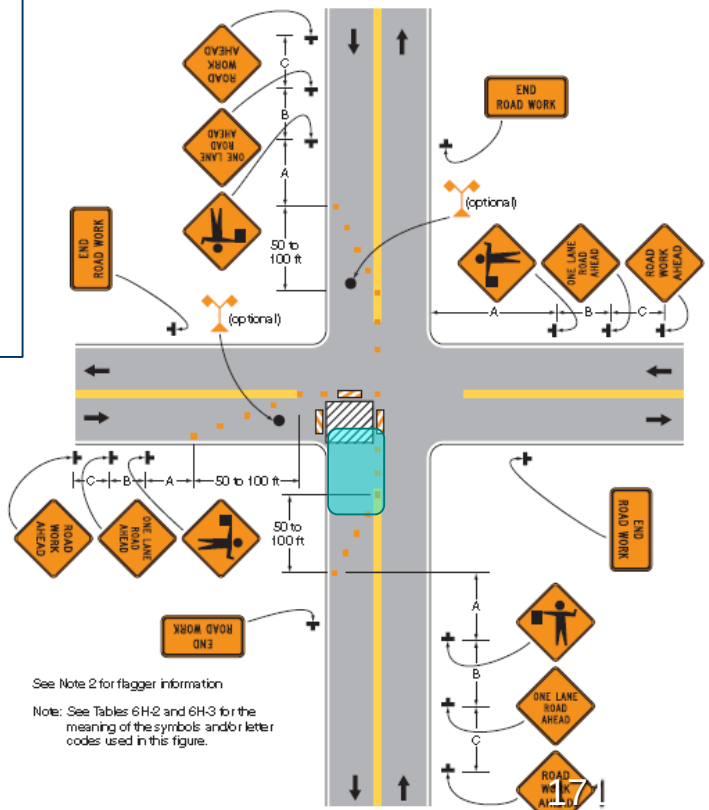
Option:

10. Vehicle hazard warning signals may be used to supplement high-intensity rotating, flashing, oscillating, or strobe lights.

Standard:

11. **Vehicle hazard warning signals shall not be used instead of the vehicle's high-intensity rotating, flashing, oscillating, or strobe lights.**

Figure 6H-27. Closure at the Side of an Intersection (TA-27)



Typical Application 27

If you decide to close one lane for part of the block.

Notes for Figure 6H-19 – Typical Application 19
Detour for One Travel Direction

Guidance:

1. *This plan should be used for streets without posted route numbers.*
2. *On multi-lane streets, Detour signs with an Advance Turn Arrow should be used in advance of a turn.*

Option:

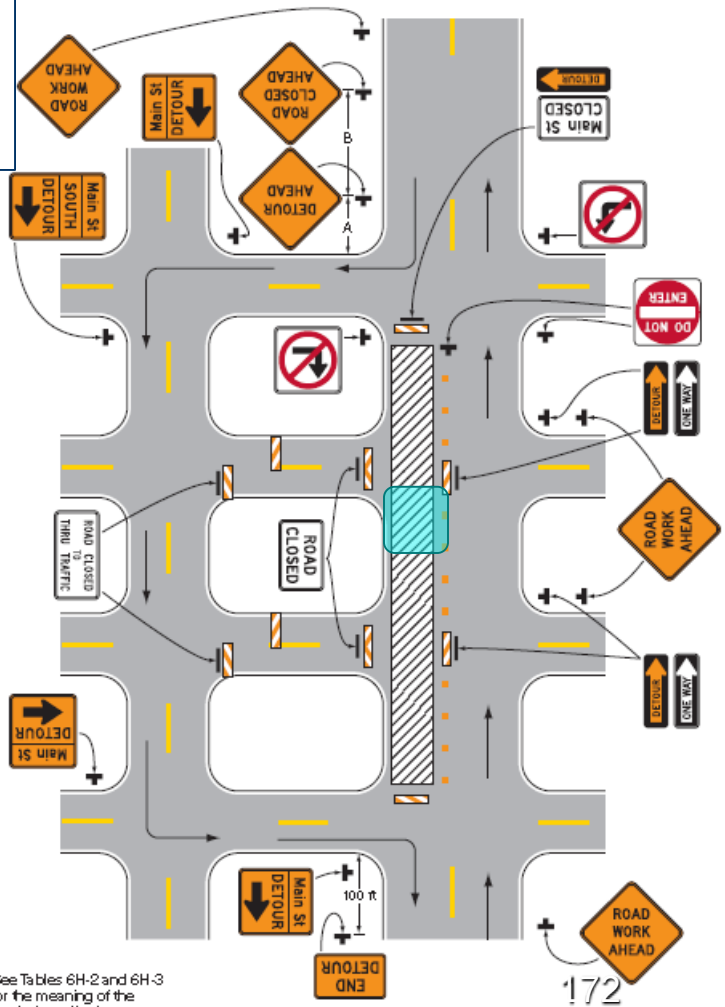
3. The STREET CLOSED legend may be used in place of ROAD CLOSED.
4. Additional DO NOT ENTER signs may be used at intersections with intervening streets.
5. Warning lights may be used on Type 3 Barricades.
6. Detour signs may be located on the far side of intersections.
7. A Street Name sign may be mounted with the Detour sign. The Street Name sign may be either white on green or black on orange.

Standard:

8. **When used, the Street Name sign shall be placed above the Detour sign.**

If you decide to close one lane for the whole block or more.

Figure 6H-19. Detour for One Travel Direction (TA-19)



Note: See Tables 6H-2 and 6H-3 for the meaning of the symbols and/or letter codes used in this figure.

Typical Application 19

Notes for Figure 6H-20 —Typical Application 20
Detour for a Closed Street

Guidance:

1. *This plan should be used for streets without posted route numbers.*
2. *On multi-lane streets, Detour signs with an Advance Turn Arrow should be used in advance of a turn.*

Option:

3. Flashing warning lights and/or flags may be used to call attention to the advance warning signs.
4. Flashing warning lights may be used on Type 3 Barricades.
5. Detour signs may be located on the far side of intersections. A Detour sign with an advance arrow may be used in advance of a turn.
6. A Street Name sign may be mounted with the Detour sign. The Street Name sign may be either white on green or black on orange.

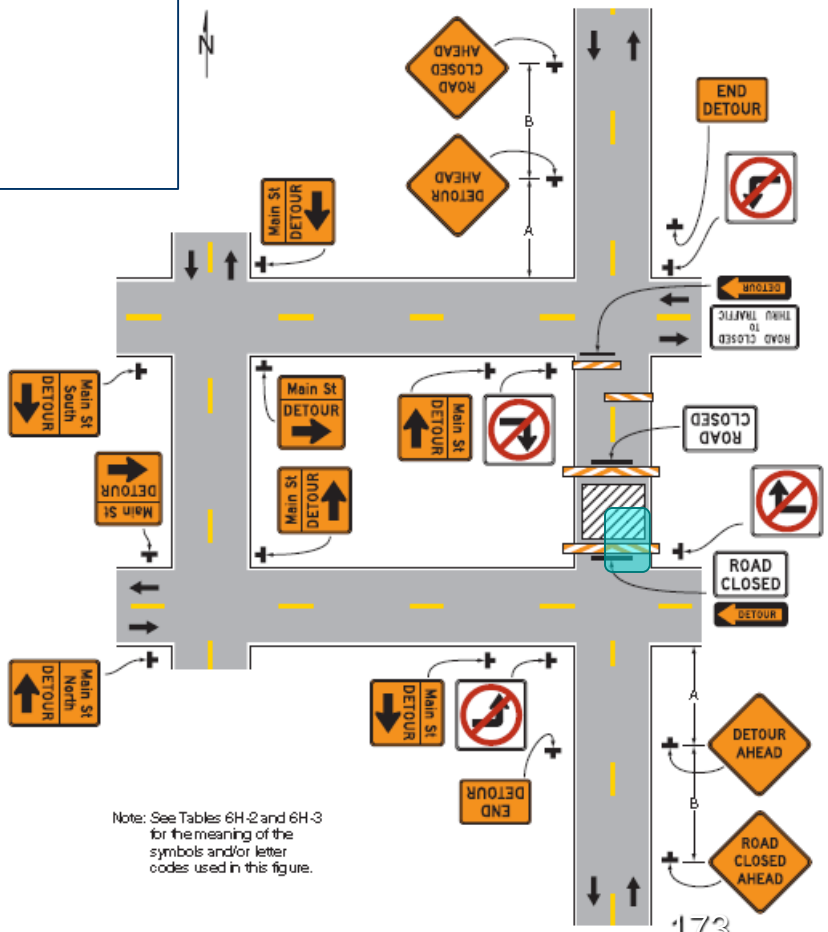
Standard:

7. **When used, the Street Name sign shall be placed above the Detour sign.**

Support:

8. See Figure 6H-9 for the information for detouring a numbered highway.

Figure 6H-20. Detour for a Closed Street (TA-20)



Typical Application 20

If you decide to close both lanes for only one block.

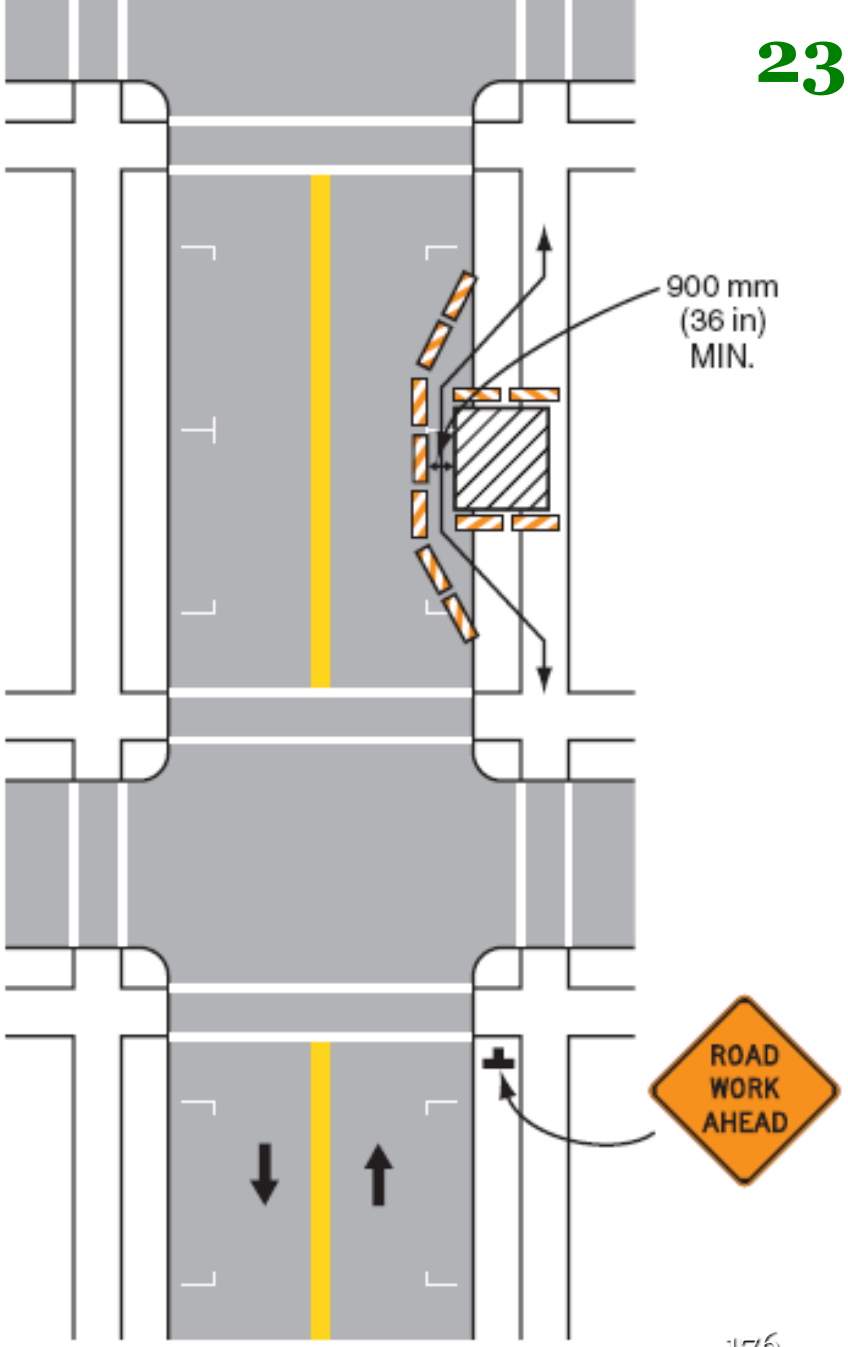
Pedestrians, Bicycles, and ADA

Pedestrians in the Work Zone

- Impact on pedestrians
  - Consider generators
    - Schools, hospitals, shopping, and so on
- Consider existing pedestrian flows
- Protection
  - Vehicles, Work space, Overhead
- Nighttime lighting

Sidewalk Diversion (TA-28)

- When crosswalks or other pedestrian facilities are closed or relocated, temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing facilities.



SIDEWALK DIVERSION

- Pedestrian route blocked by ready mix truck 23
- Pedestrians forced onto busy street
  - Lawsuit waiting to happen

Pedestrian Friendly?

- Separate pedestrians from traffic

Americans with Disabilities Act (ADA)

- Blind
  - Guide through at 6” cane height
- Wheelchairs
  - Surface and transitions
- ADA Considerations
  - ***Consistent with existing accessibility features***
    - http://www.usdoj.gov/crt/ada/adastd94.pdf

ATLANTIC
INN

ADA Considerations for the Blind

- Signs mounted lower than 7' should not extend more than 4" into the walkway

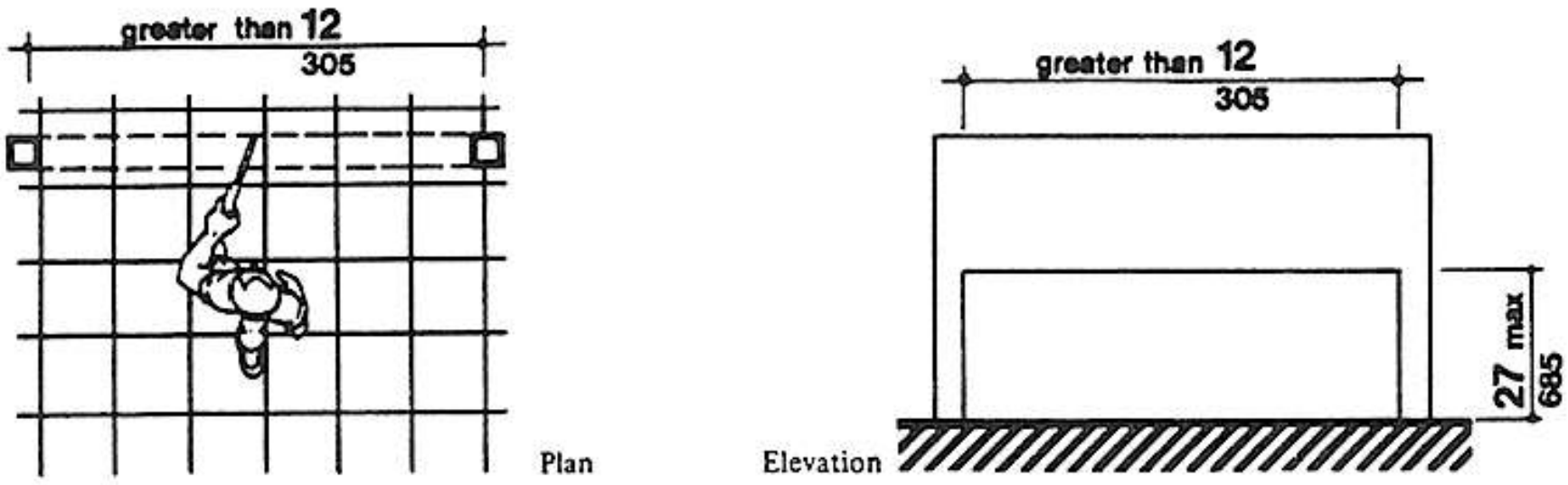


Fig. 8 (c) Free-Standing Overhanging Objects

ADA Considerations for the Blind

- When channelizing pedestrians, provide detectable edging in compliance with MUTCD Section 6F.68.
  - Rail at least 6” high with the bottom no more than 2½” high.

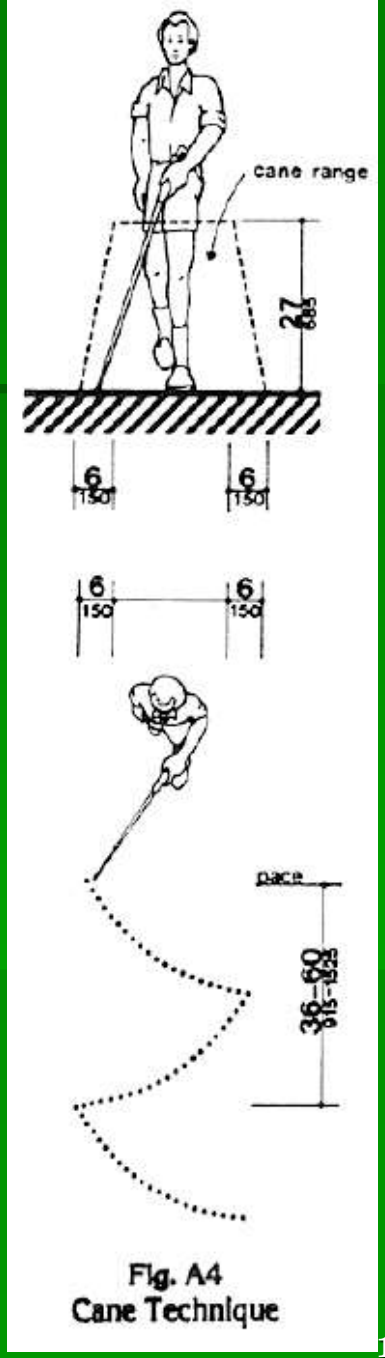


Fig. A4
Cane Technique

Cane-detectable barrier

ADA Considerations for those in Wheelchairs

- A minimum width of walkway should be 60”. If this is not practical then a 60” x 60” passing space should be provided every 200’.

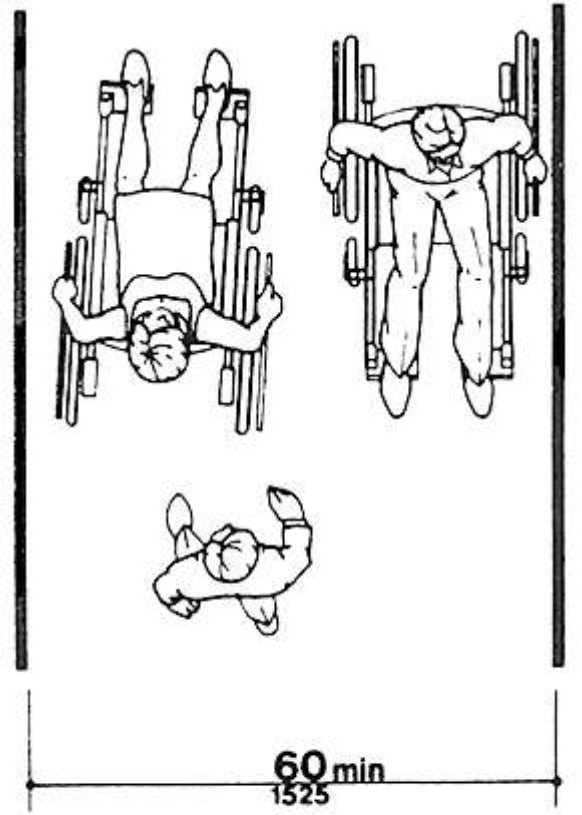


Fig. 2
Minimum Clear Width
for Two Wheelchairs

Get through this in a wheelchair…

ADA Considerations for those in Wheelchairs

- Provide wheelchair ramps as for any other construction

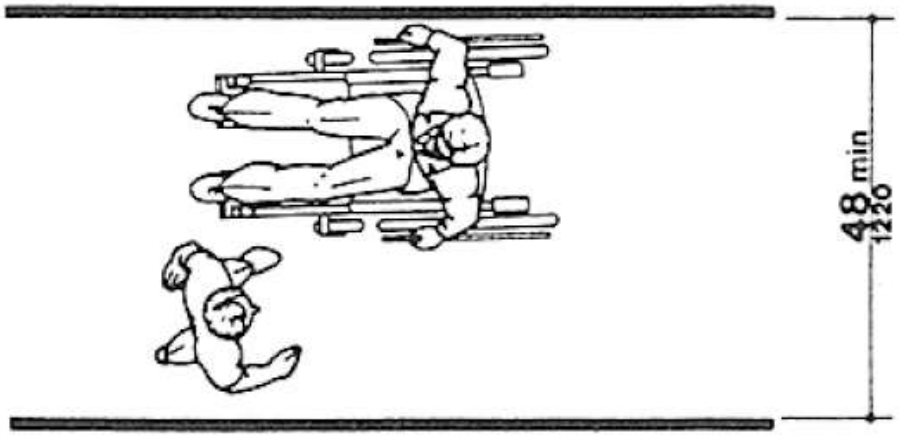


Fig. A1
Minimum Passage Width for One Wheelchair and One Ambulatory Person

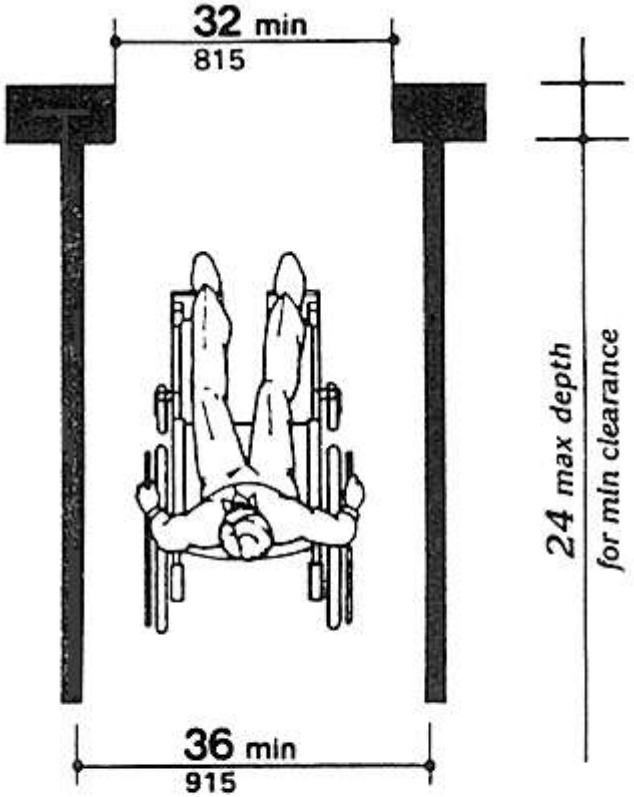


Fig. 1
Minimum Clear Width for Single Wheelchair

Comments? Questions?

Simple solutions

Driver Characteristics

Factors that affect Crash Rates

- Driver's ability
  - Driver inattention
    - Kids, cell phones, and so on…
  - Driver impaired
- Weather
- Driver confusion
  - Worker in the road
  - Poor traffic control
- Aggressive driving

Never assume a driver sees you!

Following are actual statements found on insurance forms where drivers had tried to summarize the details of their accidents:

Coming home I drove into the wrong house and collided with a tree I don't have.

I thought my window was down, but I found out it was up when I put my hand through it.

A truck backed through my windshield into my wife's face.

As I approached the intersection, a sign suddenly appeared in a place where a sign has never appeared before. I was unable to stop in time to avoid the accident.

The guy was all over the road. I had to swerve a number of times before I hit him.

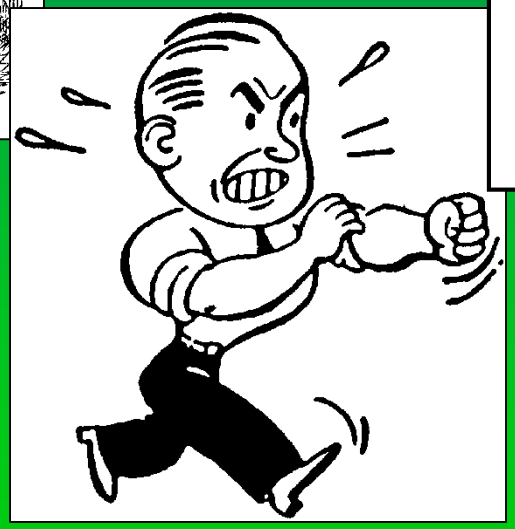
A pedestrian hit me and went under my car.

I collided with a stationary truck coming the other way.

I was sure the old fellow would never make it to the other side of the road when I struck him.

Drivers are…

- Tired, stupid, angry, drunk, late, distracted…



Drivers are…

- Invincible!

- ***How do we deal with them?***

We Train Drivers

- Drivers' Education
- Parents
- Friends
- Law Enforcement
- ***The Road***
  - ***Conditioned responses***
  - ***Familiarity***

Subconscious Training

- Which is the 2-Lane?
  Which is the 4-Lane?

- How can you tell?
- Could your spouse tell?

Controlling Drivers is Difficult

- They want to make their own decisions
- They like to be in control
- They have expectations
- Work zones are more prone to accidents
- Flaggers are in their way!

We react to symbols

California gives driver exams in over 20 languages

How We Drive: Observe, Decide, Take Action

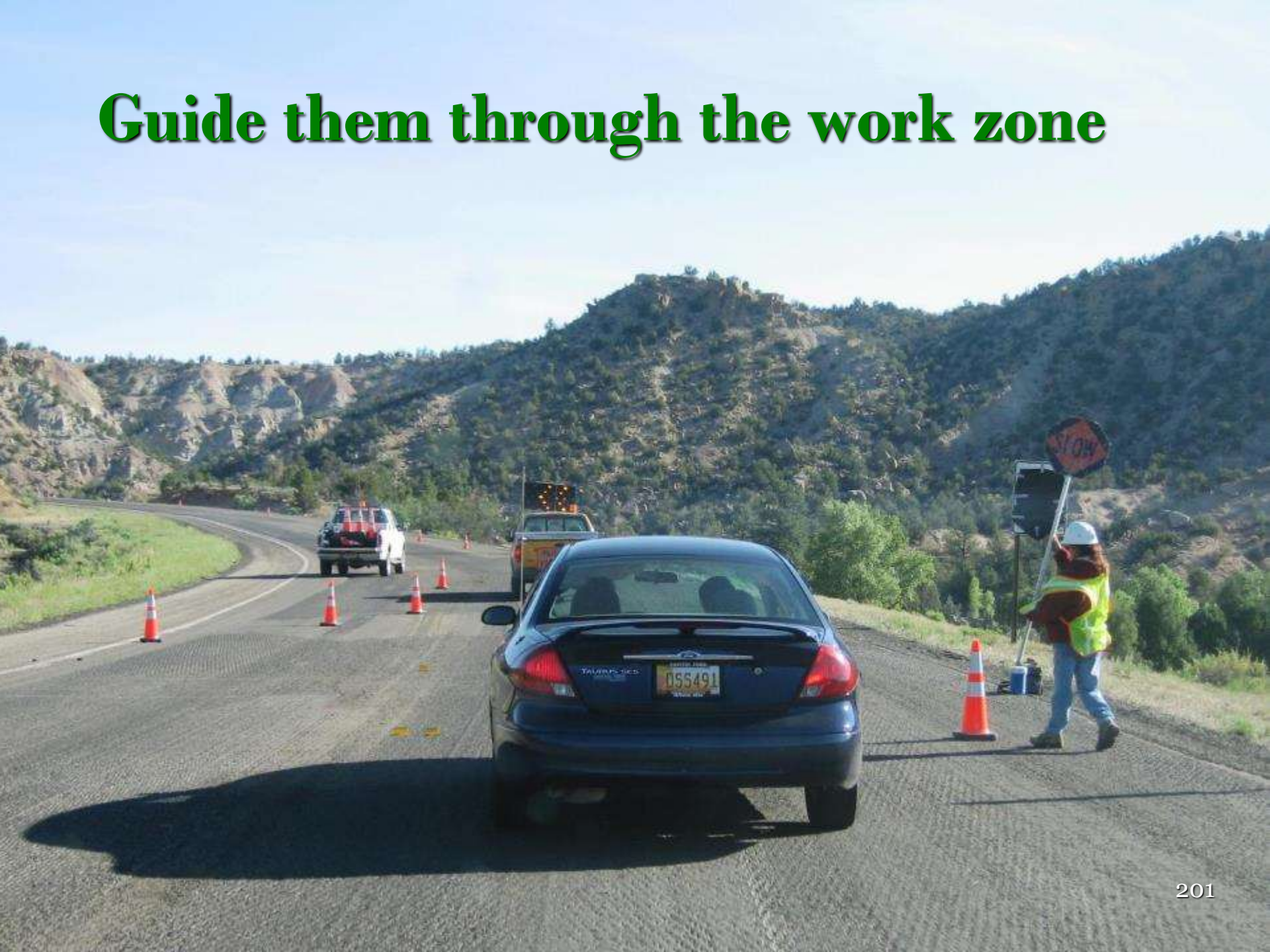
- We **Perceive** 2 or more events per second
- We make 1 to 3 **Decisions** per second
- We take 30 to 120 **Actions** per minute
- We make 1 or more ***Errors*** per minute
- We average 1 vehicle ***Crash*** every 6 years

Errors – Reduce the number of mistakes
Crashes – Reduce their severity

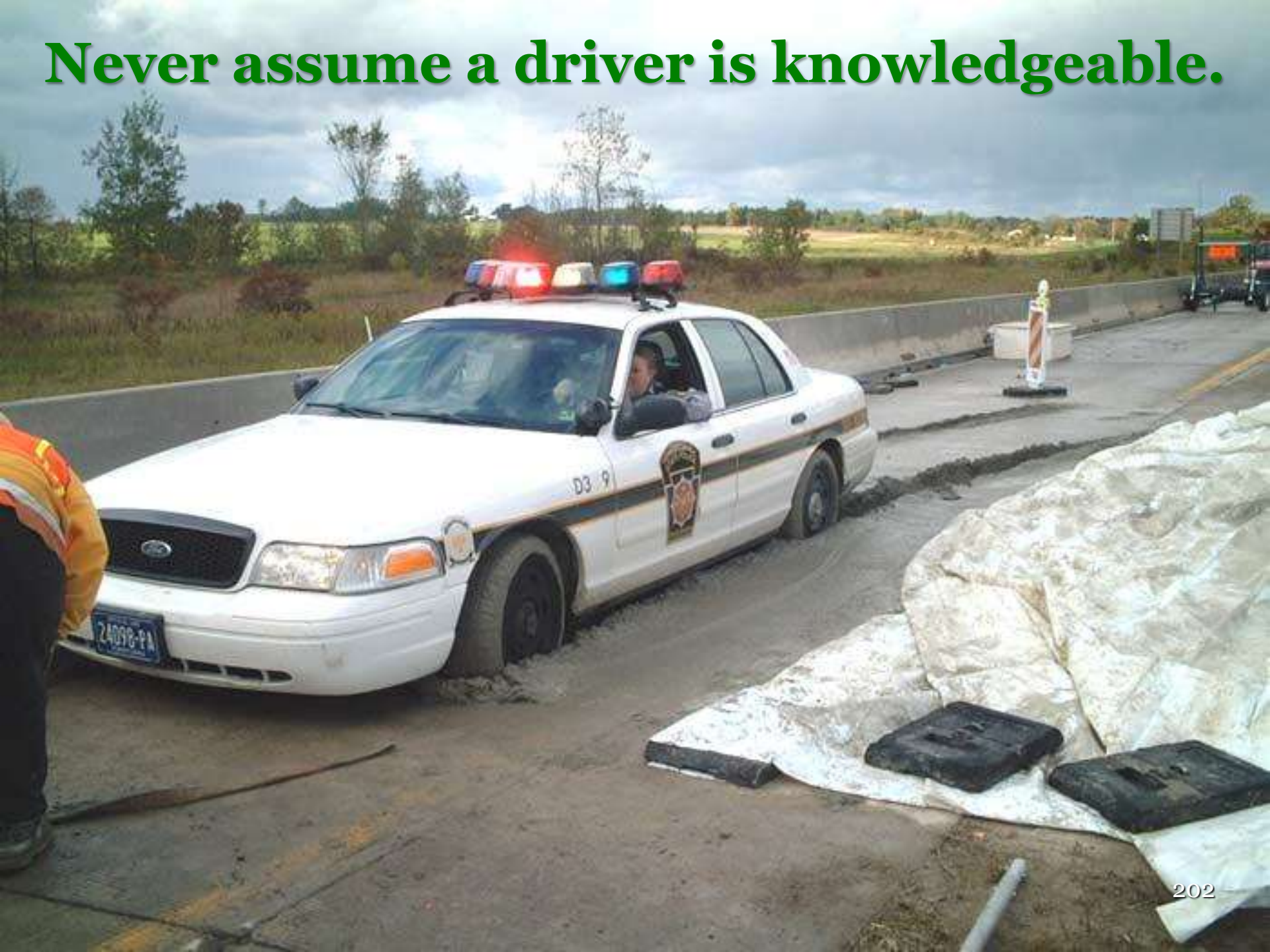
https://youtu.be/Ahg6qcgoay4

Get their attention

Guide them through the work zone



Never assume a driver is knowledgeable.



Drivers don't always think about what they're doing.

Work Zone Traffic Control: *Summary*

- Command RESPECT
  - Uniform spacing
  - Clean work zone
  - Alert flaggers
  - No unnecessary signs
- Develop FAMILIARITY
  - Follow MUTCD
    - National consistency
  - Minimize confusion
    - Similar situations demand similar responses

Work Zone Traffic Control: *Summary*

- ***Everybody's* Safety**
- **Clear and Positive Guidance**
- **Prepare for the Worst**
- **Inspect and Document**

Questions? Comments?