The mission of the West Virginia LTAP Center is to foster a safe and efficient transportation system which enhances the economic development of West Virginia by improving skills and increasing knowledge of the transportation workforce and decision makers.

Presented by:
West Virginia Local Technical Assistance Program

653 B Engineering Sciences Building
PO Box 6103
Morgantown, WV 26506-6103
304-293-3031 ext 2612 or 2629
Fax: 304-293-7109
http://wvltap.wvu.edu
Work Zone Traffic Control

Andrew Morgan, P.E., PTOE
WV Local Technical Assistance Program

Course Objectives

- Recognize the Need for Traffic Control
- Explain the Fundamental Principles
- Identify Practices to Reduce Crashes

Work Zone Crashes

- Average of 1,011 Fatalities/Yr between 2003 - 2007 (Source: National WZ Safety Info, Clearinghouse)
- Average of 6 Fatalities/Yr in WV during same time
- Trend increasing
- Financial loss of $3 billion/yr
Work Zone Crashes Cont’d .......

- Worker Fatalities at road construction sites ('03-'07)
  638 609

- Occupational injury rates for road construction workers:
  - 8 X all workers
  - 3 X other construction workers  (Source: NHI/PWRC)

Some Things to Consider

- Traffic will keep coming
  - If path is blocked, it will go around
  - Make sure you channel and direct it

- Never overestimate the intelligence or competence of drivers

Some Things to Consider

- Remember the four D’s of drivers: Drowsy, Drunk, Distracted, Dumb.

- “Slow Down, Move Over” works only if people see you. You must protect yourself.

Some Things to Consider

- Appropriate Temporary Traffic Control Procedures Cannot Be Ignored, Even for Short Duration Jobs
Some Things to Consider

• Does the public know the difference?

• Any interruption of normal traffic flow violates driver’s expectancy

Purpose of Traffic Control

• Warn Motorists/Pedestrians of Hazards
• Advise Drivers of Proper Travel Path
• Delineate Areas Closed to Traffic
• Separate and Protect Motorists, Pedestrians, and Workers

Uniformity of Operations Through Standardization Promotes:

• Recognition and Understanding
• Consistent Interpretation
• More Rapid Driver Response
• Road User Respect
• Pedestrian Mobility and Access

Traffic Control Devices for Work Zones Must Be Uniform in Their:

• Design (what they look like)
• Application (when we use them)
• Location (where we use them)
Standards

- MUTCD - Part 6
  http://mutcd.fhwa.dot.gov

Principles of Traffic Control Devices

- Fulfill a Need
- Command Attention
- Convey Clear, Simple Meaning
- Command Respect
- Give Adequate Time for Proper Response

Criteria for Device Selection

- Duration of Work
- Location of Work
- Roadway Type

Standards

- WVDOH - www.wvdot.org
- Applies to ANY & ALL work in WV's public roads
Types of Traffic Control Devices

- Signs
- Channelizing Devices
  - Cones
  - Tubular Markers
  - Barricades
  - Drums
  - Vertical Panels
  - Barriers

- Pavement Markings
- Lights

Positioning of Signs

- Where Easily Seen
- Adequate Time to Respond
- Generally on the Right-hand Side
- On Both Sides if Necessary

Parts of Work Zone

- Advance Warning Area
- Transition Area
- Activity Area
- Termination Area

Parts of Work Zone
Advance Warning Area

- Get the driver’s attention (ROAD WORK AHEAD)
- Tell them what lies ahead (RIGHT LANE CLOSED)
- Tell them what they should do (MERGE LEFT)

Without Advance Warning, the Work Zone Will Surprise Users

- NO WARNING means . . .
- SURPRISE which causes . . .
- ERRATIC MANEUVERS, and . . .
- CRASHES

Tapers

- Merging Taper
- Shifting Taper
- Shoulder Taper
- Two-Way Traffic Taper
- Downstream Taper
Length of Tapers

<table>
<thead>
<tr>
<th>Type of Taper</th>
<th>Taper Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merging Taper</td>
<td>L (Min)</td>
</tr>
<tr>
<td>Shifting Taper</td>
<td>1/2L (Min)</td>
</tr>
<tr>
<td>Shoulder Taper</td>
<td>1/3L (Min)</td>
</tr>
<tr>
<td>Two-Way Traffic Taper</td>
<td>100 ft. (Max)</td>
</tr>
<tr>
<td>Downstream Taper</td>
<td>100 ft. (Min)</td>
</tr>
</tbody>
</table>

Formulas for Length (L)

<table>
<thead>
<tr>
<th>Speed Limit</th>
<th>L = ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 MPH or less</td>
<td>L = WxS^2/60</td>
</tr>
<tr>
<td>45 MPH or greater</td>
<td>L = WxS</td>
</tr>
</tbody>
</table>

W = width of offset (lane width or lane shift) in feet
S = posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph

Installation and Removal Sequence
- Install in Direction Traffic Moves
- Remove in Reverse Order of Installation

Work Zones for Maintenance Operations Video
High-Visibility Clothing for Flaggers

- For BOTH daytime and nighttime activity:
  - flaggers shall wear safety apparel meeting the requirements of ANSI 107-1999 standard for Class 2 risk exposure
  - Apparel background material shall be either fluorescent orange or fluorescent yellow-green.
  - Retro-reflective material shall be either orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors and shall be visible at a minimum distance of 1,000 feet.
High-Visibility Clothing for Flaggers

Qualifications for Flaggers

- Able to receive and communicate instructions
- Able to maneuver quickly to avoid danger
- Able to control signaling devices to provide clear, positive guidance
- Understand and apply safe traffic control practices under emergency situations
- Able to recognize dangerous traffic situations and warn workers in time to avoid injury

Hills

When flagging near a hill, you should take a position in advance of the hill. Make sure you are visible to approaching traffic. Never take a position over the crest of a hill.

Curves

When flagging near curves, always make sure you are visible to approaching traffic. Your flagging station should be well in advance of the curve. Never take a position around a sharp curve.

Communication between flaggers is critical under these conditions. The best way to maintain communications is two-way radios, but relay flaggers, a pilot car, or the flag-carrying method could also be used.
Flagging in the Work Zone video
Work Zone Inspection Elements

- Advance Preparation
- Field Inspection
- Drive-Through Inspection
- Documentation
- Maintenance
Standard

"The needs and control of all road users (motorists, bicyclists and pedestrians within the highway, including persons with disabilities) through the temporary traffic control zone shall be an essential part of highway construction, utility work, maintenance operations and the management of traffic incidents." — WV WZ Manual

Consider the Needs of All Pedestrians

- The Americans with Disabilities Act (ADA) states that reasonable provisions must be made to accommodate all pedestrians, including the disabled.

Planning for Pedestrians

- Do not lead them into conflicts with vehicles, equipment and operations.
- Do not lead them into conflicts with vehicles moving through or around the work site.
- Provide a safe, convenient path with the most desirable characteristics of the existing walkway.
Pedestrian Barricades

- If used, barricades at the alternate circulation path should be continuously detectable, stable and rigid.

- Caution tape does not provide an adequate barricade and cannot be used to delineate the alternate circulation path.
Key to Effective WZTC is to PLAN in Advance

- Preview the site in advance.
- Layout the proper traffic control plan.
- Analyze the specific field conditions.
- Navigate the plan to assure its effectiveness for all users.

The ABC's of Temporary Traffic Control

- Advance warning is necessary
- Be visible and alert at all times
- Control the work site with proper traffic control devices

Contact for Further Reference

West Virginia Local Technical Assistance Program
http://wvltap.wvu.edu

Andrew Morgan, P.E., PTOE
Program Coordinator
PO Box 6103
Morgantown, WV 26506

304-283-3031 x 2629
Andrew.Morgan@mail.wvu.edu

Enhancing Transportation in Your Community
CHAPTER A. GENERAL

Section A.01 General

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through the temporary traffic control zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support:

When the normal function of the roadway is suspended, temporary traffic control planning provides for continuity of the movement of motor vehicle, bicycle, and pedestrian traffic (including accessible passage); transit operations; and access (and accessibility) to property and utilities.

The primary function of temporary traffic control is to provide for the safe and efficient movement of road users through or around temporary traffic control zones while reasonably protecting workers, responders to traffic incidents, and equipment.

Of equal importance to the public traveling through the temporary traffic control zone is the safety of workers performing the many varied tasks within the workspace. Temporary traffic control zones present constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the workers and incident management responders on or near the roadway (see Section D.03). At the same time, the temporary traffic control zone provides for the efficient completion of whatever activity interrupted the normal use of the roadway.

Consideration for road user safety, worker and responder safety, and the efficiency of road user flow is an integral element of every temporary traffic control zone, from planning through completion. A concurrent objective of the temporary traffic control is the efficient construction and maintenance of the highway and the efficient resolution of traffic incidents.

No one set of temporary traffic control devices can satisfy all conditions for a given project or incident. At the same time, defining details that would be adequate to cover all applications is not practical. Instead, this manual displays several diagrams that depict common applications of temporary traffic control devices. The temporary traffic control selected for each situation depends on type of highway, road user conditions, duration of operation, physical constraints, and the nearness of the work space or incident management activity to road users.

Improved road user performance might be realized through a well-prepared public relations effort that covers the nature of the work, the time and duration of its execution, the anticipated effects upon road users, and possible alternate routes and modes of travel. Such programs have been found to result in a significant reduction in the number of road users traveling through the temporary traffic control zone, which reduces the possible number of conflicts.
Standard:

Temporary traffic control plans and devices shall be the responsibility of the authority of a public body or official having jurisdiction for guiding road users. There shall be adequate statutory authority for the implementation and enforcement of needed road user regulations, parking controls, speed zoning, and the management of traffic incidents. Such statutes shall provide sufficient flexibility in the application of temporary traffic control to meet the needs of changing conditions in the temporary traffic control zone.

Support:

Temporary facilities, including safe pedestrian routes around work sites, are also covered by the accessibility requirements of the Americans with Disabilities Act of 1990 (ADA) (Public Law 101-366, 104 Stat. 327, July 26, 1990. 42 USC 12101-12213 (as amended).

Guidance:

The temporary traffic control plan should start in the planning phase and continue through the design, construction, and restoration phases. The temporary traffic control plans and devices should follow the principles set forth in this manual. The management of traffic incidents should follow the principles set forth in Chapter I.

Option:

Temporary traffic control plans may deviate from the cases in this manual to allow for conditions and requirements of a particular site or jurisdiction.

Support:

The criteria of this manual apply to both rural and urban areas. A rural highway is normally characterized by lower volumes, higher speeds, fewer turning conflicts, and less conflict with pedestrians. An urban street is typically characterized by relatively low speeds, wide ranges of road user volumes, narrower roadway lanes, frequent intersections and driveways, significant pedestrian activity, and more businesses and houses.
USE OF HAND SIGNALING DEVICES BY FLAGGER.

FIGURE 4
PORTABLE AND TEMPORARY MOUNTING

MOUNTING ON TYPE III BARRICADES

LOCATION OF WARNING SIGN

LOCATION OF REGULATORY AND GUIDE SIGNS (SEE NOTES 1 AND 2)

FIXED SUPPORTS

TYPE B LIGHT (OPTIONAL) LIGHT (OPTIONAL)

ROADSIDE SIGN RURAL DISTRICT

HEIGHT AND LATERAL LOCATION OF SIGNS - TYPICAL INSTALLATIONS

ROADSIDE SIGN URBAN DISTRICT

GENERAL NOTES:

1. SIGNS MOUNTED ON BARRICADES OR PORTABLE SUPPORTS MAY BE AT LOWER HEIGHTS BUT THE BOTTOM OF THE SIGN SHALL NOT BE LESS THAN 12" ABOVE THE PAVEMENT. WHEN PARKING IS PERMITTED WITHIN 200' OF THE SIGN, ALL SIGNS SHALL BE MOUNTED AT A MINIMUM OF 7 FEET.

2. SIGNS MOUNTED ON TYPE III BARRICADES SHOULD NOT COVER MORE THAN 50 PERCENT OF THE TOP TWO RAILS OR 33 PERCENT OF THE TOTAL AREA OF THE THREE RAILS.

3. ALL SUPPORTS FOR SIGNING SHALL BE CRAWFORD TYPE: TWO POUND U-CHANNEL, THREE POUND U-CHANNEL OR 4" X 4" WOOD POSTS MAY BE USED.

4. IF USED TYPE B LIGHTS SHALL BE MOUNTED IN SUCH A MANNER THAT NO PART OF THE LAMP ASSEMBLY OR BATTERY BOX WILL COVER THE SIGN FACE.

THE WEST VIRGINIA DIVISION OF HIGHWAYS
SIGN MOUNTING FOR CONSTRUCTION AND MAINTENANCE OPERATIONS

FIGURE 9 - DETAIL "B"
TYPICAL APPLICATIONS
- Landscaping work
- Utility operations
- Fencing contracts and maintenance
- Cleaning culverts

GENERAL NOTES
1. If the work operation requires that two or more work vehicles cross the 15 ft. clear zone in any one hour, traffic control will be in conformance with Case A3.
2. No special signing is required.

CASE A1
- Two-lane, two-way traffic
- Where, at all times, all vehicles, equipment, workers and their activities are more than 15 ft. from the edge of pavement.
SUGGESTED ADVANCE WARNING SIGN SPACING

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (IN FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN (LOW SPEED)</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>URBAN (HIGH SPEED)</td>
<td>350</td>
</tr>
<tr>
<td>RURAL</td>
<td>500</td>
</tr>
<tr>
<td>EXPRESSWAY/FREWAY</td>
<td>1,000</td>
</tr>
</tbody>
</table>

*Speed category to be determined by WV DOH

GENERAL NOTES

1. Overnight operations illustrated and if such use drums, for daylight operations only, use cones or drums as directed by the Engineer.

2. Any unattended obstacle or excavation in the work area overnight shall be protected by Type 1 or Type II barricades.

3. If the work operation requires that four or more work vehicles enter the through traffic lanes in a one-hour period a flagger shall be provided and the flagger sign shall be used (at 500 ft. in advance).

4. All vehicles, equipment, workers and their activities are restricted at all times to one side of the pavement unless otherwise authorized by the Engineer.

5. Flashing warning lights and/or flags may be used to call attention to the above warning signs, as needed on the plans, and/or as directed by the Engineer.

* Work vehicle of used shall have dual flashers and flashing amber dome light operating.

TYPICAL APPLICATIONS

- Culvert extensions.
- Side slope changes.
-Guardrail installation and maintenance.
- Delineator installation and maintenance.
- Landscaping operations.
-Cleaning ditches and drainage structures.
- Shoulder repair.
- Adjacent work on side roads/bridges
- Signing operations.

CASE A3

Two-lane, two-way traffic.
Day or night operations (stationary).

Where at any time, any vehicle equipment, workers or their activities will encroach in the area between 3 ft. and 15 ft. from the edge of the pavement.

SUGGESTED ADVANCE WARNING SIGN SPACING

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (IN FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN (LOW SPEED)</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>URBAN (HIGH SPEED)</td>
<td>350</td>
</tr>
<tr>
<td>RURAL</td>
<td>500</td>
</tr>
<tr>
<td>EXPRESSWAY/FREWAY</td>
<td>1,000</td>
</tr>
</tbody>
</table>

*Speed category to be determined by WV DOH

GENERAL NOTES

1. Overnight operations illustrated and if such use drums, for daylight operations only, use cones or drums as directed by the Engineer.

2. Any unattended obstacle or excavation in the work area overnight shall be protected by Type 1 or Type II barricades.

3. If the work operation requires that four or more work vehicles enter the through traffic lanes in a one-hour period a flagger shall be provided and the flagger sign shall be used (at 500 ft. in advance).

4. All vehicles, equipment, workers and their activities are restricted at all times to one side of the pavement unless otherwise authorized by the Engineer.

5. Flashing warning lights and/or flags may be used to call attention to the above warning signs, as needed on the plans, and/or as directed by the Engineer.

* Work vehicle of used shall have dual flashers and flashing amber dome light operating.

TYPICAL APPLICATIONS

- Culvert extensions.
- Side slope changes.
- Guardrail installation and maintenance.
- Delineator installation and maintenance.
- Landscaping operations.
- Cleaning ditches and drainage structures.
- Shoulder repair.
- Adjacent work on side roads/bridges
- Signing operations.

CASE A3

Two-lane, two-way traffic.
Day or night operations (stationary).

Where at any time, any vehicle equipment, workers or their activities will encroach in the area between 3 ft. and 15 ft. from the edge of the pavement.

SUGGESTED ADVANCE WARNING SIGN SPACING

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (IN FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN (LOW SPEED)</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>URBAN (HIGH SPEED)</td>
<td>350</td>
</tr>
<tr>
<td>RURAL</td>
<td>500</td>
</tr>
<tr>
<td>EXPRESSWAY/FREWAY</td>
<td>1,000</td>
</tr>
</tbody>
</table>

*Speed category to be determined by WV DOH

GENERAL NOTES

1. Overnight operations illustrated and if such use drums, for daylight operations only, use cones or drums as directed by the Engineer.

2. Any unattended obstacle or excavation in the work area overnight shall be protected by Type 1 or Type II barricades.

3. If the work operation requires that four or more work vehicles enter the through traffic lanes in a one-hour period a flagger shall be provided and the flagger sign shall be used (at 500 ft. in advance).

4. All vehicles, equipment, workers and their activities are restricted at all times to one side of the pavement unless otherwise authorized by the Engineer.

5. Flashing warning lights and/or flags may be used to call attention to the above warning signs, as needed on the plans, and/or as directed by the Engineer.

* Work vehicle of used shall have dual flashers and flashing amber dome light operating.

TYPICAL APPLICATIONS

- Culvert extensions.
- Side slope changes.
- Guardrail installation and maintenance.
- Delineator installation and maintenance.
- Landscaping operations.
- Cleaning ditches and drainage structures.
- Shoulder repair.
- Adjacent work on side roads/bridges
- Signing operations.

CASE A3

Two-lane, two-way traffic.
Day or night operations (stationary).

Where at any time, any vehicle equipment, workers or their activities will encroach in the area between 3 ft. and 15 ft. from the edge of the pavement.
A. For any operation that encroaches upon the roadway for a period of less than 30 minutes, with two-way traffic possible.

B. For any operation that encroaches upon the roadway for a period of more than 30 minutes, with two-way traffic possible, the operation shall not exceed 8 hours unless traffic volume is less than 500 ADT.

GENERAL NOTES

1. If the work operation requires that four or more work vehicles enter the through traffic lanes in a one hour period, a flagger shall be provided and the flagger sign shall be used or substituted for the second advance sign.

2. Any unattended obstacle or excavation in the work area shall be protected by Type I or Type I barricades and if nighttime, with flashing lights (Type A).

3. All vehicles, equipment, workers and their activities are restricted at all times to one side of the pavement unless otherwise authorized by the Engineer.

4. If it becomes necessary to operate one lane traffic, Case A8 or Case A7 shall apply as appropriate.

WORK VEHICLE SHALL HAVE DUAL FLASHERS AND FLASHING AMBER DOME LIGHT OPERATING.

SYMBOLS

- Work Area
- Sign
- Sign on portable or permanent support
- Cones

TYPICAL APPLICATIONS

- Signing operations
- Maintenance operations
- Guardrail maintenance
- Signal and lighting maintenance
- Utility operations

SUGGESTED ADVANCE WARNING SIGN SPACING

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (IN FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>URBAN HIGH SPEED</td>
<td>250</td>
</tr>
<tr>
<td>URBAN LOW SPEED</td>
<td>350</td>
</tr>
<tr>
<td>RURAL</td>
<td>300</td>
</tr>
<tr>
<td>EXPRESSWAY/FREeway</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Speed category to be determined by MV DOH.

CASE A4

Two-lane, two-way traffic, day or night operations. For less than 8 hours, or for less than 500 ADT.

Where at any time, any vehicle, equipment, workers or their activities will encroach upon the roadway, maintaining two-way traffic.
GENERAL NOTES

1. Conditions represented are for a planned closure not exceeding 30 minutes during the daytime.

2. The flaggers shall be in sight of each other or in direct communication at all times.

3. Flashing warning lights and/or flags may be used to call attention to the above warning signs, as needed on the plans, and/or as directed by the engineer.

SUGGESTED ADVANCE WARNING SIGN SPACING

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (IN FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN (LOW SPEED)</td>
<td>A</td>
</tr>
<tr>
<td>URBAN (HIGH SPEED)</td>
<td>350</td>
</tr>
<tr>
<td>RURAL</td>
<td>1500</td>
</tr>
<tr>
<td>EXPRESSWAY/INTERSTATE</td>
<td>1000</td>
</tr>
</tbody>
</table>

*Speed category to be determined by WVDOT.

SYMBOLS

- Work Area
- Sign on portable or permanent support.
- Flagger with paddle.

TYPICAL APPLICATIONS

- Short term closing
- Short term utility crossing for two or three lane roadways
- Haul roads

CASE A5

Two-lane, two-way traffic.
Short term operation.
Daytime only.
A. FOR ANY OPERATION THAT ENCROACHES IN THE AREA BETWEEN THE CENTER LINE AND A LINE 2 FT. OUTSIDE THE EDGE OF THE PAVEMENT FOR A PERIOD OF LESS THAN 15 MINUTES.

B. FOR ANY OPERATION THAT ENCROACHES IN THE AREA BETWEEN THE CENTER LINE AND A LINE 2 FT. OUTSIDE THE EDGE OF THE PAVEMENT FOR A PERIOD IN EXCESS OF 15 MINUTES BUT LESS THAN 8 HOURS.

C. FOR ANY OPERATION THAT IS MORE THAN 2 FT. OUTSIDE THE EDGE OF THE PAVEMENT FOR A PERIOD OF LESS THAN 80 MINUTES.

SYMBOLS

- WORK AREA
- SIGN
- SIGN ON PORTABLE OR PERMANENT SUPPORT
- FLAGGER WITH PADDEL
- CONES

TYPICAL APPLICATIONS
- PATCHING PAVEMENT
- FIELD SURVEY
- CLEANING UP SPILLS ON PAVEMENT
- CROSSWALK PAINTING

GENERAL NOTES

1. CONSTRUCTION OPERATIONS SHALL BE LIMITED TO ONE TRAFFIC LANE, LEAVING THE OPPOSITE LANE OPEN TO TRAFFIC. AT LEAST 500 FT. OF BOTH TRAFFIC LANES SHALL BE AVAILABLE FOR TRAFFIC MOVEMENT AT INTERVALS NOT GREATER THAN 1,000 FT. A COMPLETE TRAFFIC CONTROL PLAN MUST BE APPROVED FOR ANY PROJECT EXPECTING TO EXCEED 1,000 FT. IN LENGTH INCLUDING BOTH TAPES AND WORK AREAS.

2. FOR LOW-VOLUME SITUATIONS WITH SHORT WORK ZONES ON STRAIGHT ROADWAYS WHERE THE FLAGGER IS VISIBLE TO ROAD USERS APPROACHING FROM A SINGLE DIRECTION, A SINGLE FLAGGER, POSITIONED TO BE VISIBLE TO ROAD USERS APPROACHING FROM BOTH DIRECTIONS, MAY BE USED.

3. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE ADVANCE WARNING SIGNS.

4. THE FLAGGERS SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES.

5. ALL SIGNS ARE TO BE REMOVED AT COMPLETION OF THE DAYS OPERATIONS.

6. FOR MULTILANE DIVIDED ROADWAYS THE ADVANCE WARNING SIGNS FOR TRAFFIC APPROACHING FROM THE OPPOSITE DIRECTION MAY BE OMITTED IF APPROVED BY THE ENGINEER.

SUGGESTED ADVANCE WARNING SIGN SPACING

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>URBAN LOW SPEED</td>
<td>100</td>
</tr>
<tr>
<td>URBAN HIGH SPEED</td>
<td>150</td>
</tr>
<tr>
<td>RURAL</td>
<td>200</td>
</tr>
<tr>
<td>EXPRESSWAY/FREeway</td>
<td>1,000</td>
</tr>
</tbody>
</table>

CASE A6

TWO-LANE, TWO-WAY TRAFFIC
SHORT-TERM OPERATIONS
DAYTIME ONLY

SPEED CATEGORY TO BE DETERMINED BY MV DDH
A. WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES REQUIRE THE CLOSURE OF ONE MOVING TRAFFIC LANE LESS THAN 200 FEET BEYOND AN INTERSECTION.

CONES AT 20 FT. CTRS. DRUMS, OR TYPE 1 OR TYPE II BARRIADIES AT 50 FT. CTRS.

B. WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES REQUIRE THE CLOSURE OF ONE MOVING TRAFFIC LANE MORE THAN 200 FEET BEYOND AN INTERSECTION.

MIN. 5 DEVICES EQUALLY SPACED

CONES AT 20 FT. CTRS.

TYPE II BARRIADIES AT 50 FT. CTRS.

GENERAL NOTES

1. DRUMS OR TYPE II BARRIADIES SHALL BE USED IN LIEU OF CONES FOR NIGHT OPERATIONS.

2. IF THE WORK OPERATION PERFORMED DOES NOT EXCEED 15 MINUTES, SIGNING SHALL BE IN CONFORMANCE WITH CASE A.

3. WHERE THE WORK AREA EXTENDS THROUGH THE INTERSECTION, BARRIADIES AND/OR ADEQUATE WARNING SIGNS SHALL BE ERECTED ON THE CROSS STREET.

4. IF THE WORK AREA IS IN THE PARKING LANE A ROAD WORK AHEAD SIGN SHALL BE INSTALLED 200 FT. IN ADVANCE OF THE WORK AREA AND THE WORK AREA PROTECTED WITH CONES, DRUMS OR BARRIADIES.

5. CONSTRUCTION OPERATIONS SHALL BE CONFINED TO ONE TRAFFIC LANE, LEAVING THE OPPOSITE LANE OPEN TO TRAFFIC AT LEAST 500 FT. OF BOTH TRAFFIC LANES SHALL BE AVAILABLE FOR TRAFFIC MOVEMENT AT INTERVALS NOT GREATER THAN 1,000 FT.

6. THE FLAGGERS SHALL BE IN SIGHT OF EACH OTHER OR IN DIRECT COMMUNICATION AT ALL TIMES.

7. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS THREE DAYS.

8. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE ABOVE WARNING SIGNS, AS NEEDED ON THE PLANS, AND/OR AS DIRECTED BY THE ENGINEER.

9. ALL VEHICLES, EQUIPMENT, WORKERS (EXCEPT FLAGGERS) AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

CASE B1

TWO-LANE, TWO-WAY TRAFFIC UNDIVIDED, URBAN, LOW-VOLUME, LOW-SPEED DAY OR NIGHT OPERATIONS

WHERE, AT ANY TIME, ANY VEHICLE EQUIPMENT, WORKERS OR THEIR ACTIVITIES ENCROACH ON THE PAVEMENT REQUIRING THE CLOSURE OF ONE TRAFFIC LANE.
GENERAL NOTES

1. 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 pedestrian facility.

2. Where high speeds are anticipated, a temporary traffic barrier and, if necessary, a crash cushion should be used to separate the temporary sidewalks from vehicular traffic.

3. Only the temporary traffic control devices related to pedestrians are shown. Other devices, such as lane closure signage or road narrows signs, may be used to control motor vehicle traffic.

4. For nighttime closures, type C flashing warning lights may be used on barricades that support signs and close sidewalks.

5. Type C steady-burn warning lights may be used on channelizing devices separating the temporary sidewalks from vehicular traffic flow.

6. Signs, such as keep right (left), may be placed along a temporary sidewalk to guide or direct pedestrians.
GENERAL NOTES

1. 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 PEDESTRIAN FACILITY.

2. CURB PARKING SHALL BE PROHIBITED FOR AT LEAST 50 FT. IN ADVANCE OF THE WORKZONE CROSSWALK.

3. PEDESTRIAN TRAFFIC SIGNAL DISPLAYS CONTROLLING CLOSED CROSSWALKS SHOULD BE COVERED OR INACTIVATED.

4. ONLY THE TEMPORARY TRAFFIC CONTROL DEVICES RELATED TO PEDESTRIANS ARE SHOWN. OTHER DEVICES, SUCH AS LANE CLOSURE, DIVING OR ROAD NARROWING SIGNS, MAY BE USED TO CONTROL MOTOR VEHICLE TRAFFIC.

5. FOR NIGHTTIME CLOSURES, TYPE A FLASHING WARNING LIGHTS MAY BE USED ON BARRIERS SUPPORTING SIGNS AND CLOSING SIDEWALKS.

6. TYPE C STEADY-BURN WARNING LIGHTS MAY BE USED ON CHANNELIZING DEVICES SEPARATING THE WORK SPACE FROM VEHICULAR TRAFFIC.
GENERAL NOTES

1. DAYLIGHT OPERATIONS ILLUSTRATED IF NIGHT OPERATIONS,
   INSTALL TYPE 10 FLASHING LIGHT ON FIRST ADVANCE SIGN
   ON FIRST ROAD WORK SIGN. ALSO AT NIGHT, FLAGGER STATIONS
   SHALL BE ILLUMINATED, EXCEPT IN EMERGENCIES.

2. SPEED L-TAPER (IN FEET)
   35
   30
   15
   40
   30
   20
   45
   35
   25
   55
   45

3. IF THE WORK OPERATION DOES NOT EXCEED 15 MINUTES,
   USE CASE A AS FOUR DIRECTIONS.

4. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME
   EXCEEDS THREE DAYS.

5. WHEN NO WORK IS BEING PERFORMED, FLAGGER AHEAD SIGNS
   SHALL BE COVERED OR REMOVED AND ONE LANE ROAD AHEAD
   SIGNS SUBSTITUTED.

6. UNLESS THE STREETS ARE WIDE, IT MAY BE PHYSICALLY IMPOSSIBLE
   TO TURN LEFT ESPECIALLY FOR LARGE VEHICLES. LEFT
   TURNS MAY BE PROHIBITED AS REQUIRED BY GEOMETRIC CONDI-

SUGGESTED ADVANCE WARNING SIGN SPACING

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (ON FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN LOW SPEED</td>
<td>A</td>
</tr>
<tr>
<td>350</td>
<td>300</td>
</tr>
<tr>
<td>250</td>
<td>200</td>
</tr>
<tr>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>1000</td>
<td>1000</td>
</tr>
</tbody>
</table>

*Speed category to be determined by VV AHDH

CASE B4A

TWO-LANE TWO-WAY
TRAFFIC, MIXED
URBAN, LOW-VOLUME, LOW-SPEED
DAY OR NIGHT OPERATIONS
SYMBOLS

WORK AREA

SIGN

SIGN ON PORTABLE OR PERMANENT SUPPORT.

HIGH LEVEL WARNING DEVICE.

CONES ON 25' CENTERS MAX.

GENERAL NOTES

1. ROAD WORK AHEAD SIGNS ARE TO BE REMOVED WHEN NO WORK IS BEING PERFORMED. ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA SHALL BE PROTECTED BY TYPE I OR TYPE II BARRIEES WITH FLASHING LIGHTS, TYPE "A".

2. IF THE WORK OPERATION REQUIRES THAT FOUR OR MORE WORK VEHICLES ENTER THE THROUGH TRAFFIC LANES IN A ONE-HOUR PERIOD, A FLAGGER SHALL BE PROVIDED AND THE FLAGGER SIGN SHALL BE ERECTED ACCORDINGLY.

3. ALL VEHICLES, EQUIPMENT, WORKERS (EXCEPT FLAGGERS) AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE PAVEMENT UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

CASE C1

2-LANE, TWO-WAY TRAFFIC
DAILY LANE OPERATIONS ONLY

WHERE, AT ANY TIME, ANY VEHICLES, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENTRAP THE AREA BETWEEN 2 FT. AND 6 FT. FROM THE EDGE OF PAVEMENT.

X - MAY BE DECREASED TO 200' TO 350' FOR URBAN AREA.
GENERAL NOTES
1. Construction operations shall be confined to one traffic lane, leaving the opposite lane open to traffic.
2. If the work operation does not exceed 60 minutes, traffic control will be in conformance with case A1.
3. The flaggers shall be in sight of each other or in direct communication at all times.
4. In light traffic when there is no work being performed, flagger signs and the flagger may not be required at the option of the engineer. In this case one lane road width shall be installed in place of the flagger signs.
5. When a side road intersects the highway on which work is being performed, additional traffic control devices shall be erected as directed by the engineer.
6. All vehicles, equipment, workers (except flagger) and their activities are restricted at all times to one side of the pavement unless otherwise authorized by the engineer.

CASE C2
Two-lane, two-way traffic
Daylight operations only

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH IN THE AREA BETWEEN THE CENTER LINE AND A LINE 2 FT. OUTSIDE THE EDGE OF PAVEMENT.

SYMBOLS
- Work area
- Sign
- Sign on portable or permanent support
- Flagger with paddle
- CONEX on 25' centers max.

TYPICAL APPLICATIONS
Utility operations only

-X- May be decreased to 200' to 350' for urban areas
GENERAL NOTES

1. THE LINES ON EITHER SIDE OF THE CENTER WORK SPACE SHOULD HAVE A MINIMUM WIDTH OF 10 FEET AS MEASURED FROM THE NEAR EDGE OF THE CHANNELIZING DEVICES TO THE EDGE OF PAVEMENT OR THE OUTSIDE EDGE OF PAVED SHOULDER.

2. WORKERS IN THE ROADWAY SHOULD WEAR HIGH-VISIBILITY CLOTHING AS DESCRIBED IN SECTION 2.03.

3. WHEN NO WORK IS BEING PERFORMED, ANY UNATTENDED OBSTACLE OR EXCAVATION IN THE WORK AREA SHALL BE PROTECTED BY TYPE 1 OR TYPE 2 MARKER LUMINESCENT DEVICES.

4. IF IT BECOMES NECESSARY TO OPERATE ONE LANE TRAFFIC, CASE AS SHALL APPLY.

5. A LANE WIDTH OF 9 FT. MAY BE USED FOR SHORT-TERM STATIONARY WORK ON LOW-VOLUME, LOW-SPEED ROADWAYS WHEN MOTOR VEHICLE TRAFFIC DOES NOT INCLUDE LONGER AND WIDER HEAVY COMMERCIAL VEHICLES.

6. VEHICLE HAZARD WARNING SIGNALS MAY BE USED TO SUPPLEMENT HI-INTENSITY ROTATING, FLASHING, OSCILLATING, OR STROBE LIGHTS.

7. VEHICLES WITH DUAL FLASHERS AND FLASHER AMBER DOME LIGHT OPERATING

CASE C3

LOW VOLUME
TWO-LANE, TWO WAY OR MULTILANE, TWO WAY TRAFFIC UNDIVIDED, DAY OPERATIONS ONLY.

WHERE, AT ANY TIME, ANY VEHICLE, EQUIPMENT WORKERS OR THEIR ACTIVITIES WILL ENTRAP IN THE CENTERLINE AREA.

**SPEED**  | **L-TAPER (IN FEET)**
--- | ---
25 | 15
30 | 180
35 | 250
40 | 310
45 | 540
50 | 660
55 | 660

**SYMBOLES**

- **\[** WORK AREA
- **\^** SIGN ON PORTABLE OR PERMANENT SUPPORT
- **\O** CONES (3 FT 25 CENTERS MAX)

**TYPICAL APPLICATIONS**

UTILITY OPERATIONS ONLY
GENERAL NOTES

1. THE "L" DISTANCE EQUALS THE TAPER LENGTH.

<table>
<thead>
<tr>
<th>NORMAL POSTED SPEED</th>
<th>MIN. TAPER LENGTH (FOR 12' CLOSED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPH</td>
<td>FEET</td>
</tr>
<tr>
<td>60</td>
<td>800</td>
</tr>
<tr>
<td>60</td>
<td>725</td>
</tr>
<tr>
<td>55</td>
<td>650</td>
</tr>
<tr>
<td>50</td>
<td>600</td>
</tr>
<tr>
<td>45</td>
<td>550</td>
</tr>
<tr>
<td>40 OR LESS</td>
<td>500</td>
</tr>
</tbody>
</table>

2. OVERNIGHT OPERATIONS ILLUSTRATED, FOR DAYLIGHT OPERATIONS, MAY USE CONES INSTEAD OF DRUMS.

3. WHEN CONSTRUCTION OPERATIONS CAUSE EQUIPMENT TO ENCROACH ON THE TRAVELED WAYS, A FLAGGER WILL BE REQUIRED IN THE WORK ZONE WITH A FLAGGED SIGN PLACED 500' IN ADVANCE OF THE FLAGGER.

4. THE CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED IN THE LANE ADJACENT TO THE MEDIAN ON A DIVIDED HIGHWAY. UNDER THESE CONDITIONS LEFT LANE CLOSURES SHALL BE SUBSTITUTED FOR RIGHT LANE CLOSURE SIGNS.

5. THE CASE ALSO APPLIES WHEN WORK IS BEING PERFORMED IN THE LANE ADJACENT TO THE CENTER LINE ON AN UNDIVIDED HIGHWAY. UNDER THESE CONDITIONS THE SIGNS NORMALLY MOUNTED IN THE MEDIAN SHALL BE OMITTED. SIGNS SHALL BE ADDED IN THE OPPOSITE DIRECTION IN CONFORMANCE WITH CASE A4 AND ADDITIONAL CHANNELIZING DEVICES SHALL BE PLACED ALONG THE CENTER LINE THROUGH THE TAPER AND WORK AREA.

6. ALL SIGNS SHALL BE POST MOUNTED IF THE CLOSURE TIME EXCEEDS THREE DAYS.

7. REFLECTORIZED TEMPORARY PAVEMENT MARKING MAY BE OMITTED IF CLOSURE TIME IS LESS THAN SEVEN DAYS.

8. WHEN A SIDE ROAD INTERSECTS THE HIGHWAY ON WHICH WORK IS BEING PERFORMED ON MAINLINE, OPPOSITE DIRECTION IS AFFECTED, ADDITIONAL TRAFFIC CONTROL DEVICES SHALL BE ERECTED AS DIRECTED BY THE ENGINEER.

9. ALL VEHICLES, EQUIPMENT, WORKERS AND THEIR ACTIVITIES ARE RESTRICTED AT ALL TIMES TO ONE SIDE OF THE ROAD CLOSED UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

10. CARS MUST BE TAKEN TO INSURE 24 HOUR OPERATION OF THE ELECTRIC ARROW, IT SHALL BE POSITIONED BEFORE THE CHANNELIZATION DEVICES AND SHALL NOT BE AN UNPROTECTED OBJECT TO THE MOTORIST. MINIMUM SIGHT DISTANCE IS 1,000 FT.

11. DEVICES SHALL BE SPACED AT 50 FT INTERVALS WHEN WORK IS PERFORMED IN THIS AREA.

12. FLASHING WARNING LIGHTS AND/OR FLAGS MAY BE USED TO CALL ATTENTION TO THE ABOVE WARNING SIGNS, AS NEEDED ON THE PLANS AND/OR AS DIRECTED BY THE ENGINEER.

CASE E4

MULTIPLE CLOSED DAY OR NIGHT OPERATIONS
SINGLE LANE CLOSURE - STATIONARY

WHERE AT ANY TIME ANY VEHICLE, EQUIPMENT, WORKERS OR THEIR ACTIVITIES WILL ENCROACH ON ANY PORTION OF THE LANE IMMEDIATELY ADJACENT TO THE SHOULDER OR ON THE SHOULDER WITHIN 2 FEET OF THE EDGE OF PAVEMENT.

TYPICAL APPLICATIONS

PAVEMENT REPAIRS
PAVING
SLIDES
BRIDGE DECK REPAIRS

SUGGESTED ADVANCE WARNING SIGN SPACING

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (IN FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>URBAN LOW SPEED</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td>URBAN INTERSTATE</td>
<td>350</td>
</tr>
<tr>
<td>RURAL</td>
<td>500</td>
</tr>
<tr>
<td>EXPRESSWAY/FRE way</td>
<td>1,000</td>
</tr>
</tbody>
</table>

*SPEED CATEGORY TO BE DETERMINED BY MV DOT*
The following common problems in work zones can increase the danger to motorists and workers:

**SIGNS LEFT UP WHEN NO WORK IS GOING ON.** When drivers see work zone signs but no work activity, they lose respect for such signs. Before leaving the work zone, crews should keep up only those signs necessary to warn motorists of the road conditions. Especially important is the removal of the “Flagger Ahead” sign.

**IMPROPER SIGNS AND SIGN STANDS.** Wooden and heavy metal signs and sign supports can cause considerable harm in minor accidents. They should be “crashworthy,” which means that they conform to NCHRP Report 350. Suppliers can provide certification that signs and supports meet “350” requirements.

**TOO FEW CONES AND BARRELS.** There must be enough cones or barrels to define the transition area tapers clearly. The minimum number depends on taper length and traffic speed. They should be evenly spaced along the taper length.

**DEVICES TOO SMALL.** In greater than 35 mph work zones, and in all work zones at night, cones must be 28 inches high. They must have two retroreflective stripes or lights. In 35 mph and less work zones, cones can be 18 inches high with one retroreflective stripe. Barrels must be at least 36 inches high and 18 inches wide. They must be orange with at least two white, 4 to 6 inch wide, retroreflective stripes. Barrels can have weight in the bottom, but not be filled.

**NON-REFLECTIVE DEVICES.** All signs and other devices must be retroreflective and visible at night.

**FLAGGERS USING FLAGS.** Flags should be used for emergency use only. Flaggers should use STOP/SLOW paddles, and hand signals when necessary. Paddles must be 8-sided (not round), retroreflective, at least 18 high and wide, and on a rigid handle.

**COMPLACENT FLAGGERS.** Flagging can be boring and tiring, but flaggers must stay alert and pay attention at all times. One moment of complacency can result in injury to motorists, passengers, workers, and/or the flagger.

**POOR FLAGGER LOCATION.** Flaggers should be on the outer edge of the travel lane they are directing. They should stand alone, away from equipment and other workers. They should stay out of shadows and be visible to drivers well in advance of their location.

**LACK OF TERMINATION SIGNS.** As a courtesy to drivers, all lane closures should end with an “End Road Work” sign.

References:
- Slides from Workzone Traffic Control, UNH T2 Workshop.

Reprinted with permission from Road Business, Spring 2005, Volume 1, No. 20, Technology Transfer Center, University of New Hampshire.

Article Credit:
From VA Newsletter, The Road Ahead, published quarterly by the Virginia Transportation T2 Center. The views expressed do not necessarily represent the views of the sponsoring agencies.
Planning Worksite Traffic Controls

The Manual on Uniform Traffic Control Devices (MUTCD) and WVDOT Manual on Temporary Traffic Control for Streets and Highways shows how to use traffic control devices after basic decisions have been made about the work to be performed and the configuration of the control zone. However, to make these decisions, planning must be accomplished. Good planning is fundamental to the efficient, economical, and safe performance of the highway construction and maintenance operations. The needs of the motorists and the requirements of those persons doing the work, which are often in opposition, must be evaluated.

Planning should anticipate needs so that appropriate materials, equipment, and manpower are available at the right time and place. It should take into account that actions that reduce roadway occupancy time will minimize the exposure of both workers and motorists to hazards and conflicts.

Construction and maintenance operations vary widely in scope of the activity and the impact on traffic operations. Key factors to be addressed include the following:

- Work Classification
  - Stationary
  - Moving
- Work Location
  - Off roadway
  - On Sidewalk
  - On shoulder
  - On Roadway
- Description of Work – e.g. patching, painting, etc.
- Magnitude of Work Operation
  - Number of lanes required
  - Length of work area
- Occupancy Time
  - Time required to perform work
  - Time required for curing
  - Unavoidable and avoidable delay time
  - Traffic control set-up and take-down time
  - Occupancy time is affected by the following:
    - Type of work
    - Efficiency of the crew
    - Type of equipment
    - Weather
    - Traffic
The type of roadway network of which the facility is part of as well as other area characteristics can impact traffic control planning. These considerations include the following:

- In Rural areas expect:
  o High speeds
  o Low volumes
  o No or few pedestrians
  o Adequate lateral space
  o Limited detour options
  o Infrequent turns

- In Urban areas expect:
  o Usually lower speeds
  o Pedestrians and bicycles
  o Little lateral space, with obstructions
  o Many detour options
  o Frequent turns
  o Special events
  o Transit
  o Effect on commercial establishments

A roadway closure occurs when a portion of the roadway must be closed to traffic in order to perform the work operation. The traffic service viewpoint is usually to close as little of the road as possible, while the road work viewpoint usually would find it useful to use more than the minimum amount of roadway for storage and operations. Roadway closure options include the following:

- Restricting the number of lanes that can be closed at any one time and during peak travel periods
- Making use of shoulders for temporary lanes
- Reduce lane width to carry more lanes past worksite
- Constructing on-site detours
- Detouring traffic onto another road
- Diverting traffic upstream from the work area

Advantages of closing the road and providing a detour include:

- Increased safety for motorists and workers
- Better working conditions
- Ability to optimize the work function

Detours may create problems, however. Potential disadvantages include:

- Longer travel route and motorist delay
- Impact on transit operations and school buses
- Traffic controls needed on detour route
- Environmental impact of detour on surrounding area
- Volume on detour exceeding capacity
- Disruption of pedestrian movements
There are several aspects of time to be considered in planning for a construction or maintenance traffic control operation:

- Avoid peak periods if congestion is likely to occur
- For major long-term projects in urban areas, it is best to avoid starting on a Monday or the day after a holiday as commuters tend to forget advance publicity over the weekend
- On major projects, install the traffic control zone during low volume periods
- A reduction in the time required to perform the work and occupy the site will reduce the extent of the work zone hazard to motorists and workers

The particular procedure selected for the performance of the work activity may influence planning requirements. Optimizing the use of available equipment and personnel can be achieved with adequate scheduling. Factors to consider include:

- Crew size and composition
- Materials
- Equipment size and type
- Construction, maintenance and traffic control techniques

Supervisory functions which will expedite and improve construction, maintenance and traffic control operations include:

- Proper instruction of work crews before they arrive at the site
- Making certain that all tools and equipment needed are taken to the site and are in good working condition
- Controlling breaks and lunch periods, when possible, so that they coincide with curing times or other waiting times
- Selecting quickly installed or rapidly curing materials

Public relations are often an overlooked element in a program that affects so vital a part of the community life as transportation. It is such an extremely important element of the construction or maintenance work project that the payoff in goodwill, reduced congestion and increased safety far exceed the cost and effort involved in disseminating information about the project.

Advance knowledge of the activity and the reasons for it will:

- Enable the motorists to be prepared to deal with it
- Improve the interaction between the motorists and the workers and equipment on the road
- Minimize delay, inconvenience and discomfort

Some direct affects in terms of actions on the part the driver may be as follows:

- The driver may choose another route or time of day and avoid the construction activity
- The driver may start earlier on the trip so as not to be late in reaching their destination
• The motorist is likely to be more understanding and cooperative with those involved in the operation

There are a number of *techniques and communication forms* and channels for the dissemination of information to the public:
• Radio news broadcasts and spot announcements
• Newspaper articles and news releases
• Distribution of bulletins, detour maps, letters and flyers
• Meetings with civic associations and other groups
• Notices on internet websites

Traffic Control Devices Used at Worksites

Traffic control devices are the final and often the only means available to communicate with the motoring public. While almost all traffic control devices at onetime or another may be used at roadway worksites, the primary devices most often used are signs and channelizing devices.

Signs are used to advise and warn the motorist and to instruct them how to proceed through the worksite, to indicate hazardous areas and to exclude traffic from the actual workspace.

Channelizing devices and barricades are used to guide motorists to follow the proper path. Since they are used in and adjacent to the traveled way, they may become hazards themselves. Therefore, they must always be preceded by warning signs.

Construction and maintenance signs are a special series with a black legend on an orange background. The orange color is used to indicate the temporary nature of the condition and the additional potential hazard of the worksite.

**Signs should be positioned** according to the following principles:
• Locate where they will be effectively seen
• Place so that the driver will have time to respond
• Place signs on the right side of the roadway
• All signs used during hours of darkness shall be reflectorized and illuminated

**Channelizing devices** are placed in or adjacent to the roadway to control the flow of traffic. They have two distinct purposes:
• As a taper to force movement of traffic from one lane to another
• To delineate and guide the motorist to and along the safe path of travel
There are several different types of accepted channelizing devices. Each has distinct characteristics and advantages.

- **Cones**: Shape of the cone is conical with a broadened base. Minimum height is 18 inches for daytime and low speed roadways. At night, on high-speed roadways or when more visible guidance is needed, the minimum height is 28 inches. Color should be predominantly orange. A flag may be attached for increased visibility.

As a device to guide motorists through a hazardous area, cones have the following advantages:
- Are minor impedance to traffic flow
- Have little effect on capacity
- Will not damage vehicle when hit
- Are well recognized and understood
- Are easy to store and transport

Disadvantages of cones are:
- Have minimal respect by motorists
- Are easily penetrated
- Are easily displaced or knocked over
- Require special treatment for nighttime application

- **Tubular Markers (Tubes)**: Tubes are cylindrical in shape with a broad base. Minimum height is 18 inches and minimum width is 2 inches. At nighttime or in high-speed zones the minimum height is 28 inches. Tubes are used similarly to cones. In addition, they can be fastened to pavement and can be self-restoring when hit. The disadvantages of tubes are similar to cones. With their smaller diameter, they present less visual impact than cones.

- **Drums**: Drums are approximately 36 inches high with a minimum diameter of 18 inches. They must contain a minimum of 2 orange and 2 white stripes. During hours of darkness, warning lights should be placed on drums, as needed. Drums are generally used on long term projects because they have reduced mobility.

The advantages of drums are:
- They provide the appearance of a formidable obstacle
- They command respect, as they can damage a vehicle if hit

Disadvantages are:
- May reduce capacity of adjacent travel lane
- Can roll when hit
- Are difficult to store and place
- Can be damaged when hit

Various drum substitutes have been developed which alleviate some of these problems. For example, plastic drums nest and are not readily damaged when hit. Drum panels will not roll.
• **Barricades**: The minimum length for Type I and Type II barricades is 24 inches. For Type III barricades the minimum height is 48 inches. Barricade design includes 8 to 12 inch width of rail. The rails must be reflectorized with orange and whit stripes on a 45 degree angle. The stripes slope downward towards the side on which traffic is to pass. The stripes are to be 6 inches wide, unless the rail is less than 3 feet long when 4 inch wide stripes shall be used. White is the predominant color for barricade components, other than the reflectorized rail.

Advantages of All three types of barricades:
- They appear to be formidable obstacles and demand driver respect
- Provide good visibility due to large amount of reflective area
- Offer effective means of supporting signs
- Are useful for pedestrian control

Timber barricades should not be used as a positive barrier on any roadway. Where positive barriers are needed to control traffic in construction zones, devices such as concrete safety shape barriers and metal beam systems are recommended. Where channelization or delineation is the primary need, devices such as barricades, cones or vertical panels should be used.

• **Vertical Panels**: Are 8 to 12 inches wide. Height of a panel is a minimum of 24 inches. Striping and reflectorization are the same as for barricades. Panels are mounted on single light-weight post with the top a minimum of 36 inches above the roadway. Panels are effective where lateral spacing is limited.

---

**Designing Traffic Control Zone Layouts**

A traffic control zone is defined as the stretch of the road which contains all of the traffic control devises that are used to warn, regulate or guide drivers through or around a roadway construction or maintenance operation. Most traffic control zones can be divided into four parts, called areas, which are as follows:

- Advance warning area
- Transition area
- Work area
- Termination area

All traffic control zones must have an **advance warning zone**. Main devices used in this zone are the black and orange diamond shaped warning signs. In warning area, the driver is given information about the hazards ahead and the actins he/she must take to travel safely through the traffic control zone.

A **transition area** is required where some form of closure occurs. In the transition area, traffic is channelized from the normal roadway lanes to the paths required to
move past the workspace. The transition area contains the tapers which are used to close lanes.

The *work area* is that portion of the roadway which contains the work activity. The work space is that space within the work area that is closed to traffic and set aside for exclusive use by workers, equipment and construction materials. It is delineated by channelizing devices or shielded by barriers to exclude vehicles and pedestrians.

**Tapers** are used to move traffic laterally from one path to another. Two main types of tapers are used in work site traffic control zones:

- Channelizing taper
- Two-way traffic taper

A *Channelizing Taper* is used to move traffic laterally from its normal lane to another path. The formula for the minimum length of a channelizing taper is:

\[
L = \frac{(W*S^2)}{60} \quad \text{For speeds of 40mph or less}
\]

\[
L = W*S \quad \text{For speeds of 45mph or more}
\]

Where \( L \) is the length of the taper in feet, \( W \) is the width of the offset in feet, and \( S \) is the posted speed limit. A channelizing taper is usually used to close one lane of a road and cause traffic from that lane to merge into an adjacent lane. In this case, the offset "\( W \)" is the actual width of the lane being closed.

Where the minimum taper length cannot be obtained, for example because of short blocks in urban area, it may be necessary to control traffic manually in the merging area.

As a general guideline, use one device for each foot of lane width or each foot that traffic must be moved laterally.

**Example:**

- 50mph and 12 foot lane
  - Minimum taper length: \( 12 \times 50 = 600 \) feet
  - Maximum device spacing = 50 feet
  - Number of devices = \( 12 + 1 = 13 \) (one needed at each end)

The *two-way traffic taper* is used in advance of a work area that occupies part of a two-lane roadway in such a way that the remainder of the road is used alternately by traffic in either direction. In the situation, the function of the taper is not to cause traffic to merge but rather to resolve the potential head-on conflict. A short taper is used to cause traffic to slow down by giving the appearance of a restricted alignment. Drivers then have time at reduced speeds to decide whether to proceed cautiously past the workspace or to wait for opposing traffic to clear. A flagger is usually employed to assign the right-of-way in such situations.
Two-way traffic tapers should be 50-100 feet long. Five channelizing devices are recommended in this distance to provide clear delineation of the taper.

**Spacing of work area devices** is critical to delineate the work space adequately. Usually, a somewhat longer device spacing is acceptable along the work space than on the taper, as channelization is used merely to hold traffic in the proper lane rather than move it out of a lane. Also, since drivers are moving directly parallel to the workspace delineation, the apparent device spacing is shortened as compared with a taper which crosses in front of the driver.

The required spacing of devices in the work area is related to the following factors:
- Speed of traffic
- Length of the work space
- Curvature of the road
- Hazard level
- Conflicting information
- Size of devices

A good **rule of thumb for the maximum spacing of devices** is 100ft. For lower speed roadways this spacing should be reduced. The spacing should be shortened enough so that traffic cannot turn between devices. For low-speed conditions, the spacing may need to be reduced to 10 feet to keep traffic from driving between adjacent devices.

For short work spaces of a few hundred feet or less, the device spacing will need to be reduced in order to provide a sufficient number of devices to define the work area.

When the work space delineation is carried around a curve, the actual device spacing should be reduced to maintain adequate delineation. On curves, drivers tend to look between devices rather than along a line of devices.

In choosing the device spacing, consideration should be given to the hazard involved if vehicles should penetrate the workspace in terms of hazards to motorists, workers and pedestrians. If the hazard level is high, this message is better communicated by a closer spacing and larger devices.
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 traffic control 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 ATSSA 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.

**Suggested Advance Sign Spacing**

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance Between Signs in meters (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Urban (low speed)*</td>
<td>30 (100)</td>
</tr>
<tr>
<td>Urban (high speed)*</td>
<td>100 (350)</td>
</tr>
<tr>
<td>Rural</td>
<td>150 (500)</td>
</tr>
<tr>
<td>Freeway</td>
<td>300 (1,000)</td>
</tr>
</tbody>
</table>

* Speed determined by road authority

**EXAMPLE**

- Lane closures are properly marked.
- Where there are drop-offs 2" or greater, and is not protected by portable barriers, appropriate sign(s) are in place (UNEVEN LANES or 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.
- Sign Height
  - Rural Areas: Post-mounted signs should be mounted at least 1.5m (5ft.) from bottom of the sign to the near edge of the road surface. If there is a secondary sign mounted below, the minimum height can be reduced by 0.3 m (1 ft.)
  - Urban Areas or where parking or pedestrians are likely: Signs should be mounted at least 2.1m (7ft) from the bottom of the sign to the near edge of the road surface. If there is a secondary sign mounted below, the minimum height can be reduced by 0.3 m (1 ft.)
  - Signs posted on barricades or other portable supports are no less than .3 m (1 ft.) above the traveled roadway.
• Lateral Offset
  o Curbed Roads: Edges of signs are a minimum of 1.2m (4ft.) away from face of curbs.
  o Non-curbed Roads: Edges of signs are a minimum of 1.8m (6ft.) and a maximum of 3.6m (12ft.) away from the shoulder edge.
• Signs smaller than 0.9m x 0.9m (36" x 36") may be mounted on a single 100mm x 100mm (4" x 4") wooden post. Signs larger than 0.9m x 0.9m (36" x 36") or with a width greater than 920mm (36") must have two wooden posts.
• Sign sizes are as designated by project documents. (See Exhibit 1 for minimums)
• Temporary sign stands are ballasted safely (ballast is not suspended off ground.)
• Signs with wooden posts have been drilled for proper breakaway performance.

<table>
<thead>
<tr>
<th>Post size</th>
<th>Hole Diameter</th>
<th>14&quot;</th>
<th>14&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>100mm x 100mm</td>
<td>No Holes Needed</td>
<td>4&quot;</td>
<td>14&quot;</td>
</tr>
<tr>
<td>(4&quot; x 4&quot;)</td>
<td></td>
<td>4&quot;</td>
<td></td>
</tr>
<tr>
<td>100mm x 150mm</td>
<td>40mm (1.5&quot;)</td>
<td>4&quot;</td>
<td></td>
</tr>
<tr>
<td>(4&quot; x 6&quot;)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150mm x 150mm</td>
<td>50mm (2&quot;)</td>
<td>4&quot;</td>
<td></td>
</tr>
<tr>
<td>(6&quot; x 6&quot;)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The first hole should be drilled a maximum of 100mm (4") from the ground and the second should be drilled 355mm (14") above the first hole. Holes are to be perpendicular to direction of traffic.

Electronic Signing

Portable Changeable Message Systems (PCMS)

• PCMS is in a safe location and delineated with retroreflective temporary traffic control devices. When within the "Clear Zone" the PCMS should be shielded with a crash cushion or barrier.
• PCMS is visible form 0.8km (0.5mi) under night and day conditions.
• PCMS is legible from a minimum distance of 200m (650ft) and can be read at least twice at posted speed limit.
• Bottom of the panel is at least 2.1m (7ft) above the roadway.
The message will not scroll or travel horizontally or vertically.
PCMS will automatically adjust brightness under varying light conditions.
PCMS is used as a supplement to and not as a substitute for conventional signs and pavement markings.
PCMS is equipped with a power source and a back-up battery.
Standard abbreviations are used, per MUTCD Part 1 Section 1A.14.

Arrow Boards

- Arrow Board is in a safe location and delineated with retroreflective temporary traffic control devices. When within the "Clear Zone" the PCMS should be shielded with a crash cushion or barrier.
- Arrow Board is visible from 0.8km (0.5mi) under night and day conditions.
- Arrow Board is capable of at least 50% dimming from full brilliance.
- Full brilliance is used for daytime operation and 50% dim mode is used for night.
- Bottom of the panel is at least 2.1m (7ft) above the roadway.
- Proper display is used for type of operation (see Exhibit 1).
- 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.
- All delineation devices meet the acceptable category in the ATSSA Quality Standards for Work Zone Traffic Control Devices guide.

Proper Use of Channelizing Devices

General

- Warning lights should be added to channelizing devices in areas with frequent fog, snow, severe roadway curvature, or where visual distractions are present.
- Temporary delineation devices are ballasted safely (not suspended off the ground.)
o The spacing of channelizing devices should not exceed a distance in meters (feet) equal to 1.0 times the speed limit in mph when used for taper channelization, and a distance in meters (feet) of 2.0 times the speed limit in mph when used for tangent channelization.

o If warning lights are used they should be put on the side of the device where the traffic is intended to travel.

- Cones
  o 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.
  o Cones are proper height for their use and are retroreflectored for nighttime use.
  o 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
  o 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.
  o Tubular Markers are proper height for their use and retroreflectored for nighttime use.
  o 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 in).
  o Tubular markers are only used when there is a limited space.

- Vertical Panels
  o Vertical panels have alternating orange and white diagonal strips.
  o Diagonal stripes slant downward to the direction where the traffic is intended to travel.
  o If panels are used at night they are retroreflectored.

- Drums
  o Drums are a minimum of 900mm (36in) in height and have at least 450mm (18in) in width regardless of orientation.
  o Metal drums shall not be used.
  o Markings on the drums are horizontal, circumferential, alternating orange and white retroreflective stripes 100 to 150mm (4 to 6in) wide.
  o 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.
- If drums are placed in regions susceptible to freezing there are hole drilled in the bottom of the drum.

**Type I, 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:

<table>
<thead>
<tr>
<th>Road Closures</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Diagram of Barricades]</td>
</tr>
<tr>
<td>If traffic is to turn left.</td>
</tr>
<tr>
<td>If traffic may turn either left or right.</td>
</tr>
<tr>
<td>If traffic is to turn right.</td>
</tr>
<tr>
<td>If no turns are intended.</td>
</tr>
</tbody>
</table>

- Stripes are retroreflective.
- Minimum length for type I and II barricades is 600mm (24in), minimum for type III is 1,200mm (48in.), and rails are 200 to 300mm (8 to 12in) 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 chucks of concrete are used as ballast.
- Signs may be placed on type III barricades, but can only be placed on top two rails. The sign may only cover 50% of the top two rails and only 33% of the entire barricade.

**Direction Indicator Barricade**
- Consists of a retroreflective horizontal arrow on the top panel and a striped retroreflective bottom panel.
- The arrow panel is a black on orange and is 600 x 300mm (24 x 12in.)
- The striped panel has 100mm (4in) stripes at a 45° angle, pointing down in the direction the arrow points. The panel is 600 x 200mm (24 x 8in.)
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 ft long, every 40 ft
  - Raised Pavement Markers (RPMs) for broken lines have at least 3 RPMs per line
  - Raised Pavement Markers for no passing zones have 2 RPMs side by side at five foot spacing, unless otherwise allowed in the contract documents.
  - 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 (6E.02)

- DAY- Vest, shirt or jackets should be orange, yellow, yellow/green or a fluorescent version of these colors.
- NIGHT- Similar clothing as above but material should be retroreflective.
Proper devices (6E.03) and procedures (6E.04)

- Flaggers should have STOP/SLOW Paddles made out of type III or IV retroreflective material.
- STOP/SLOW paddles are a minimum of 18" with minimum 6" height of letters.
- If STOP/SLOW or flags are used at night they should be made out of a retroreflective material.
- 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 (6E.05)

Flagger Station Location in Advance of Work Space

<table>
<thead>
<tr>
<th>Metric</th>
<th>Speed (km/h)</th>
<th>30 (20)</th>
<th>40 (25)</th>
<th>50 (30)</th>
<th>60 (35)</th>
<th>70 (40)</th>
<th>80 (45)</th>
<th>90 (50)</th>
<th>100 (55)</th>
<th>110 (60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distance (m)</td>
<td>10 (35)</td>
<td>15 (55)</td>
<td>30 (85)</td>
<td>45 (120)</td>
<td>65 (170)</td>
<td>85 (220)</td>
<td>110 (280)</td>
<td>135 (335)</td>
<td>170 (415)</td>
</tr>
</tbody>
</table>

Construction Personnel/Equipment

- High-visibility clothing (6E.02), 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.

Miscellaneous

- Traffic is not held back more than 30 minutes unless otherwise stated by contracts.
- If railroad crossing exists no lane restrictions or temporary traffic control zone is allowed to create a condition where vehicles can be stopped with no means of escape.
- Crash-tested devices
  (http://safety.fhwa.dot.gov/fourthlevel/pro_res_road_nchrp350.htm)
### Warning Signs Sizes

<table>
<thead>
<tr>
<th>Standard Size</th>
<th>30&quot; x 30&quot;</th>
<th>36&quot; x 36&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Signs" /></td>
<td><img src="image2" alt="Signs" /></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard Size</th>
<th>48&quot; x 48&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Signs" /></td>
<td></td>
</tr>
</tbody>
</table>

#### Miscellaneous (in inches)

<table>
<thead>
<tr>
<th>Sign</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Sign" /></td>
<td>48 x 24</td>
</tr>
<tr>
<td><img src="image5" alt="Sign" /></td>
<td>18 x 24</td>
</tr>
<tr>
<td><img src="image6" alt="Sign" /></td>
<td>36 x 48 x 48</td>
</tr>
<tr>
<td><img src="image7" alt="Sign" /></td>
<td>42 x 36</td>
</tr>
<tr>
<td><img src="image8" alt="Sign" /></td>
<td>42 x 36</td>
</tr>
<tr>
<td><img src="image9" alt="Sign" /></td>
<td>36 x 18</td>
</tr>
<tr>
<td><img src="image10" alt="Sign" /></td>
<td>36 x 18</td>
</tr>
<tr>
<td><img src="image11" alt="Sign" /></td>
<td>36 x 18</td>
</tr>
<tr>
<td><img src="image12" alt="Sign" /></td>
<td>30 x 24</td>
</tr>
<tr>
<td><img src="image13" alt="Sign" /></td>
<td>48 x 18</td>
</tr>
<tr>
<td><img src="image14" alt="Sign" /></td>
<td>36 dia.</td>
</tr>
</tbody>
</table>
Other Temporary Traffic Control Devices

<table>
<thead>
<tr>
<th>Cones</th>
<th>Vertical Panels</th>
<th>Tubular Markers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retroreflective Band</td>
<td>Day and Low-Speed Roadway (≤ 60 km/h) (≤ 40 mph)</td>
<td></td>
</tr>
<tr>
<td>Night and/or Freeway High-Speed Roadway (&gt; 70 km/h) (&gt; 45 mph)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75 to 100 mm (3 to 4 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 mm (4 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90 mm (3.5 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 mm (3 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75 mm (2.5 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 mm (2 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 mm (2.5 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 mm (2 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>450 mm (18 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300 mm (12 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200 to 250 mm (8 to 10 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>700 mm (28 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 mm (4 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600 mm (24 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 mm (19 in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 mm (2 in)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Arrow Board Displays

<table>
<thead>
<tr>
<th>Sequential Series</th>
<th>Flashing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move/Merge Right</td>
<td></td>
</tr>
<tr>
<td>Move/Merge Right Move/Merge Right or Left</td>
<td></td>
</tr>
<tr>
<td>Caution</td>
<td></td>
</tr>
<tr>
<td>Caution</td>
<td></td>
</tr>
</tbody>
</table>

Page 10 of 10
Pedestrian Accommodation Work Zone CHECKLIST

Did you consider: (If NO, check box)

- Impact on pedestrian generators (Schools, Senior Centers, transit stops, etc.)
- Impact on existing pedestrian flow
- Pedestrian information needs—advance, transition, work area, and exit information
- Pedestrian Facilities—walkway width, surface, boundaries, transitions, and channelization.
- Intersections—crosswalk placement, additional signing/marking, traffic signals modification (timing, pedestrian signals, push button, etc.)
- Adequate and safe detour or diversion due to sidewalk closure or blockage
- Adequate pedestrian protection—physical separation from work space and vehicular traffic, overhead protection, etc.
- Construction staging to maintain pedestrian access throughout all construction phases
- Temporary nighttime lighting
- Requirements of the Americans with Disabilities Act (ADA) of 1990
- Location/access to business, residences, etc.

Future considerations—frequent checks of the pedestrian accommodations during construction to ensure that the temporary traffic control plan (TCP) is followed, traffic control devices are maintained in good condition, and a safe, accessible pedestrian route is available at all times.

NOTE: If you checked any box, you need to go back and review your traffic control plan and make the necessary changes.


http://safety.fhwa.dot.gov/programs/wsz.htm

Sidewalk Detour

- Additional advance warning may be necessary
- Only traffic control devices relating to pedestrian flow are shown. Other devices may be needed to control traffic on the streets.
- It may be necessary to allow pedestrians to travel to the closure points to allow access to businesses, residences, etc.

Crosswalk Closure

- Advance warning may be necessary
- Only traffic control devices relating to pedestrian flow are shown. Other devices may be needed to control traffic on the streets.
- Pedestrian signals should be deactivated for closed crosswalks.
- Nighttime lighting should be considered.
Creating Safer Work Zones: Improving Operations on Both Sides of the Barrel

Pedestrians in work zones present special safety and mobility concerns. Providing safe, convenient passage to all pedestrians must be addressed in the planning, design, and operation of work zones. This brochure provides some helpful guidelines that can be used to accommodate pedestrians in work zones.

Facts about Pedestrian Work Zone Crashes

- Over the last decade more than 1200 pedestrians and bicyclists died in work zones.
- Over 10,000 pedestrians and bicyclists were injured in work zone crashes during that same period.
- Non-motorist fatalities (workers, pedestrians, bicyclists) in work zone crashes increased more than 60 percent in the last 5 years.

Considerations for Design of Pedestrian Accommodations:

The need to accommodate pedestrians in work zones can be identified by observing existing pedestrian usage and accommodations prior to the start of work. The presence of pedestrians in the area, existing sidewalks and other pedestrian paths, and pedestrian generators such as schools, residences, and parks, all indicate that pedestrians are likely to be present in the work zone. If existing sidewalks must be closed, relocated, or otherwise affected by the planned work activity, temporary facilities should be provided. The following considerations should be addressed when a need for pedestrian accommodations in the work zone is identified:

- Adverse economic consequences to business establishments in the work zone should be avoided by maintaining pedestrian access.

Pedestrian information needs:

- Advance information placed at appropriate distances before the work zone allows pedestrians to make timely decisions about routes through or around the work zone. This is especially important when existing pedestrian routes are closed or detoured.
- Transition information — allows pedestrians to find a safe path through and around work zones. Important when the pathway is restricted, diverted, or detoured.
- Work area information — aids the passage of pedestrians through the work zone. This information is needed on all pedestrian routes except detours.
- Exit information directs pedestrians back to the original route. Important when the pedestrian route is diverted or detoured.

Sidewalk Diversion

- Advance warning may be necessary.
- Only traffic control devices relating to pedestrian flow are shown. Other devices may be needed to control traffic on the streets.
- Transition signing may be necessary to guide or direct pedestrians.