The Need

- Deteriorating Infrastructure
- Changing Traffic Patterns
- Changing Driver Habits
- Aging Driver
- Visual Noise
- Field Operation Personal Habits (Attitude)
THE STANDARDS

- OSHA - 29 CFR 1926.200
- State MUTCD’s
OSHA STANDARDS

- OSHA General Duty 5(a)
- Construction – 1926.200
- Telecommunications Industry - 1910.268
- Electric/Gas Utility Industry - 1910.269
OSHA STANDARDS

• General Duty Construction Standard

• 1926.200

• Covers construction workers in the work zone.
OSHA STANDARDS

- 1926.200 (g)
- (2) All traffic control signs or devices used for the protection of construction workmen shall conform to the Manual of Uniform Traffic Control Devices for Streets and Highways, 1988/1994 MUTCD Revised or 2000 MUTCD.
Principles of Safe Traffic Control

- Plan for Safety
- Keep it Moving
- Communicate
- Monitor
- Plan for the Worst
- Train
"Stages" of the Roadway Work Zone

- Advance Warning
- Transition
- Activity - Buffer Space, Work Space, Traffic Space
- Termination
FIGURE 1 - Component Parts of a Temporary Traffic Control Zone

Most TTC zones can be divided into four areas in the order that drivers encounter them.

**Buffer Space (Lateral)**
- Provides protection for traffic and workers

**Traffic Space**
- Allows traffic to pass through the activity area

**Shoulder Taper**
- Tells traffic what to expect ahead

**Advance Warning Area**
- Tells traffic what to expect ahead

**Transition Area**
- Moves traffic out of its normal path

**Activity Area**
- Is where work takes place

**Termite Area**
- Lets traffic resume normal operations

**Buffer Space (Longitudinal)**
- Provides protection for traffic and workers

**Work Space**
- Is set aside for workers, equipment, and material storage

**Buffer Space (Longitudinal)**
- Provides protection for traffic and workers

**Buffer Space (Longitudinal)**
- Provides protection for traffic and workers

**NOTE: LOCAL REGULATIONS MAY VARY**

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#PRG3A Publ. 11.04 Page 5
The 3 Key Elements of the Utility Work Zone

1. Typical Applications (# of Signs & Spacing)
2. Cone Taper (# of Cones & Spacing)
3. Buffer Space (# of Cones & Spacing)
FIGURE 1 - Component Parts of a Temporary Traffic Control Zone

Most TTC zones can be divided into four areas in the order that drivers encounter them.

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- **Termination Area**: Lets traffic resume normal operations.

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Typical Application Selection Criteria

- Work Duration
- Work Location
- Roadway Type
- Work Type
Work Duration

- Long Term Stationary - > 3 days
- Intermediate Term Stationary –
- Over 1 daylight period to 3 days or over 1 hour nighttime
- Short Term Stationary - > 1 hr. single daylight period
- Short Duration – Up to one hour
- Mobile - Continuous or intermittent
Work Location

• Outside the shoulder edge.
• On shoulder edge - no encroachment.
• On shoulder edge - minor encroachment.
• Within the median.
• Within the traveled way.
Roadway Type

- Urban Streets
- Urban Arterial Roads
- Intersections
- Rural Two-Lane Roadways
- Rural / Urban Multilanes
- Freeways
Work Type

- Utility – Overhead and Underground – Electric, Gas, Cable TV, Telephone, etc.
- City/Municipal Work – Street Crews, Bridge Crews, Park Crews, etc.
- County Work – Road Crews, Bridge Crews, Survey Crews, etc.
- Contractor Work – Utility/Road/Bridge, Locators, One Call Crews, etc.
1. A SHOULDER WORK sign should be placed on the left side of the roadway for a divided or one-way street only if the left shoulder is affected.

2. The Workers symbols signs may be used instead of SHOULDER WORK signs.

3. The SHOULDER WORK AHEAD sign on an intersecting roadway may be omitted where drivers emerging from that roadway will encounter another advance warning sign prior to this activity area.

NOTE: LOCAL REGULATIONS MAY VARY

4. For short-duration operations of 60 minutes or less, all signs and channelizing devices may be eliminated if a vehicle with activated high-intensity rotating, flashing, oscillating, or strobe lights is used.

5. Vehicle hazard warning signals may be used to supplement rotating lights or strobe lights.

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

7. When paved shoulders having a width of 2.4 m (8 ft) or more are closed, at least one advance warning sign shall be used. In addition, channelizing devices shall be used to close the shoulder in advance to delineate the beginning of the work space and direct vehicular traffic to remain within the traveled way.
1. All lanes should be a minimum of 3 m (10 ft) in width as measured to the near face of the channelizing devices.

2. The treatment shown should be used on a minor road having low speeds. For higher-speed traffic, a lane closure should be used.

3. For short-term use on low-volume, low-speed roadways with vehicular traffic that does not include longer and wider heavy commercial vehicles, a minimum lane width of 2.7 m (9 ft) may be used.

4. Where the opposite shoulder is suitable for carrying vehicular traffic and of adequate width, lanes may be shifted by use of closely spaced channelizing devices, provided that the minimum lane width of 3 m (10 ft) is maintained.

5. Additional advance warning may be appropriate, such as a ROAD NARROWS sign.

6. Temporary traffic barriers may be used along the work space.

7. The shadow vehicle may be omitted if a taper and channelizing devices are used.

8. A truck-mounted attenuator may be used on the shadow vehicle.

9. For short-duration work, the taper and channelizing devices may be omitted if a shadow vehicle with activated high-intensity rotating, flashing, oscillating, or strobe lights is used.

10. Vehicle hazard warning signals may be used to supplement, but not in place of, high-intensity rotating, flashing, oscillating, or strobe lights.
### Table 1

**Stopping Sight Distance as a Function of Speed**

Guideline Distances for: Longitudinal Buffer Space, Flagger Stations, and Road User Visibility

<table>
<thead>
<tr>
<th>SPEED* - MPH</th>
<th>DISTANCE - FEET</th>
<th>CHANNELER - QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>115</td>
<td>6</td>
</tr>
<tr>
<td>25</td>
<td>155</td>
<td>7</td>
</tr>
<tr>
<td>30</td>
<td>200</td>
<td>7</td>
</tr>
<tr>
<td>35</td>
<td>250</td>
<td>8</td>
</tr>
<tr>
<td>40</td>
<td>305</td>
<td>8</td>
</tr>
<tr>
<td>45</td>
<td>360</td>
<td>8</td>
</tr>
<tr>
<td>50</td>
<td>425</td>
<td>9</td>
</tr>
<tr>
<td>55</td>
<td>495</td>
<td>9</td>
</tr>
<tr>
<td>60</td>
<td>570</td>
<td>10</td>
</tr>
<tr>
<td>65</td>
<td>645</td>
<td>10</td>
</tr>
<tr>
<td>70</td>
<td>730</td>
<td>11</td>
</tr>
<tr>
<td>75</td>
<td>820</td>
<td>11</td>
</tr>
</tbody>
</table>

* Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated speed in mph.

NOTE: LOCAL REGULATIONS MAY VARY

### Table 2

**Suggested Advance Warning Sign Spacing.**

Advance Warning Sign Spacing can vary from state to state or agency to agency. These distances can be from 4 to 12 times the speed limit in feet depending on roadway conditions. Check your local regulations for guidelines.

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban (Low Speed*)</td>
<td>100' (30m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban (High Speed*)</td>
<td>350' (100m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>500' (150m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expressway - Freeway</td>
<td>1,000' (300m)</td>
<td>1,500' (450m)</td>
<td>2,640' (800m)</td>
</tr>
</tbody>
</table>

* Speed category to be determined by highway agency.
The 3 Key Elements of the Utility Work Zone

1. Typical Applications (# of Signs & Spacing)
2. Cone Taper (# of Cones & Spacing)
3. Buffer Space (# of Cones & Spacing)
DEFINITIONS OF TAPERS IN TEMPORARY TRAFFIC CONTROL ZONES

Transition Area - Standard: When redirection of the road users' normal path is required, they shall be channelized from the normal path to a new path.

MERGE TAPER
Used when drivers are required to merge into common road space. A merging taper should be long enough to enable merging drivers to have adequate advance warning and sufficient length to adjust their speeds and merge into a single lane before the end of the transition. (See Table 3 for length & formula for "L")

SHIFT TAPER
Used when a lateral shift is needed. When merging is not required but a lateral shift is needed. A shifting taper should have a length of approximately 1/2 L. (See Table 3 for length & formula for "L")

SHOULDER TAPER
Used where shoulders are part of the activity area and are closed or when improved shoulders might be mistaken as a driving lane. A shoulder taper should have a length of approximately 1/3 L. (See Table 3 for length & formula for "L"). If a shoulder is used as a travel lane, either through practice or during a TTC activity, a normal merging or shifting taper should be used.

DOWNSTREAM TAPER
May be useful in termination areas to provide a visual cue to the driver that access is available back into the original lane or path that was closed. A downstream taper should have a length of approximately 100 ft. per lane with devices placed at a spacing of approximately 20 ft. apart.

ONE LANE, TWO-WAY TAPER (Flagger)
Used in advance of an activity area that occupies part of a two-way roadway in such a way that a portion of the road is used alternately by traffic in each direction. Traffic should be controlled by a flagger or temporary traffic control signal (if sight distance is limited), or a STOP or YIELD sign. A one-lane, two-way taper should have a maximum length of 100 ft. and a minimum length of 50 ft. with devices spaced approximately 20 ft. apart. (See Table 3 for length.)
FIGURE 2 - Tapers in the Temporary Traffic Control Zone

Tapers are created by using a series of channelizing devices placed to move traffic out of its normal path. Maximum device spacing in feet is equal to traffic speed (Example: 30 MPH = 30' spacing).

L = MERGE TAPER LENGTH (See Table 3 for values)

- **MERGE TAPER**
  - Longitudinal Buffer Space
  - 100' (30m) MIN
  - Downstream Taper (Optional)

- **SHIFT TAPER**
  - 1/2 L

- **SHOULDER TAPER**
  - 1/3 L

- **FLAGGER TAPER**
  - Transition Area
  - Longitudinal Buffer Space
  - MAX 100' (30m)
  - MIN 50' (15m)

Note: Local regulations may vary.
Table 3
Suggested Taper Length and Channelizer Quantity Index - (Feet and MPH)

- Downstream Taper - 100' Min.
- One Lane-Two Way (Flagger) Taper - 100' Max./50' Min.

<table>
<thead>
<tr>
<th>SPEED MPH</th>
<th>Merge Taper - &quot;L&quot;</th>
<th>Shift Taper - &quot;1/2 L&quot;</th>
<th>Shoulder Taper - &quot;1/3 L&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WIDTH OF LANE OFFSET</td>
<td>WIDTH OF LANE OFFSET</td>
<td>WIDTH OF LANE OFFSET</td>
</tr>
<tr>
<td></td>
<td>From Normal Lane Width Due to Work Zone</td>
<td>From Normal Lane Width Due to Work Zone</td>
<td>From Normal Lane Width Due to Work Zone</td>
</tr>
<tr>
<td>30</td>
<td>60' (3) 90' (4) 120' (5) 150' (6) 180' (7)</td>
<td>30' (3) 45' (3) 60' (4) 75' (4) 90' (4)</td>
<td>20' (3) 30' (3) 40' (3) 50' (3) 60' (3)</td>
</tr>
<tr>
<td>35</td>
<td>80' (4) 125' (5) 165' (5) 205' (5) 245' (5)</td>
<td>40' (3) 65' (4) 85' (4) 105' (5) 125' (5)</td>
<td>30' (3) 45' (3) 55' (3) 70' (3) 85' (3)</td>
</tr>
<tr>
<td>40</td>
<td>105' (4) 160' (5) 215' (5) 270' (5) 320' (5)</td>
<td>55' (3) 80' (4) 110' (4) 135' (5) 160' (5)</td>
<td>35' (3) 55' (3) 75' (3) 90' (3) 110' (3)</td>
</tr>
<tr>
<td>45</td>
<td>180' (7) 270' (7) 360' (7) 450' (7) 540' (7)</td>
<td>90' (3) 135' (4) 180' (4) 225' (5) 270' (5)</td>
<td>60' (3) 90' (3) 120' (3) 150' (3) 180' (3)</td>
</tr>
<tr>
<td>50</td>
<td>200' (7) 300' (7) 400' (7) 500' (7) 600' (7)</td>
<td>100' (4) 150' (4) 200' (4) 250' (5) 300' (5)</td>
<td>70' (3) 100' (3) 135' (3) 170' (3) 200' (3)</td>
</tr>
<tr>
<td>55</td>
<td>220' (7) 330' (7) 440' (7) 550' (7) 660' (7)</td>
<td>110' (4) 165' (4) 220' (4) 275' (5) 330' (5)</td>
<td>75' (3) 110' (3) 150' (3) 185' (3) 220' (3)</td>
</tr>
<tr>
<td>60</td>
<td>240' (7) 360' (7) 480' (7) 600' (7) 720' (7)</td>
<td>120' (4) 180' (4) 240' (4) 300' (5) 360' (5)</td>
<td>80' (3) 120' (3) 160' (3) 200' (3) 240' (3)</td>
</tr>
<tr>
<td>65</td>
<td>260' (7) 390' (7) 520' (7) 650' (7) 780' (7)</td>
<td>130' (4) 195' (4) 260' (4) 325' (5) 390' (5)</td>
<td>90' (3) 130' (3) 175' (3) 220' (3) 260' (3)</td>
</tr>
<tr>
<td>70</td>
<td>280' (7) 420' (7) 560' (7) 700' (7) 840' (7)</td>
<td>140' (4) 210' (4) 280' (4) 350' (5) 420' (5)</td>
<td>95' (3) 140' (3) 190' (3) 235' (3) 280' (3)</td>
</tr>
</tbody>
</table>

The maximum distance in feet (meters) between devices in a taper should not exceed 1 times the speed limit in mph (0.2 times the speed limit in km/h).

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<th>Channelizer Qty.</th>
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<td>250</td>
<td>8</td>
</tr>
<tr>
<td>40</td>
<td>305</td>
<td>8</td>
</tr>
<tr>
<td>45</td>
<td>360</td>
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<tr>
<td>50</td>
<td>425</td>
<td>9</td>
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<tr>
<td>55</td>
<td>495</td>
<td>9</td>
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<tr>
<td>60</td>
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<td>65</td>
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<td>10</td>
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<td>75</td>
<td>820</td>
<td>11</td>
</tr>
</tbody>
</table>

*Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated speed in mph.*

### Table 2

**Suggested Advance Warning Sign Spacing.**

Advance Warning Sign Spacing can vary from state to state or agency to agency. These distances can be from 4 to 12 times the speed limit in feet depending on roadway conditions. Check your local regulations for guidelines.

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance Between Signs (Feet) (Meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban (Low Speed*)</td>
<td>A: 100' (30m)</td>
</tr>
<tr>
<td>Urban (High Speed*)</td>
<td>B: 350' (100m)</td>
</tr>
<tr>
<td>Rural</td>
<td>C: 500' (150m)</td>
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</tr>
</tbody>
</table>

*Speed category to be determined by highway agency.*

**NOTE: LOCAL REGULATIONS MAY VARY**
The Plan

A Five Part Compliance Plan

- Training
- Manual
- Documentation
- Update
- Inspection / Audit Function
**TYPICAL WARNING SIGNS**

**UTILITY WORK AHEAD**
Alerts drivers of utility work in or near the roadway.  
#W21.7

**FLAGGER SYMBOL**
Used before any flagger station.  
#W20.7a

**CENTER LANE CLOSED AHEAD**
For work in center lane of a three lane one way road.  
#A8.3

**ONE LANE ROAD AHEAD**
Used for one lane, two way traffic.  
(Flagger)  
#W20.4

**RIGHT SHOULDER CLOSED**
Used when shoulder work closes an improved shoulder.  
#A2.1-4a

**ROAD CLOSED AHEAD**
Used where road is closed to all or just local traffic.  
#A20.8

*As an alternative to a specific distance, the word "AHEAD" may be used.*

**NOTE: LOCAL REGULATIONS MAY VARY**
CHANNELIZING DEVICES - Used to warn road users of conditions created by work activities in or near the roadway and to guide road users.

- **TUBULAR MARKERS**
  - Day and Low-Speed Roadway (≤ 40 mph)
  - Night and/or High Speed Roadway (≥ 46 mph)
  - 2" MIN. 18" MIN.

- **CONES**
  - 18" Cones - Day and Low-Speed Roadway (≤ 40 mph)
  - Night and/or High Speed Roadway (≥ 46 mph)
  - 3" to 6" 6" 2" 4" 6" 36" MIN.

- **DRUM**
  - 18" MIN. 36" MIN. 4" to 8" 4" to 8" 45°

- **TYPE 1 BARRICADE**
  - 8" to 12" 8" to 12" 2" MIN. 2" MIN. 36°

- **TYPE 2 BARRICADE**
  - 8" to 12" 2" MIN. 2" MIN. 36°

- **TYPE 3 BARRICADE**
  - 8" to 12" 5 MIN. 45°

*Note: Local regulations may vary*
CHANNELIZING DEVICES (Cont.)

1. Devices used to channelize pedestrians shall be detectable to users of long canes and visible to persons of low vision.

2. Barricades used to channelize pedestrians shall have a continuous detectable bottom and top rail with no gaps between individual barricades to be detectable to users of long canes. The bottom of the bottom rail shall be no higher than 6 inches above the ground surface. The top of the top rail shall be no lower than 36 inches above the ground surface.

3. If drums, cones, or tubular markers are used to channelize pedestrians, they shall be located such that there are no gaps between the bases of the devices, in order to create a continuous bottom, and the height of each individual drum, cone, or tubular marker shall be no less than 36 inches to be detectable to users with long canes.

4. Devices that are damaged or have lost significant amount of their retroreflectivity and effectiveness shall be replaced.

NOTE: LOCAL REGULATIONS MAY VARY

LIGHTING DEVICES

WARNING LIGHT (BARRICADE LIGHT)

When warning lights are used, they shall be mounted on signs or channelizing devices in a manner that, if they are hit by an errant vehicle, they will not be likely to penetrate the windshield.

TYPE A - Low Intensity Flashing warning lights are used to warn road users during nighttime hours that they are approaching or proceeding into a potentially hazardous area.

TYPE B - High Intensity Flashing warning lights are used to warn road users during both daylight and nighttime hours that they are approaching a potentially hazardous area.

TYPE C - Steady-Burn and Type D - 360 degree Steady-Burn warning lights may be used during nighttime hours to delineate the edge of the traveled way.

FLASHING WARNING BEACON (VEHICLE STROBE)

Although vehicle hazard warning lights are permitted to be used to supplement high-intensity rotating, flashing, oscillating, or strobe lights, they shall not be used instead of high-intensity rotating, flashing, oscillating, or strobe lights.
LIGHTING DEVICES - Arrow Panels

An arrow panel shall be a sign with a matrix of elements capable of either flashing or sequential displays. The sign shall provide additional warning and directional information to assist in merging and controlling road users through or around a TTC zone. Arrow panel elements shall be capable of at least 50 percent dimming from full brilliance. The dimmed mode shall be used for nighttime operation of arrow panels.

<table>
<thead>
<tr>
<th>Panel Type</th>
<th>Minimum Size</th>
<th>Minimum Legibility Distance</th>
<th>Minimum Number of Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>48&quot; x 24&quot; (1200 x 600 mm)</td>
<td>1/2 Mile (0.8 km)</td>
<td>12</td>
</tr>
<tr>
<td>B</td>
<td>60&quot; x 30&quot; (1500 x 75 mm)</td>
<td>3/4 Mile (1.2 km)</td>
<td>13</td>
</tr>
<tr>
<td>C</td>
<td>96&quot; x 48&quot; (2400 x 1200 mm)</td>
<td>1 Mile (1.6 km)</td>
<td>15</td>
</tr>
<tr>
<td>D</td>
<td>None*</td>
<td>1/2 Mile (0.8 km)</td>
<td>12</td>
</tr>
</tbody>
</table>

* Length of arrow: 48" (1200mm). Width of arrowhead: 24" (600mm)

Three Modes of Operation

- Flashing or Sequential Arrow or Sequential Chevron
- Flashing Double Arrow
- Caution

Applications

1. An arrow panel in the arrow or chevron mode shall be used only for stationary or moving lane closures on multi-lane roadways.
2. For shoulder work, blocking the shoulder, for roadside work near the shoulder, or for temporarily closing one lane on a two-lane, two-way roadway, an arrow panel shall be used only in the caution mode.
3. When arrow panels are used to close multiple lanes, a separate arrow panel shall be used for each closed lane.
4. A vehicle displaying an arrow panel shall be equipped with high-intensity rotating, flashing, oscillating, or strobe light
5. Arrow panel(s) shall not be used to laterally shift traffic.

NOTE: LOCAL REGULATIONS MAY VARY
FLAGGER PROCEDURES - One Lane / Two-Way Traffic Control

A flagger shall be a person who provides temporary traffic control.

NOTE: Some states require flaggers to be certified by the state. Consult local regulations.

QUALIFICATIONS FOR FLAGGERS

Because flaggers are responsible for public safety and make the greatest number of contacts with the public of all highway workers, they should be trained in safe traffic control practices and public contact techniques. Flaggers should be able to satisfactorily demonstrate the following abilities:

1. Ability to receive and communicate specific instructions clearly, firmly, and courteously;
2. Ability to move and maneuver quickly in order to avoid danger from errant vehicles;
3. Ability to control signaling devices (such as paddles and flags) in order to provide clear and positive guidance to drivers approaching a TTC zone in frequently changing situations;
4. Ability to understand and apply safe traffic control practices, sometimes in stressful or emergency situations, and;
5. Ability to recognize dangerous traffic situations and warn workers in sufficient time to avoid injury.

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### Flagger Procedures - One Lane/Two-Way Traffic Control

<table>
<thead>
<tr>
<th>Preferred Method</th>
<th>Emergency Only Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To Stop Road Users</strong></td>
<td>The flagger shall face road users and extend the flag staff horizontally across the road users' lane in a stationary position so that the full area of the flag is visibly hanging below the staff. The free arm shall be held with the palm of the hand above the shoulder level toward approaching traffic.</td>
</tr>
<tr>
<td>The flagger shall face road users and aim the STOP paddle face toward road users in a stationary position with the arm extended horizontally away from body. The free arm shall be held with the palm of the hand above shoulder level toward approaching traffic.</td>
<td><strong>To Direct Stopped Road Users to Proceed</strong></td>
</tr>
<tr>
<td>The flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body. The flagger shall motion with the free hand for road users to proceed.</td>
<td>The flagger shall stand parallel to the road user movement and with flag and arm lowered from the view of the road users, and shall motion with the free hand for road users to proceed. Flags shall not be used to signal road users to proceed.</td>
</tr>
<tr>
<td><strong>To Alert or Slow Traffic</strong></td>
<td>The flagger shall face road users and slowly wave the flag in a sweeping motion of the extended arm from shoulder level to straight down without raising the arm above a horizontal position. The flagger shall keep the free hand down.</td>
</tr>
<tr>
<td>The flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body. To further alert or slow traffic, the flagger holding the SLOW paddle face toward road users may motion up and down with the free hand, palm down.</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Local regulations may vary*
FLAGGER PROCEDURES

HIGH VISIBILITY SAFETY APPAREL

1. For daytime and nighttime activity, flaggers shall wear safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Apparel" (see Section 1A.11) and labeled as meeting the ANSI 107-1999 standard performance for Class 2 risk exposure. The apparel background (outer) material color shall be either fluorescent orange-red or fluorescent yellow-green as defined in the standard. The retroreflective 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 300m (1,000ft). The retroreflective safety apparel shall be designed to clearly identify the wearer as a person.

2. For nighttime activity, safety apparel meeting ISEA/ANSI 107.1999 Class 3 risk exposure should be considered for wear (instead of the Class 2 safety apparel in the Standard above).

3. When uniformed law enforcement officers are used, high-visibility safety apparel as described above shall be worn by the law enforcement officer.

HAND SIGNALING DEVICES

1. The STOP/SLOW paddle shall have an octagonal shape on a rigid handle. STOP/SLOW paddles shall be at least 18 in (450 mm) wide with letters at least 6 in (150 mm) high and should be fabricated from light semirigid material.

2. The background of the STOP face shall be red with white letters and border. The background of the SLOW face shall be orange with black letters and border.

3. When used at night, the STOP/SLOW paddle shall be retroreflectorized.

4. Use of flags should be limited to emergency situations.

5. Flags, when used, shall be a minimum of 24" (600 mm) square, made of a good grade of red material and securely fastened to a staff about 36" (900 mm) long. When used at nighttime, flags shall be retroreflectorized red.

NOTE: LOCAL REGULATIONS MAY VARY

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FLAGGER PROCEDURES - One Lane / Two-Way Traffic Control

FLAGGER STATIONS

1. Flagger stations shall be located such that approaching road users will have sufficient distance to stop at an intended stopping point. The distances shown in Table 1, provides information regarding the stopping sight distance as a function of speed, may be used for the location of a flagger station. These distances may be increased for downgrades and other conditions that affect stopping distance.

2. Except in emergency situations, flagger stations shall be preceded by an advance warning sign or signs. Except in emergency situations, flagger stations shall be illuminated at night.

3. Flagger stations should be located such that an errant vehicle has additional space to stop without entering the work space.

4. Flaggers should:
   A. Stand either on the shoulder adjacent to the road user being controlled or in the closed lane prior to stopping road users.
   B. Only stand in the lane being used by moving road users after road users have stopped.
   C. Be clearly visible to the first approaching road user at all times.
   D. Be visible to other road users.
   E. Be stationed sufficiently in advance of the workers to warn them (for example, with audible warning devices such as horns or whistles) of approaching danger by out-of-control vehicles.
   F. Stand alone, never permitting a group of workers to congregate around the flagger station.

5. At a spot constriction, the flagger may have to take a position on the shoulder opposite the closed section in order to operate effectively. At spot lane closures where adequate sight distance is available for the reasonably safe handling of traffic, the use of one flagger may be sufficient.

NOTE: LOCAL REGULATIONS MAY VARY
PEDESTRIAN CONSIDERATIONS

1. 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 36.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

2. The various TTC provisions for pedestrian and worker safety set forth in Part 6 shall be applied by knowledgeable (for example, trained and/or certified) persons after appropriate evaluation and engineering judgment.

3. Advance notification of sidewalk closures shall be provided to the maintaining agency. Where pedestrians with visual disabilities normally use the closed sidewalk, a barrier that is detectable by a person with a visual disability traveling with the aid of a long cane shall be placed across the full width of a closed sidewalk.

4. Adequate provisions should be made for persons with disabilities as determined by an engineering study or by engineering judgment. Because printed signs and surface delineation are not usable by pedestrians with visual disabilities, blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing audible information devices, accessible pedestrian signals, and barriers and channelizing devices that are detectable to pedestrians traveling with the aid of a long cane or who have low vision.

5. The following three items should be considered when planning for pedestrians in TTC zones:
   A. Pedestrians should not be led into conflicts with work site vehicles, equipment, and operations.
   B. Pedestrians should not be led into conflicts with vehicles moving through or around the work site.
   C. Pedestrians should be provided with a reasonably safe, convenient, and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or footpath(s). Where pedestrians who have visual disabilities encounter work sites that require them to cross the roadway to find an accessible route, instructions should be provided using an audible information device. Accessible pedestrian signals with accessible pedestrian detectors might be needed to enable pedestrians with visual disabilities to cross wide or heavily traveled roadways. (See sections 4E.06 and 4E.07 of the Federal MUTCD 2003 Edition for further information.)

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6. A pedestrian route should not be severed and/or moved for nonconstruction activities such as parking for vehicles and equipment.

7. Consideration should be made to separate pedestrian movements from both work site activity and vehicular traffic. Unless a reasonably safe route that does not involve crossing the roadway can be provided, pedestrians should be appropriately directed with advance signage that encourages them to cross to the opposite side of the roadway. In urban and suburban areas with high vehicular traffic volumes, these signs should be placed at intersections (rather than midblock locations) so that pedestrians are not confronted with midblock work sites that will induce them to attempt skipping the work site or making a midblock crossing.

8. When pedestrian movement through or around a work site is necessary, a separate usable footpath should be provided. If the previous pedestrian facility was accessible to pedestrians with disabilities, the footpath provided during temporary traffic control should also be accessible. There should not be any abrupt changes in grade or terrain that could cause a tripping hazard or could be a barrier to wheelchair use. Barriers and channelizing devices should be detectable to pedestrians who have visual disabilities.

9. TTC devices used to delineate a TTC zone pedestrian walkway shall be crashworthy, and when struck by vehicles, present a minimum threat to pedestrians, workers, and occupants of impacting vehicles.

10. Movement by work vehicles and equipment across designated pedestrian paths should be minimized and, when necessary, should be controlled by flaggers or TTC. Staging or stopping of work vehicles or equipment along the side of pedestrian paths should be avoided, since it encourages movement of workers, equipment, and materials across the pedestrian path. Access to the work space by workers and equipment across pedestrian walkways should be minimized because the access often creates unacceptable changes in grade, and rough or muddy terrain, and pedestrians will tend to avoid these areas by attempting nonintersection crossings where no curb ramps are available.

11. If a significant potential exists for vehicle incursions into the pedestrian path, pedestrians should be rerouted or temporary traffic barriers should be installed.
WORKER SAFETY CONSIDERATIONS

1. Equally as important as the safety of road users traveling through the TTC zone is the safety of workers. TTC zones present temporary and constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for workers on or near the roadway.

2. Maintaining TTC zones with road user flow inhibited as little as possible, and using TTC devices that get the road user's attention and provide positive direction are of particular importance. Likewise, equipment and vehicles moving within the activity area create a risk to workers on foot. When possible, the separation of moving equipment and construction vehicles from workers on foot provides the operator of these vehicles with a greater separation clearance and improved sight lines to minimize exposure to the hazards of moving vehicles and equipment.

3. The following are the key elements of worker safety and TTC management that should be considered to improve worker safety:

A. Training—all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability. Workers having specific TTC responsibilities should be trained in TTC techniques, device usage, and placement.

B. Worker Safety Apparel—all workers exposed to the risks of moving roadway traffic or construction equipment should wear high-visibility safety apparel meeting the requirements of ANSI-American National Standard for High-Visibility Safety Apparel (see Section 1A.11, 2003 Edition MUTCD), or equivalent revisions, and labeled as ANSI 107-1999 standard performance for Class 1, 2, or 3 risk exposure. A competent person designated by the employer to be responsible for the worker safety plan within the activity area of the job site should make the selection of the appropriate class of garment.

C. Temporary Traffic Barriers—temporary traffic barriers should be placed along the work space depending on factors such as lateral clearance of workers from adjacent traffic, speed of traffic, duration and type of operations, time of day, and volume of traffic.

D. Speed Reduction—reducing the speed of vehicular traffic, mainly through regulatory speed zoning, funneling, lane reduction, or the use of uniformed law enforcement officers, or flaggers, should be considered.

E. Activity Area—planning the internal work activity area to minimize backing-up maneuvers of construction vehicles should be considered to minimize the exposure to risk.

F. Worker Safety Planning—a competent person designated by the employer should conduct a basic hazard assessment for the work site and job classifications required in the activity area. This safety professional should determine whether engineering, administrative, or personal protection measures should be implemented. This plan should be in accordance with the Occupational Safety and Health Act of 1970, as amended, “General Duty Clause” Section 5(a)(1) - Public Law 91-596, 84 Stat. 1590, December 29, 1970, as amended, and with the requirement to assess worker risk exposures for each job site and job classification, as per 29 CFR 1928.20 (b)(2) of “Occupational Safety and Health Administration Regulations, General Safety and Health Provisions.” (See Section 1A.11, 2003 Edition MUTCD)

NOTE: LOCAL REGULATIONS MAY VARY

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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. Audible information devices should be considered where midblock closings and changed crosswalk areas cause inadequate communication to be provided to pedestrians who have visual disabilities.

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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 15 m (50 ft) in advance of the midblock crosswalk.

3. Audible information devices should be considered where midblock closings and changed crosswalk areas cause inadequate communication to be provided to pedestrians who have visual disabilities.

4. Pedestrian traffic signal displays controlling closed crosswalks should be covered or deactivated.

NOTE: LOCAL REGULATIONS MAY VARY