Work Zone Safety

Developed by HMTRI through cooperative agreement #2 U45 ES006177-14 with NIEHS
Goal

• Provide you with information to keep you:
  – Safe in the work zone.
  – Prevent injury and death.
Introduction

Workers in areas where there are moving vehicles and traffic must be informed of the special hazards they will be facing during recovery efforts. Some of the specific hazards in the Disaster Work Zone include:

- Ever changing roadway conditions as debris is cleared
- Keep your distance when driving behind trucks loaded with debris.
  - Materials can fly out of the trucks
- Stressed drivers
- Congestion
Overview

- Work zone hazards
- Establishing a proper work zone
- Work zone equipment
- Flagger & work crew PPE
- Flagger/Work crew equipment
- Flagger information
- Summary
How are Roadway Construction Workers Killed?

Heavy and Highway Fatalities
(SIC 1611)

- Contractor Vehicle Inside Work Area: 41%
- Traffic Vehicle Entered Work Area: 22%
- Other Traffic Crash: 19%
- Other: 18%
Where are Workers Killed?

- Worker on foot: 57.0%
- Operator: 35.1%
- Passenger: 7.9%
Subpart G - Signs, Signals & Barricades (1926.200 - 203)

- Traffic signs at points of hazard (200(g)(1))
- Traffic control signs/devices - Requirements (200(g)(2))
- Flaggers – Proper signaling by and use of (201(a))
- Barricades - Requirements (202)
- Visible signs and symbols (200(a))
What is the MUTCD?

The Manual on Uniform Traffic Control Devices (MUTCD) was developed to create standardized control during roadway construction, maintenance, and utility (work zone) operations.
The Unique Hazards of Katrina Work Zones

- Residential debris removal in narrow, uncontrolled residential streets
- Congested and uncontrolled intersections during utility work
- The ever changing/moving temporary work zones
- Aggravated drivers
- Hurried drivers

Class 2 vest is required
This worker is not in compliant high visibility apparel
Residential Streets

This is a typical picture of residential debris removal:

• Improperly zoned, no warning signs, taper, nor identified work zone.
• Flagger is improperly dressed, using a red emergency flag instead of a Stop/Slow Paddle
• Very little control of the work zone

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Work Zone Traffic Safety

• Develop and use a site plan for the work zone
  – Provide traffic flow details
  – Train workers
  – Advanced warning area
  – Transition area
  – Activity area (Work Space & Traffic Space), and
  – Termination area
• Ensure work zone is well lit but control glare
• Use flaggers, traffic cones, and highway channeling devices to steer traffic away from workers.
Work Zone Hazards

• Struck-by vehicles – Stepping into traffic lanes
• Consider all electrical lines to be live
• Ensure proper placement of personnel, equipment, vehicles, signs, cones and barricades
• Maintain communication with other flaggers
Work Zone Hazards

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Work Zone Hazards
Various work equipment & trucks have “blind spots” to the work crew – Be aware of……

The NO-ZONE

The shaded area surrounding each vehicle represents the danger zone, or “NO-ZONE” in which the vehicle operator’s view of pedestrian traffic is greatly reduced or completely obscured.
Operator sight distances from eye level to ground

Vehicle: Rubber Tire Backhoe

Vehicle: Bulldozer
Operator sight distances from eye level to ground

Vehicle:
Manlift

Vehicle:
Bobcat/Skid Steer
Operator sight distances from eye level to ground

Vehicle: Refuse Truck

Vehicle: 5 ton Dumptruck
Minimum Requirements

• Work-zone traffic control must provide adequate notice to motorists that describes the condition ahead, the location, and the required driver response.

• Once drivers reach a work zone, pavement markings, signing, and channelization must be conspicuous and unambiguous in providing guidance through the area.
Stopping Sight Distance

- **Section 6E.05 Flagger Stations**
- **Standard**: Flagger stations shall be located such that approaching road users will have sufficient distance to stop at an intended stopping point.

<table>
<thead>
<tr>
<th>Speed (km/h)</th>
<th>Distance (m)</th>
<th>Speed (mph)</th>
<th>Distance (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>35</td>
<td>20</td>
<td>115</td>
</tr>
<tr>
<td>40</td>
<td>50</td>
<td>25</td>
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<td>730</td>
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<tr>
<td></td>
<td></td>
<td>75</td>
<td>820</td>
</tr>
</tbody>
</table>

Class 2 vest is required

This worker is not in compliant high visibility apparel
Component Parts of a Temporary Traffic Control Zone

- Traffic Space
- Work Space
- Buffer Space
- Termination Area
- Activity Area
- Transition Area
- Advance Warning Area
Component Parts of a Temporary Traffic Control Zone
Minimum Signs Recommended in the Manual on Uniform Traffic Control Devices (MUTCD)
Typical Residential Layout
**Downstream Shifting Taper**
- Buffer Space: 125 ft, 5 cones

**Work space**
- Buffer space: 120 ft

**Transition Area**
- Merging Shoulder Taper: 245 ft, 8 cones

**Worker Education & Training Program**
Buffer Space Data

Buffer space length based on posted speed (minimum distance)

<table>
<thead>
<tr>
<th>Speed (MPH)</th>
<th>35</th>
<th>55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (Feet)</td>
<td>120</td>
<td>335</td>
</tr>
</tbody>
</table>
## Advanced Warning Sign Spacing

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance Between Sign A</th>
<th>Distance Between Sign B</th>
<th>Distance Between Sign C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban (low speed)</td>
<td>100 ft.</td>
<td>100 ft.</td>
<td>100 ft.</td>
</tr>
<tr>
<td>Urban (high speed)</td>
<td>350 ft.</td>
<td>350 ft.</td>
<td>350 ft.</td>
</tr>
<tr>
<td>Rural</td>
<td>500 ft.</td>
<td>500 ft.</td>
<td>500 ft.</td>
</tr>
<tr>
<td>Freeway/Expressway</td>
<td>1000 ft.</td>
<td>1500 ft.</td>
<td>2640 ft.</td>
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</table>
# Taper Lengths and Number of Cones

Merging, Shifting and Shoulder Taper Lengths and Number of Channelization Devices (Cones) Used

(All minimums)

<table>
<thead>
<tr>
<th>Lane Width</th>
<th>10 Feet</th>
<th>11 Feet</th>
<th>12 Feet</th>
<th>Shoulder Tapers (Assume 10' shoulders)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>170</td>
<td>35</td>
<td>3</td>
<td>75</td>
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<tr>
<td>25</td>
<td>115</td>
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</tr>
<tr>
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<td>6</td>
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<td>45</td>
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<td>50</td>
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<td>150</td>
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<tr>
<td>70</td>
<td>700</td>
<td>11</td>
<td>350</td>
<td>150</td>
</tr>
</tbody>
</table>

*L for shoulder taper equals Shoulder Width x Speed.

Figures shown are for 10' shoulder.
What is Missing?
Equipment for the Flagger

- Stop/Slow Paddle
- Red Flag (emergency only)
- Traffic Cones

Replace with reflective cone
Flagger

Personal Protective Equipment and High Visibility Clothing

PPE program should contain:

• Identification and evaluation of hazards
• PPE selection, maintenance and use
• Employee training
• Continuous program review
Head Protection

ANSI approved hard hats must be worn to protect against impact and penetration of anticipated hazards, including electrical shock.
Foot and Leg Protection

• For protection against:
  – falling or rolling objects
  – sharp objects
  – molten metal and hot surfaces
  – wet, slippery surfaces

Workers should use appropriate foot guards, safety shoes or boots and leggings
Eye and Face Protection

• Protection should be based on kind and degree of hazard present and should be:
  – ANSI approved
  – Reasonably comfortable
  – Fit properly
  – Durable
  – Cleanable
  – Provide clear/unobstructed vision
  – UV Lenses are recommended for safety glasses when worker is exposed to sunlight
Ear Protection

Exposure to high noise levels can cause irreversible hearing loss or impairment

- Noise can also create physical and psychological stress
- Disposable earplugs should be used once and thrown away
- Non-disposable ones should be cleaned after each use for proper maintenance
Arm and Hand Protection

- Burns, cuts, electrical shock, amputation and absorption of chemicals are examples of hazards associated with arm and hand injuries
- Insulating gloves and sleeves must conform to ANSI standards
High Visibility Clothing

*High visibility clothing* refers to reflective garments that workers should wear whenever their workplace contains hazards related to low visibility or when they work near vehicles or moving equipment.
Class 1 Garments

- For workers who have ample separation from traffic
- Traffic speeds do not exceed 25 mph
- Delivery vehicle drivers, parking lot attendants, warehouse workers
Class 2 Garments

- For workers who need visibility in inclement weather conditions
- Traffic speeds between 25 & 50 mph
- Targeted at law enforcement conducting traffic control, toll gate personnel, airport ground crews, etc.
Class 3 Garments

- Highest level of conspicuity
- Wide range of weather conditions
- Traffic speed exceeds 50 mph
- Targeted at road construction, utility workers, survey crews, etc.
Respiratory Protection

Respiratory protection is required when there is a potential exposure to harmful dust, fogs, fumes, mites, gases, sprays, or vapors.

Employers/Workers have responsibility for:

* Providing (Employer)
* Inspection
* Cleaning
* Training
* Medical Requirements

* Wearing
* Maintenance
* Storage
* Record Keeping
* Respirator Fit
Use of Hand-Signaling Devices by Flaggers
Use of Hand-Signaling Devices by Flaggers

**Preferred Method**
STOP/SLOW Paddle

**Emergency Situations Only**
Red Flag

TO STOP TRAFFIC
Red Flags are for Emergencies Only
Use of Hand-Signaling Devices by Flaggers
Flagger Stations

*Stand either on the shoulder adjacent to the road user being controlled or in the closed lane prior to stopping road users

*Be clearly visible to the first approaching road user at all times

*Be stationed sufficiently in advance of the workers to warn them of approaching danger

*Stand alone
• Flaggers should use STOP/SLOW paddles

• The STOP sign should be octagonal with a red background and white letters and border

• The SLOW sign is the same shape, with an orange background and black letters and a border
Do Not:

- Mingle with crew
- Leave your post
- Turn your back
- Sit down on job

Compliant Class 2 vest

Non-compliant vests
Flagger Safety

- Stand in the Proper Location
- Remain Attentive
- Always Face Traffic
- Communicate Effectively
- Clothing and Equipment Meet Standards
- Proper Training
Traffic Control Devices
Traffic Control Devices

**Signs**

a. Regulatory signs  
b. Warning signs  
c. Guide signs  

**Portable Changeable Message Signs**
Traffic Control Devices

Arrow Displays

a. Arrow display specifications
b. Arrow display application

High-Level Warning Devices
Traffic Control Devices

Channelizing Devices

- Cones
- Panels
- Drums
- Barricades
- Portable barriers
- Temporary raised islands
- Other channelizing devices
Traffic Control Devices

Markings
- Pavement marker applications
- Interim markings
- Raised pavement markers
- Delineators

Lighting Devices
- Function
- Floodlights
- Flashing identification beacons (Flashing electric lights)
- Steady burning electric lamps
- Warning lights
Traffic Control Devices

Other Devices

- Impact attenuators
- Portable barriers
- Temporary traffic signals
- Rumble strips
- Screens
- Opposing traffic lane divider
Professionalism

• Mentally alert
• Good physical condition
• Courteous
• Authoritative

Remember, the safety of your co-workers depends on proper work zone design and the Flagger!!