Understanding Work Zones
Module Objectives

- Discuss sources of WZ standards & guidelines
- Define the component parts of a TTC zone
  - WZ terminology
- Discuss patrol vehicle positioning
Where Can Federal WZ Standards be Found?

- Manual on Uniform Traffic Control Devices (MUTCD)
Manual on Uniform Traffic Control Devices

- **MINIMUM** standards
  - States and local agencies can have more restrictive standards
  - Applies to **ALL** streets and highways open to the public travel

2-4
The MUTCD

- **Does not** address use of law enforcement officers in WZ
- **Does not** show location of police vehicles
1. Advance Warning Area

- Uses advance warning signs to warn drivers
- Where drivers make their decisions!

No warning

Surprise!!

Erratic Maneuver

Crash
Advance Warning Signs

- Usually, 3-step process:
  - 1\textsuperscript{st} sign: Gets their attention
  - 2\textsuperscript{nd} sign: Tells the problem
  - 3\textsuperscript{rd} sign: Tells them what to do
- Diamond shape
- Orange in WZ
- 48” x 48”
# MUTCD Suggested Advance Warning Sign Spacing

<table>
<thead>
<tr>
<th>Road Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban (low speed*)</td>
<td>100’</td>
<td>100’</td>
<td>100’</td>
</tr>
<tr>
<td>Urban (high speed*)</td>
<td>350’</td>
<td>350’</td>
<td>350’</td>
</tr>
<tr>
<td>Rural</td>
<td>500’</td>
<td>500’</td>
<td>500’</td>
</tr>
<tr>
<td>Freeways and Expressways</td>
<td>1,000’</td>
<td>1,500’</td>
<td>2,640’</td>
</tr>
</tbody>
</table>

* Speed determined by local agency
Parts of a WZ
Sign spacing is critical!

To give TIME to analyze and decide on maneuver
Portable Changeable Message Signs (PCMS)

- Sometimes used before the advance warning area
- Supplemental devices
- Optional devices
2. Transition

- Typically uses channelizing devices to form a taper

A taper is a gradual transition
Channelizing Devices

- Cones
  - Two white bands for night use!
  - Short duration only
- Drums
- Others
Minimum length of **MERGING taper** (L) in feet necessary to close a 12-ft lane

<table>
<thead>
<tr>
<th>SPEED</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>125</td>
</tr>
<tr>
<td>30</td>
<td>180</td>
</tr>
<tr>
<td>35</td>
<td>245</td>
</tr>
<tr>
<td>40</td>
<td>320</td>
</tr>
<tr>
<td>45</td>
<td>540</td>
</tr>
<tr>
<td>50</td>
<td>600</td>
</tr>
<tr>
<td>55</td>
<td>660</td>
</tr>
<tr>
<td>60</td>
<td>720</td>
</tr>
<tr>
<td>65</td>
<td>780</td>
</tr>
<tr>
<td>70</td>
<td>840</td>
</tr>
<tr>
<td>75</td>
<td>900</td>
</tr>
</tbody>
</table>

Most lanes are 12’
One-Lane Two-Way Taper

- On two-lane roads
- Flaggers required
  - “Flagging taper”

50-100’ MAX

Special case!!
Speeds are Critical in Work Zones!

The faster the speed:
- The less time motorists will have to make their maneuvers
- The more severe the crash

This is called "Perception- Reaction Time"
Perception-Reaction Time (PRT)

- The amount of TIME drivers need to perceive, analyze, react and complete their maneuvers

- $PRT = 2.5$ sec. under "normal" conditions
- $PRT = 5+$ sec. for work zones!!!
Converting mph to fps

- Multiply the speed in miles per hours by **1.47** to obtain the number of feet a vehicle travels in one second

**Example:**

60 mph = (60)(1.47) = 88 fps

**At 60 mph you travel 88 feet in ONE second!**
ESTIMATING: Converting mph to fps

- Approximate by using 1.5
  - The number plus its half

Example:
60 mph = 60 + 30 = 90 fps
<table>
<thead>
<tr>
<th>Feet Traveled in One Second</th>
<th>37</th>
<th>51</th>
<th>66</th>
<th>81</th>
<th>88</th>
<th>96</th>
<th>110</th>
<th>118</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traveling Speed (mph)</td>
<td>25</td>
<td>35</td>
<td>45</td>
<td>55</td>
<td>60</td>
<td>65</td>
<td>75</td>
<td>80</td>
</tr>
</tbody>
</table>
## Distance Traveled During the PRT

<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>Feet traveled in 2.5 sec.</th>
<th>Feet traveled in 5.0 sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>92</td>
<td>183</td>
</tr>
<tr>
<td>35</td>
<td>129</td>
<td>257</td>
</tr>
<tr>
<td>45</td>
<td>165</td>
<td>331</td>
</tr>
<tr>
<td>55</td>
<td>202</td>
<td>404</td>
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<tr>
<td>60</td>
<td>220</td>
<td>440</td>
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<tr>
<td>65</td>
<td>239</td>
<td>478</td>
</tr>
<tr>
<td>75</td>
<td>276</td>
<td>551</td>
</tr>
<tr>
<td>80</td>
<td>294</td>
<td>588</td>
</tr>
</tbody>
</table>

Football Field = 300 ft.!!
Arrow Panels

- Supplemental device
- Used in addition to signs

Arrows are used **ONLY** when a lane is closed and merging is required
The “CAUTION” Mode

- Displayed for shoulder operations
- No arrows if all lanes are open
Use of the "CAUTION" Mode for Shoulder Work

[Diagram showing shoulder work setup with notices and attenuator]

See Note 1

Truck-Mounted Attenuator (optional)
Preferred Arrow Panel Location

- For a stationary lane, panel should be located on the shoulder at the beginning of the taper
3. Activity Area

- 3 Sub-areas
  - Buffer space
  - Work space
  - Traffic space
3. Activity Area

Work Space

Buffer Space

Traffic Space

Not to scale
Buffer Space

- Recovery area for errant vehicles
- Protects workers
- **ALWAYS** empty
  - No vehicles or equipment allowed
- **Highly** recommended

A "FORGIVING DESIGN"

DO NOT PARK IN BUFFER SPACE!
Do not park in buffer space!

- Your vehicle is not equipped with an impact attenuator!
- Not a "forgiving design"
<table>
<thead>
<tr>
<th>Speed (mph)</th>
<th>Buffer (ft.)</th>
<th>Buffer (ft.)</th>
<th>Buffer (ft.)</th>
<th>Buffer (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>115</td>
<td>25</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>25</td>
<td>155</td>
<td>200</td>
<td>250</td>
<td>305</td>
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<td>40</td>
<td>305</td>
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<tr>
<td>45</td>
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</tr>
</tbody>
</table>
Determining distances in the field

- Use odometer for longer distances
  - 1/10 mile = 525’
- Use skip pattern for short ones

"10-30 SKIPS"

- 10 skips = 400’
The space open for public to pass **safely**
4. Termination Area

- May (optionally) include
  - Termination taper
    - 100’ min.
  - END ROAD WORK sign
Positioning your patrol car

Based on what you’ve learned so far, where would be the safest place to position a patrol vehicle for “presence”, and why?
- BEFORE the transition
  - NOT IN BUFFER
  - On the SHOULDER or MEDIAN
  - Between the 2\textsuperscript{nd} and 3\textsuperscript{rd} sign
    - Where we need the motorists to pay most attention to what they need to do ahead.
  - Facing traffic
  - Headlights OFF
  - Emergency lights ON

YOU SHOULD BE HERE!
Why Face Traffic??

- Larger field of view
  - More alert!
- Engine protects you
  - Not the gas tank!
- Air bags protect you
- Allows your position to be dynamic

Case by case!
Your Position is Dynamic!

- May need to move your vehicle often
- Minimizes crashes at the end of the queue
Use of Emergency Lights

- Use emergency lights only during nighttime.
- Headlights off.
- May be helpful during the day.
If Traffic Backs Up....

- Queuing beyond the advance warning signs may cause **rear end crashes**
- **Move** your vehicle back (toward traffic) to stay ahead of the traffic queue

**Stay far enough ahead** of stopped traffic to give fast-moving cars plenty of time to stop (approx. ¼ mile.)
Moving Operations

- **The work zone** moves continuously
  - Example: Striping
- May use **truck-mounted attenuators** (TMA) to protect workers
  - Unlike patrol vehicles, designed for impacts
Installation and Removal of Stationary Lane Closures

- Devices are installed "with the flow of traffic".
- Removed "against the flow of traffic".
- Except for detours.
- Reverse the above instructions.
Officer’s Visibility

SAFE?

VISIBLE?
**High-Visibility Safety Apparel**

- **Wear** if outside the patrol vehicle
- Retroreflective trim provides **human form outline**
  - ANSI Class 2 or 3
- Specially designed to provide **access to holsters**
Module Recap

- Where do we find WZ standards & guidelines?
- What are the component parts of a TTC zone?
- What is a buffer space?
- Where is the patrol vehicle positioned?
- How are devices installed and removed?