FHWA Nine Proven Crash Countermeasures

Addressing Critical Safety Concerns
Nine Proven Crash Countermeasures

• Safety Edge
• Road Safety Audits (RSAs)
• Rumble Strips and Rumble Stripes
• Median Barriers
• Roundabouts
• Left- and Right-Turn Lanes
• Yellow Change Intervals
• Median and Pedestrian Refuge Areas
• Walkways

http://safety.fhwa.dot.gov/policy/memo071008/
The Safety Edge

- Targeted at severe roadway departure crashes.
- Crashes involving pavement edge drop-offs greater than 2.5 inches – more severe and more likely to be fatal than other roadway departure crashes.
- Pavement edges – may contribute to a significant portion of roadway departure crashes on rural roads with narrow shoulders.
The Safety Edge (continued)

- Paving technique where the interface between the roadway and graded shoulder is paved at an angle to eliminate vertical drop-off.
  - 30 degree angled wedge.
- Created by fitting resurfacing equipment with a device that extrudes the shape of the pavement edge as the paver passes.
- Very low cost countermeasure.
- Should be incorporated in all Federal-Aid new paving and resurfacing projects.
Safety Edge Effectiveness

1980’s Research
- 45 degree pavement wedge effective in mitigating crash severity.

Georgia DOT Demonstration Project
- Beneficial to flatten wedge to a 30 degree angle (current Safety Edge).

Current Research Findings
- 30 degree angle is more effective than 45 degree wedge.
Safety Edge Resources

Every Day Counts Web Page
http://www.fhwa.dot.gov/everydaycounts/technology/safetyedge/

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Road Safety Audits (RSA)

- Formal safety performance examination by an independent, multi-disciplinary team.
  - What road elements present a safety concern?
  - What are the opportunities to eliminate/mitigate the safety concern?
- Very low cost countermeasure.
- Can achieve up to 60 percent crash reduction.
- Implemented through an RSA Policy.
RSA Resources

Road Safety Audits/Assessments Training  
NHI Course 380068

RSA Peer-to-Peer Program  
(866) P2P-FHWA  
SafetyP2P@dot.gov

FHWA Road Safety Audit Web Page  
http://safety.fhwa.dot.gov/rsa/

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Rumble Strips and Rumble Stripes

• Rumble Strips
  – Raised or grooved patterns on the roadway that provide an audible warning (rumbling sound) and a physical vibration to alert drivers that they are leaving the driving lane

• Rumble Stripes
  – Rumble strips that coincide with centerline or edgeline striping

![Rumble Strip Image](image1.png)
![Rumble Stripe Image](image2.png)
Rumble Strips and Rumble Stripes (continued)

• Low cost countermeasure.

• Should be installed on:
  – All new rural freeways.
  – All new rural two-lane highways with travel speeds of 50 mph or greater.

• Can also be considered for certain conditions on:
  – Rural two-lane road projects.
  – Rural freeways and rural two-lane highways.
# Rumble Strip/Stripe Effectiveness

<table>
<thead>
<tr>
<th>Crash Reductions at Sites with ...</th>
<th>Centerline Rumble Strips/Stripes</th>
<th>Continuous Shoulder Rumble Strips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural two-lane roads – total</td>
<td>30%</td>
<td>15%</td>
</tr>
<tr>
<td>Rural two-lane roads – injury</td>
<td>44%</td>
<td>29%</td>
</tr>
<tr>
<td>Urban two-lane roads – total</td>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>Urban two-lane roads - injury</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>Rural multi-lane divided roads – total</td>
<td>22%</td>
<td></td>
</tr>
<tr>
<td>Rural multi-lane divided roads – injury</td>
<td>51%</td>
<td></td>
</tr>
<tr>
<td>Rural freeways – total</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>Rural freeways – injury</td>
<td>16%</td>
<td></td>
</tr>
</tbody>
</table>

Target crashes for centerline rumbles are opposite direction collisions; for shoulder rumbles are SVROR. Injury crashes include fatal and other injury crash types.
Rumble Strip/Stripe Resources

FHWA Rumble Strip/Stripes Web Page
http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/

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Median Barriers

• Longitudinal barriers used to separate opposing traffic on a divided highway.
  – W-beam guardrail.
  – 42-inch tall concrete F-Shape or Constant Slope barriers.
  – High-tension cable median barriers.
• Medium to high cost countermeasure.
• Significantly reduce occurrence of cross-median crashes and the overall severity of median-related crashes.
• Use in medians up to 50 feet wide or wider.
Median Barrier Resources

FHWA Roadside Hardware Policy and Guidance Web Page
http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hard ware/

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Roundabouts

• Circular intersections with specific design and traffic control features that ensure low travel speeds (less than 30 mph).

• Medium to high cost countermeasure.

• Can reduce fatal and injury crashes in the range of 60-87 percent.

• Should be considered for:
  – All new intersections on Federally-funded highway projects.
  – Existing intersections identified as needing major safety or operational improvements.
Roundabout Resources

FHWA Roundabout Web Page
http://safety.fhwa.dot.gov/intersection/roundabouts/

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Left- and Right-Turn Lanes at Stop-Controlled Intersections

Left-Turn Lanes
- Auxiliary lanes for storage or speed change of left-turning vehicles.

Right-Turn Lanes
- Lanes that provide a separation between right-turning traffic and adjacent through traffic at intersection approaches.
Left- and Right-Turn Lanes at Stop-Controlled Intersections (continued)

• Medium to high cost countermeasure.
• Should be considered on 3- and 4- leg, 2-way stop-controlled intersections with:
  – Significant turning volumes.
  – A history of turn-related crashes.
# Left- and Right-Turn Lane Effectiveness

<table>
<thead>
<tr>
<th>Crash Reductions at Sites with ...</th>
<th>Left-Turn Lanes</th>
<th>Right-Turn Lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Roads (Major Road VPD – 1,600-32,400; Minor Road VPD – 50-11,800)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Crashes</td>
<td>28-44% (one approach)</td>
<td>48% (both approaches)</td>
</tr>
<tr>
<td>Fatal and Injury Crashes</td>
<td>35-55% (one approach)</td>
<td></td>
</tr>
<tr>
<td>Urban Roads (Major Road VPD – 1,520-40,600; Minor Road VPD – 200-8,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Crashes</td>
<td>27-33% (one approach)</td>
<td>47% (both approaches)</td>
</tr>
<tr>
<td>Fatal and Injury Crashes</td>
<td>29% (one approach)</td>
<td></td>
</tr>
<tr>
<td>Rural and Urban Roads (Major Road VPD – 1,520-40,600; Minor Road VPD – 25-26,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Crashes</td>
<td>14%(one approach)</td>
<td>26% (both approaches)</td>
</tr>
<tr>
<td>Fatal and Injury Crashes</td>
<td>23% (one approach)</td>
<td></td>
</tr>
</tbody>
</table>
Left- and Right-Turn Lanes at Stop-Controlled Intersection Resources

FHWA Intersection Safety Web Page
http://safety.fhwa.dot.gov/intersection/

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Yellow Change Intervals

- Displayed to warn drivers of the impending change in right of way assignment.
- Very low cost countermeasure.
- Should be determined using kinematics formula and factoring in prevailing speed of traffic.
- Additional interval time considered for locations with:
  - Significant truck traffic.
  - Older drivers.
  - Where more than 3 percent of the traffic is entering on red.
Yellow Change Interval Effectiveness

Violation and Crash Reductions at Sites with Increased Yellow Change Interval

- Average Red-Light Violations: 36%
- Total Crashes: 8%
- Right Angle Crashes: 4%
- Pedestrian and Bicycle Crashes: 37%
Yellow Change Interval Resources

FHWA Safety Red-Light Running Web Page
http://safety.fhwa.dot.gov/intersection/redlight/

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Median and Pedestrian Refuge Areas

Median Refuge
- Area between opposing lanes of traffic, excluding turn lanes.
  - Open – pavement markings only.
  - Channelized – raised medians or islands.

Pedestrian Refuge
- Raised island in the street at intersection or midblock locations to separate crossing pedestrians from motor vehicles.
- Also called crossing island, center island, refuge island, median slow point.
Median and Pedestrian Refuge Areas (continued)

- Low cost countermeasure.
- Demonstrated reductions in pedestrian crashes:
  - Marked crosswalks – 46%
  - Unmarked crosswalks – 39%
- Considered for curbed sections of multi-lane roadways in urban and suburban areas:
  - Significant number of pedestrians.
  - High traffic volumes.
  - Intermediate or high travel speeds.
Median and Pedestrian Refuge Area Resources

FHWA Safety Pedestrian and Bicycle Safety Web Page
http://safety.fhwa.dot.gov/ped_bike/

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# Walkways

<table>
<thead>
<tr>
<th>Walkway Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pedestrian Walkway</strong></td>
<td>A continuous way designated for pedestrians and separated from motor vehicle traffic by a space or barrier.</td>
</tr>
<tr>
<td><strong>Shared Use Path</strong></td>
<td>A bikeway or pedestrian walkway physically separated from motorized vehicular traffic by an open space or barrier either within a highway right-of-way or within an independent right-of-way.</td>
</tr>
<tr>
<td><strong>Sidewalk</strong></td>
<td>Walkway that is paved and separated from the street, generally by curb and gutter.</td>
</tr>
<tr>
<td><strong>Roadway Shoulder</strong></td>
<td>Used in rural or suburban areas where sidewalks and pathways are not feasible, to provide an area for pedestrians to walk next to the roadway.</td>
</tr>
</tbody>
</table>
Walkways (continued)

• Medium to high-cost countermeasure.

• Considered for use:
  – Along both sides of streets and highways in urban areas, particularly near school zones and transit locations.
  – Along both sides of rural highways routinely used by pedestrians.
## Walkway Effectiveness

<table>
<thead>
<tr>
<th></th>
<th>“Walking Along the Road” Pedestrian Crashes</th>
<th>All Types of Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sidewalks or Pathways on Both Sides of a Street</td>
<td>88%</td>
<td></td>
</tr>
<tr>
<td>Widened Shoulders (min 4 ft) – Paved – All Roads</td>
<td>71%</td>
<td></td>
</tr>
<tr>
<td>Widened Shoulders (min 4 ft) – Paved – Rural Roads</td>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>Widened Shoulders (min 4 ft) – Unpaved – Rural Roads</td>
<td>25%</td>
<td></td>
</tr>
</tbody>
</table>
Walkway Resources

FHWA Safety Pedestrian and Bicycle Safety Web Page
http://safety.fhwa.dot.gov/ped_bike/

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FHWA Safety Program Web Site
http://safety.fhwa.dot.gov