

FHWA Nine Proven Crash Countermeasures

Addressing Critical Safety Concerns



U.S. Department of Transportation
Federal Highway Administration



Safe Roads for a Safer Future
Investment in roadway safety saves lives

<http://safety.fhwa.dot.gov>



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 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

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

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_hardware/

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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

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

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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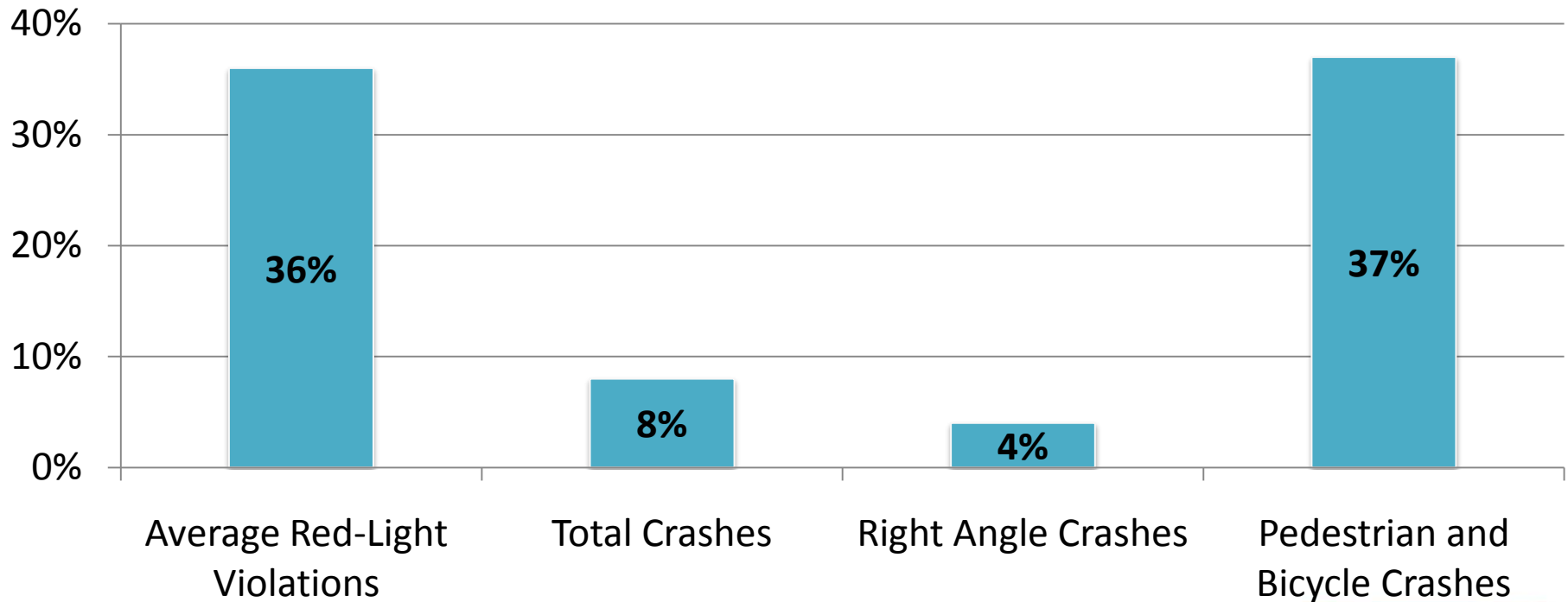
Yellow Change Intervals

- 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



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

Pedestrian Walkway

- A continuous way designated for pedestrians and separated from motor vehicle traffic by a space or barrier.

Shared Use Path

- 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.

Sidewalk

- Walkway that is paved and separated from the street, generally by curb and gutter.

Roadway Shoulder

- 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.

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

	“Walking Along the Road” Pedestrian Crashes	All Types of Crashes
Sidewalks or Pathways on Both Sides of a Street	88%	
Widened Shoulders (min 4 ft) – Paved – All Roads	71%	
Widened Shoulders (min 4 ft) – Paved – Rural Roads		29%
Widened Shoulders (min 4 ft) – Unpaved – Rural Roads		25%

Walkway Resources

FHWA Safety Pedestrian and Bicycle Safety Web Page

http://safety.fhwa.dot.gov/ped_bike/

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<http://www.fhwa.dot.gov/field.html>

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