

# A Guide for Effective Countermeasures for Low Volume Road Facilities in the Southeast USA

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# Background

- ◆ Large portion of US network
  - 20% of National Highway System
  - 50% of Federal Aid System
- ◆ High crash rates
  - More than 50% of fatalities
- ◆ Low priority in safety improvements
- ◆ How to improve safety



# STC States Statistics

State	Fatalities Rural	Percent	Percent Rural Highway	Percent Rural Population
AL	647	62	73.2	41.0
AR	362	66	83.3	43.8
FL	1,388	44	29.7	8.8
GA	603	39	59.2	25.0
KY	607	73	81.2	41.6
LA	368	49	71.3	26.8
MS	675	98	83.2	50.7
NC	902	62	61.5	33.9
SC	612	60	74.0	33.7
TN	464	45	67.2	33.6
VA	477	63	64.8	24.6
WV	169	63	82.8	51.3
USA	18,590	50	70.7	19.2



Source: National Highway Traffic Safety Administration (2018); US Census Bureau (2010)

# Objectives

- ◆ Synthesize current knowledge
  - Evaluate and prioritize contributing crash factors
  - Identify countermeasure effectiveness
  - Recognize new countermeasures



# LVR Safety Issues

- ◆ Roadside features
  - Trees and poles
  - Culverts
- ◆ Cross section elements
  - Lane and shoulder widths
- ◆ Alignment
  - Horizontal curvature
  - Vertical grades



# LVR Countermeasures

(1/2)

- ◆ Based on crash type avoidance
- ◆ Run-off-road
  - Lane and shoulder width widening
  - Shoulder paving
- ◆ Head on
  - Centerline rumble strips
- ◆ All crashes
  - Enhanced signs and markings



# LVR Countermeasures

(2/2)

- ◆ Safety treatment categories
  - Clear zones
  - Lane and shoulder improvements
  - Pavement markings
  - Pavement surface
  - Sign and signal improvements
  - Curve improvement
- ◆ Focus on cost/benefit



# Agency Survey

- ◆ Survey of State Highway Agencies
  - Web based
  - STC state and local agencies
  - Inventory of countermeasures and applications
  - Rate of effectiveness
- ◆ Response rate
  - 9 DOTs
  - 2 County





# Agency Survey Notes

- ◆ Network extent
  - Varied from none (GA) to 2/3 (KY)
- ◆ Policies
  - Cost/benefit
  - Road Safety Audits
  - Network screening based on crashes
- ◆ LVR volume
  - Paved: KY:1,000 vpd; TN 3,000 vpd
  - Unpaved: KY no unpaved; TN 500 vpd



# Survey Results

(1/2)

◆ Install edge rumble strips	1.14/7
◆ Install high friction surface	1.29/8
◆ Add pavement markings	1.38/8
◆ Install center rumble strips	1.43/7
◆ Install horiz. alignment signs	2.00/9
◆ Widen shoulders	2.11/6
◆ Add pavement markers	2.29/5



# Survey Results

(2/2)

◆ Remove fixed objects	2.44/6
◆ Increase clear zone	2.44/5
◆ Realignment	2.50/5
◆ Shield fixed objects	2.66/7
◆ Add left-turn lane	2.75/6
◆ Install adv. intersection	2.77/8
◆ Install retroreflective strips	3.00/7



# Survey Summary

- ◆ Response rate
  - 75% of STC states
- ◆ Practice trends
  - Some agreement
- ◆ Countermeasure effectiveness
  - Overall agreement
  - Subjective



# Countermeasure Summaries

- ◆ Identified 14 for summary sheets
- ◆ Varied characteristics
  - Cost
  - Effectiveness
  - Crash types
  - CMF and B/C



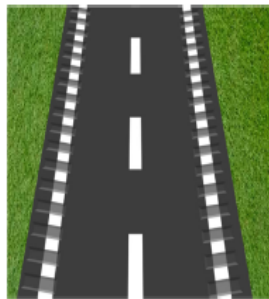
# Summary Table

Countermeasure	Affected Crashes	Cost	Maintenance		Effectiveness	
			Cost	Frequency	CMF	B/C
Install safety edge	Run-off-road Drop off	Low	-	20 years	0.85-0.92	40.9
Add centerline rumble strips	Run-off-road Head-on Sideswipe Adverse weather condition crashes	Low	-	10 years	0.75 to 0.85	26.1
Add edge line rumble strips	Run-off-road Adverse weather crashes	Low	-	10 years	0.78 to 0.90	71.8
Install advanced intersection warning signs	Right angle Rear end Head-on	Low	-	15 years	0.73; 0.425 (rear end)	-
Install horizontal alignment signs	Run-off-road	Low	\$1,280	5 years	0.70	43.5
Install retro- reflective strips on sign posts	Run-off-road Right angle Rear end Head-on	Low	-	-	-	-



# Summary Sheet

## ADD EDGE LINE RUMBLE STRIPS



**DESCRIPTION** "Rumble strips are raised or grooved patterns on the roadway that provide both an audible warning (rumbling sound) and a physical vibration to alert drivers that they are leaving the driving lane. Rumble strips may be installed on the center line of undivided highways, on the roadway shoulder, or on the roadway surface (transverse rumble strips)". [1]

**IMPLEMENTATION** Edge line rumble strips are installed to prevent run-off-road crashes [2]. The noise and vibration alerts a distracted or drowsy driver that a steering correction is required. When visibility is poor due to rain, fog, snow, and darkness, edge line rumble strips can

help keep drivers in their lane. Rumble strips should be installed on all new rural two-lane highways with posted speeds of 50 mph or greater [1]. Installing edge line rumble strips is a strong countermeasure for improving safety along rural, undivided, two-lane roads [3].

**CRASHES AFFECTED** Run-off-road; adverse weather condition

**EFFECTIVENESS** Installing edge line rumble strips in lower volume, narrower conditions has a CMF of 0.78 to 0.90 with a benefit-cost ratio of 71.8 [1]. Installing edge line strips following installation of centerline rumble strips can lower crash rates 47 percent and produce a 15.3 percent decline in fatal or injury crash rates [4].

**COST** Low; Initial investment: \$3,000 Cost of maintenance: N/A; Frequency of maintenance: 10 years (two applications)

### SOURCES

1. Atkinson, J. E., Chandler, B. E., Betkey, V., Weiss, K., Dixon, K., Giragosian, A., Donoughe, K. and O'Donnell, C. (2014). *Manual for Selecting Safety Improvements on High Risk Rural Roads*. U.S. Department of Transportation, Federal Highway Administration.
2. American Traffic Safety Services Association. (2015). *Preventing Vehicle Departures from Roadways*. Fredericksburg, VA, USA.
3. Golembiewski, G.A., Chandler, B. and Anderson, R., 2011. *Roadway Departure Safety: A Manual for Local Rural Road Owners*. U.S. Department of Transportation, Federal Highway Administration.
4. Olson, D., Sujka, M., and Manchas, B. (2013). *Performance Analysis of Centerline and Shoulder Rumble Strips Installed in Combination in Washington State*. Washington State Department of Transportation.

# Conclusions

- ◆ Synthesis effort identified
  - Promising countermeasures
  - Evaluated potential impacts
  - Summarized countermeasures
- ◆ Need for understanding issues to be resolved
- ◆ Effect of multiple countermeasures





# Recommendations

- ◆ Documentation of issues to be addressed
- ◆ Evaluation
  - Countermeasure applications in Southeast
  - Effect of multiple countermeasures
  - Impacts of systemic vs. spot applications



# Questions

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