

# Printing Instructions

## Desktop Print

Send the file called *RRRwD\_TradingCards\_Desktop.pdf* to your desktop printer. It is recommended to use manual feed and send even pages first. Flip printed pages on the long side. Place back in manual feed tray and then send odd pages starting on page 3. The short lines at the edge of the cards should be used as a cutting guide.

*Note: Pages seven and eight have multiple copies of the same card.*



TOOL



# Rx Systemic Analysis

How healthy is your road system?

**Symptoms**

Severe roadway departure crashes on curves.

**Diagnosis**

11% of all curves have 3 or more risk factors.

**Possible Risk Factors:**

- ⚡ Avg. Daily Traffic > 1,000 vehicles
- ⚡ Curve Radius < 1,000 feet
- + Intersection within Curve
- ⚡ Visual Trap within Curve
- ⚡ Severe Crash within Curve

**Lab Results:**

- Curve A ⚡
- Curve B ⚡ + ⚡
- Curve C ⚡ +
- Curve D ⚡
- Curve E ⚡ + ⚡

**Treatment**

Prioritize highest risk sites and treat with low-cost countermeasures such as chevron signs or rumble strips.

**Follow-Up**

Track and evaluate safety improvements. Further remediation can be implemented as needed.

**Systemic vs. Systemwide**  
Systemic does not mean treating all locations. It allows agencies to treat the highest-risk sites within limited budgets.



COUNTERMEASURE

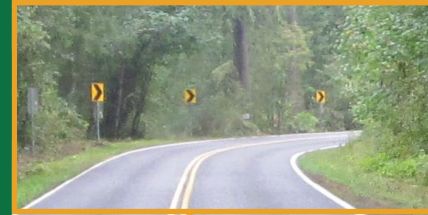
## Edge Line and Shoulder Rumbles



Source: FHWA

COUNTERMEASURE

## Curve Signing



Source: Thurston County, Washington

COUNTERMEASURE

## Edge and Center Line Markings



Source: Thurston County, Washington

COUNTERMEASURE

## Center Line Rumbles



Source: FHWA

COUNTERMEASURE

## SafetyEdge<sup>SM</sup>



Source: FHWA

Advance curve warning signs alert a driver to changes in the road alignment and chevrons delineate the curve. These countermeasures are effective to reduce:

- **Curve crashes**
- **Nighttime crashes**

[https://safety.fhwa.dot.gov/provencountermeasures/enhanced\\_delineation/](https://safety.fhwa.dot.gov/provencountermeasures/enhanced_delineation/)

#### Crash Reductions for Installing Chevrons

Nighttime Crashes on curves	25%
Non-intersection Fatal and Injury crashes	16%



Source: CMF Clearinghouse IDs 2438 and 2439

SafetyEdge<sup>SM</sup> is a paving technique producing a durable 30-degree edge to prevent tire-scrubbing, which often results in:

- **Head-on crashes**
- **Rollovers**
- **Run-off-road crashes**

<https://safety.fhwa.dot.gov/safetyEdge>

#### Crash Reductions on Two-Lane Rural Roads

Drop-Off	35%
Run-Off-Road	21%
Head-On RwD	19%
Fatal & Injury	11%



Source: CMF Clearinghouse IDs 9221, 9211, 9217, and 9205

Edge rumble strips are milled corrugations in pavement to alert inattentive drivers that they are leaving the roadway to reduce:

- **Run-off-road crashes**
- **Fixed object crashes**
- **Rollovers**
- **Distracted/drowsy driver crashes**

[https://safety.fhwa.dot.gov/roadway\\_dept/pavement/rumble\\_strips](https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips)

#### Fatal and Injury Reductions

Run-Off-Road (two-lane rural)	36%
Run-Off-Road (rural freeways)	17%



Source: CMF Clearinghouse IDs 3454 and 3447

Center rumble strips are milled corrugations in pavement to alert inattentive drivers that they are crossing the center line to reduce:

- **Head-on crashes**
- **Run-off-road left crashes**
- **Distracted/drowsy driver crashes**

[https://safety.fhwa.dot.gov/roadway\\_dept/pavement/rumble\\_strips](https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips)

#### Fatal and Injury Reductions

Head-On RwD (two-lane rural)	45%
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Source: CMF Clearinghouse ID 3360

A “systemic safety improvement” means a proven countermeasure(s) that is widely implemented based on high-risk roadway features that are correlated with particular severe crash types, rather than crash frequency.

(23 CFR Part 924.3)

<https://safety.fhwa.dot.gov/systemic/>

Systemic improvements:



- Supplements traditional analysis
- Used for crash types that are not concentrated such as rural roadway departures

You don't have to wait for a crash to happen to save lives!

Retroreflective pavement markings improve nighttime highway visibility. Wider lines (6”–8”) have an increased safety effect, reducing:

- **Curve crashes**
- **Nighttime crashes**
- **Head-on crashes**

[https://safety.fhwa.dot.gov/roadway\\_dept/night\\_visib/pavement-markings.cfm](https://safety.fhwa.dot.gov/roadway_dept/night_visib/pavement-markings.cfm)

#### Crash Reductions

Adding edge and center line marking	24%
Wider edge lines	22%



Source: AASHTO Highway Safety manual, CMF Clearinghouse IDs 101 and 4792

COUNTERMEASURE

## High Friction Surface Treatment



COUNTERMEASURE

## Slope Flattening



COUNTERMEASURE

## Clear Zone



COUNTERMEASURE

## Center Line Buffer Area



COUNTERMEASURE

## Barriers



COUNTERMEASURE

## Shoulder Widening



Establishing and maintaining a clear zone provides an unobstructed, traversable area where an errant driver can recover to reduce:

- Fixed Object Crashes
- Rollover Crashes

[https://safety.fhwa.dot.gov/roadway\\_dept/countermeasures/safe\\_recovery/clear\\_zones/](https://safety.fhwa.dot.gov/roadway_dept/countermeasures/safe_recovery/clear_zones/)

Increase Distance to Trees By	Crash Reduction
3 feet	22%
5 feet	34%
8 feet	49%
10 feet	57%
13 feet	66%



Source: NCHRP Report 440

Flattening steep slopes provides a better opportunity for vehicles to traverse the slope, reducing the likelihood of:

- Rollovers
- Fixed object crashes

Crash Reductions (%) for Single Vehicle Crashes			
Before Sideslope	After Sideslopes		
	1V:4H	1V:5H	1V:6H
1V:2H	10	15	21
1V:3H	8	14	19
1V:4H	–	6	12
1V:5H	–	–	6

Source: AASHTO Highway Safety Manual

HFST is a pavement surface treatment using calcined bauxite that provides exceptional skid-resistant properties at high friction demand locations such as curves, ramps, or intersections where problems with wet conditions, speed, or geometrics contribute to:

- Run-off-road crashes
- Head-on crashes

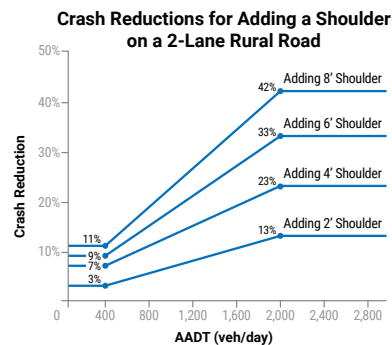
[https://safety.fhwa.dot.gov/roadway\\_dept/pavement\\_friction](https://safety.fhwa.dot.gov/roadway_dept/pavement_friction)

Crash Reductions on Curves	
Total	24%
Wet Crashes	52%



Source: CMF Clearinghouse (CMF ID's 7900 and 7901)

Adding a paved shoulder provides an errant driver an opportunity to regain control. Shoulders have been shown to be effective at reducing all roadway departure crashes. Adding shoulders may also allow for installation of rumble strips and the SafetyEdge<sup>SM</sup>.



Adapted from the AASHTO Highway Safety Manual (HSM) for 2 lane rural roads with no existing shoulder. For existing shoulders to be widened, see the HSM.

Roadside and median barriers are designed to redirect and slow vehicles while shielding them from obstacles likely to result in a more severe crash, such as:

- Rigid fixed objects
- Steep slopes
- Bodies of water
- Opposing traffic

[https://safety.fhwa.dot.gov/roadway\\_dept/countermeasures/reduce\\_crash\\_severity/](https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/)

The crashworthiness of barriers is evaluated through crash testing. The current crash test criteria is contained in the AASHTO Manual for Assessing Safety Hardware (MASH) 2016.



A center line buffer area provides extra space between the two solid center line markings, further separating opposing directions of traffic to reduce:

- Head-on Crashes

Facility Type	Buffer Width	*Head-on RWD Crash Reduction
2-lane	2 feet	35%
2-lane	4 feet	64%
2-lane	10 feet	90%
4-lane	Not significant	

\*Preliminary results from NCHRP Project 17-66



Source: Oregon State Police

### Tree Crashes

CRASH TYPE

CRASH TYPE

### Head-On Crashes



Source: Oregon State Police

CRASH TYPE

### Rollover Crashes



Source: FHWA

CRASH TYPE

### Curve Crashes



Source: FHWA

CRASH TYPE

### Rural Roadway Departure Crashes



Source: Oregon State Police

TOOL

### LOCAL ROAD SAFETY PLANS



Rollover crashes result in over 3,600 fatalities each year on rural roads, which is 30% of Rural Rwd fatalities.

- 44% of these rural fatalities are on curves
- 78% of these rural fatalities are where speed limits are 50 mph or higher



Credit: Bigmouse/iStock/Thinkstock

**Countermeasures**

- Flatten Slopes
- SafetyEdge<sup>SM</sup>
- Rumbles
- Friction
- Barrier



**LRSP Benefits**

- Defines and prioritizes achievable safety investments
- Serves as a communication tool
- Supports funding applications
- Creates a sustainable safety effort and greater awareness of road safety
- Supports development of lasting partnerships
- Supports reduction in severe crashes

[https://safety.fhwa.dot.gov/provencountermeasures/local\\_road/](https://safety.fhwa.dot.gov/provencountermeasures/local_road/)

“Do what you can, with what you have, where you are.”  
-Theodore Roosevelt



Head-on Rwd crashes (which include opposing direction sideswipes) result in over 3,300 fatalities each year on rural roads, which is 28% of Rural Rwd fatalities.

- 32% of these rural fatalities are on curves
- 84% of these rural fatalities are where speed limits are 50 mph or higher



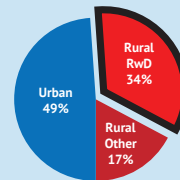
Credit: skalapendra/iStock/Thinkstock

**Countermeasures**

- Center Line Markings
- Rumbles
- SafetyEdge<sup>SM</sup>
- Center Buffer Area
- Median Barrier



Rural Roadway Departures account for 34% of all fatalities.



**Objectives to Reduce Rwd Crashes**

- 1<sup>st</sup> - Keep vehicles on the roadway.
- 2<sup>nd</sup> - Reduce the potential for crashes.
- 3<sup>rd</sup> - Minimize the severity of crashes.

**Countermeasures**

- Removal
- Maintain Clear Zone
- Rumbles
- Friction
- Barrier



Tree crashes result in over 2,300 fatalities each year on rural roads, which is 19% of Rural Rwd fatalities.

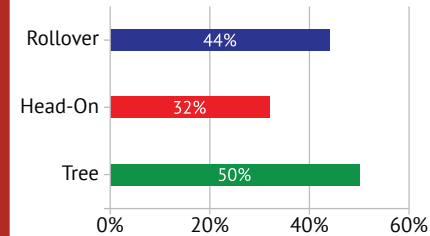
- 50% of these rural fatalities are on curves
- 63% of these rural fatalities are where speed limits are 50 mph or higher



Credit: skalapendra/iStock/Thinkstock

Curve crashes account for 42% of rural Rwd fatalities.

**Curve-Related Rural Rwd Fatalities**



**Countermeasures**

- Warning Signs
- Pavement Markings
- Friction
- Clear Zone
- Barrier









Reduce the potential for serious injury and fatal roadway departure crashes on all public rural roads by increasing the systemic deployment of proven countermeasures.

**BENEFITS**

- ▶ Partnerships
- ▶ Data-driven Deployment
- ▶ Safer Rural Roads



U.S. Department of Transportation  
**Federal Highway Administration**



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