

# Rollover Crashes

Roadway departures accounted for 57,475 highway deaths between 2016 and 2018. Rollovers were the most harmful event in 14,256 of these fatalities.

Rollovers<sup>1</sup> are the most harmful event in approximately 15 percent of all U.S. traffic fatalities each year and 25 percent of all roadway departure<sup>2</sup> (RwD) fatalities. There were 4,752 average annual RwD fatalities where the most harmful event

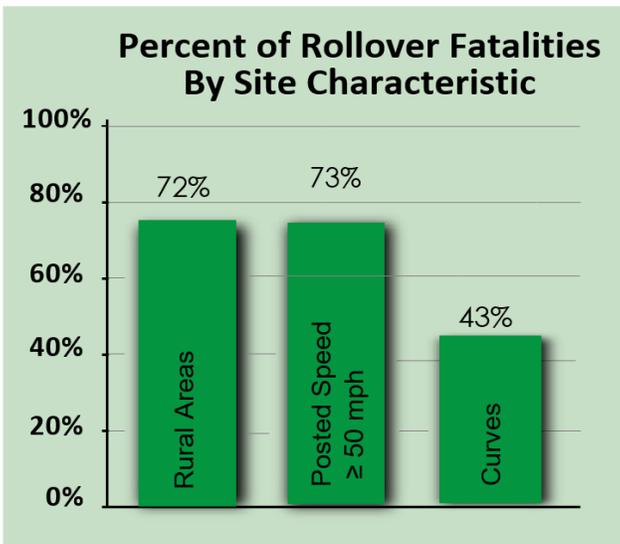


Figure 1. Characteristics of RwD fatalities involving rollover — FARS data 2016–2018.

was a rollover. Figure 1 shows the key characteristics of fatalities where rollovers are overrepresented in RwD crashes.

To reduce severe RwD crashes, FHWA recommends that State and local agencies consider three broad strategies:

1. Keep vehicles on the roadway.
2. Reduce the potential for crashes when vehicles leave the roadway.
3. Minimize the severity of crashes that do occur.

This brochure describes solutions that can be used to reduce fatal and serious injuries resulting from RwD rollover crashes in each of these three broad strategy areas (Ref. [Roadway Departure Safety](#)).

## Keeping Vehicles on the Roadway

- **Delineation Treatments** — Installing chevron signs on horizontal curves on rural two-lane undivided roads can

produce a 16 percent reduction in non-intersection fatal and injury crashes and a 25 percent reduction in nighttime, non-intersection crashes of all severity types (Ref. [FHWA-SA-17-058](#), CMF Clearinghouse IDs [2438](#) and [2439](#)). Installing new fluorescent curve signs or upgrading existing curve signs to fluorescent sheeting on rural two-lane undivided roads can result in approximately a 25 percent reduction in non-intersection fatal and injury crashes and a 34 percent reduction in nighttime, non-intersection crashes of all severity types (Ref. CMF Clearinghouse IDs [2433](#) and [2435](#)). Widening edge lines, along rural two-lane highways, from 4 inches to 6 inches can reduce non-intersection, non-winter fatal and injury crashes by approximately 37 percent (Ref. [FHWA-HRT-12-048](#), CMF Clearinghouse ID [4737](#)).

- **Shoulder and Edge Line Rumble Strips** — Two multistate studies and more than a dozen state studies report reductions in single-vehicle run-off-road crashes of 13 to 80 percent when milled rumble strips are installed on rural two-lane roads, with a widely accepted reduction of 17 percent for fatal and injury run-off-road crashes at rural freeway locations. A reduction of 36 percent can be expected for single-vehicle run-off-road injury crashes at rural two-lane roadways (Ref. [Rumble Strips and Rumble Stripes](#), CMF Clearinghouse IDs [3447](#) and [3454](#)).
- **Friction Treatment** — For locations with a history of RwD crashes and where the pavement surface is in good condition, high-friction surface treatment (HFST) is an effective solution to help reduce crashes. Research conducted by the National Transportation Safety Board and FHWA indicates that about 70 percent of wet pavement crashes

<sup>1</sup> Crashes where the most harmful event is a motor vehicle that rotates at least one-quarter turn onto its side or end (FARS code 1).

<sup>2</sup> Crashes in which the vehicle crosses an edge line or center line, or otherwise leaves the traveled way.



can be prevented or minimized by improved pavement friction. At least 41 states had applied HFST to at least one project site. A research report published by FHWA shows HFST is estimated to reduce wet crashes by 83 percent and total crashes by 57 percent (Ref. [FHWA-HRT-20-061](#)).



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## Reducing the Crash Potential When Vehicles Leave the Roadway

- **SafetyEdge<sup>SM</sup>** — Run-off-road crashes are twice as likely to result in a fatality when a near-vertical pavement edge is exposed (Ref. [SafetyEdge](#)). Installing the SafetyEdge<sup>SM</sup> during all paving or resurfacing projects allows drivers who drift off roadways to return to the pavement with much less potential to lose control. A five-state study showed the SafetyEdge<sup>SM</sup> will reduce fatal and injury crashes by 11 percent (Ref. [FHWA-SA-17-044](#), CMF Clearinghouse ID [9660](#)).
- **Recoverable Slopes** — A recoverable slope<sup>3</sup> is a slope on which a motorist may have a greater potential to retain or regain control of a vehicle by slowing or stopping. Flattening sideslopes from 1V:2H to 1V:6H can reduce single-vehicle run-off-road crashes by 21 percent (Ref. CMF Clearinghouse ID [4625](#)).
- **Clear Zones** — A clear zone is “the unobstructed, traversable<sup>4</sup> area provided beyond the edge of the through traveled way for the recovery of errant vehicles.” Removing fixed objects within the clear zone and/or widening the clear zone are proven strategies to reduce Rwd crashes (Ref. [Clear Zones](#)). AASHTO’s *Roadside Design Guide* includes suggestions for clear zone width based on average daily traffic, horizontal curve radius, design speed, and sideslopes.
- **Maintenance to Control Vegetation Growth** — Roadside vegetation can potentially contribute to the rollover of an errant vehicle. Vegetation management techniques and planting guidelines can help minimize the potential negative effects of roadside vegetation (Ref. [FHWA-SA-07-018](#)).

## Minimizing the Severity of Crashes

- **Shielding Objects and Slopes** — Shielding steep slopes by constructing longitudinal barriers, such as guardrails, can reduce the severity of Rwd crashes when it is not practical to flatten side slopes. Shielding objects and slopes, especially on curves, can reduce the severity of Rwd crashes.
- **Countermeasures for Drainage Ditches** — It is desirable to locate ditches outside the nominal clear zone. If constructing a reasonably traversable ditch is not practical, delineation countermeasures could be effective. If there is potential for higher severity crashes due to the location or geometry of a ditch, installation of a barrier may be an option (see the AASHTO *Roadside Design Guide*).
- **Culvert End Treatments** — The untreated end of a culvert could present an opening into which a vehicle could drop, resulting in an abrupt stop or rollover maneuver. Various treatments can usually be applied, including extension of the culvert out of the clear zone, beveling the end to match the sideslope, adding a bar or grate for larger culverts, or protecting the culvert end treatment through the use of guardrail (Ref. [FHWA-SA-09-024](#)).
- **Breakaway Sign Posts** — Road sign supports that are designed with breakaway features can minimize crash severity. [Section 2A.19](#) of the *Manual on Uniform Traffic Control Devices* states that ground-mounted sign supports “shall be breakaway, yielding, or shielded with a longitudinal barrier or crash cushion if within the clear zone.”

## For Additional Information

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<sup>3</sup> Foreslopes flatter than 1V:4H are generally considered recoverable.

<sup>4</sup> Foreslopes between 1V:3H and 1V:4H may be considered traversable but non-recoverable if smooth and free of fixed objects.

