

# Tree Crashes

Roadway departures accounted for 57,475 highway deaths between 2016 and 2018. Trees were the most harmful event in 10,697 of these fatalities.

Hitting a tree<sup>1</sup> is the most harmful event in approximately 10 percent of all U.S. traffic fatalities each year and 19 percent of all roadway departure<sup>2</sup> (RwD) fatalities. There were 3,566 average annual RwD fatalities between 2016 and 2018 where a tree was identified as the most harmful event. Figure 1 shows the key characteristics where trees are overrepresented in crashes.

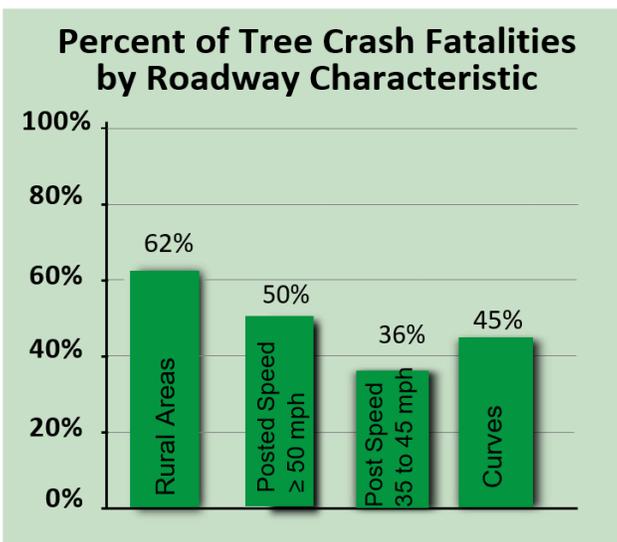


Figure 1. Characteristics of RwD fatalities associated with tree crashes as the most harmful event — FARS data 2016–2018.

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 crashes into roadside trees or shrubs for each of these three strategy areas (Ref. [Roadway Departure Safety](#)).

## Keeping Vehicles on the Roadway

- **Roadside Vegetation Control** — Clearing roadside vegetation, particularly trees close to the road, can enhance a driver's view of the roadway ahead, approaching vehicles, wildlife, and adjacent traffic control devices. In addition, reducing the shade from trees reduces ice on pavement and provides better growth of roadside grasses to prevent erosion (Ref. [FHWA-SA-07-018](#)).

- **Delineation Treatments** — Chevron signs, curve warning signs, and sequential flashing beacons can be applied to curves to warn drivers that the roadway alignment is changing. Installing chevron signs at 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 two-lane rural roads, with a widely accepted reduction of 17 percent for fatal and injury run-off-road crashes at

<sup>1</sup> Crashes where the most harmful event is an impact with a tree (FARS code 42). Shrubs (FARS code 41) are not included.

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



rural freeway locations. A reduction of 36 percent can be expected for single-vehicle run-off-road injury crashes on 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 can be prevented or minimized by improved pavement friction. At least 41 states have 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](#)).
- **Widen Clear Zones by Removing/Relocating Trees** — A clear zone is “the unobstructed, traversable<sup>3</sup> area provided beyond the edge of the through traveled way for the recovery of errant vehicles.” Removing trees 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. One Ohio study determined that the removal or relocation of roadside fixed objects for all road types reduced injury crashes by 38 percent (Ref. CMF Clearinghouse IDs [1024](#) and [1044](#)). Similarly, a Texas study determined that widening the rural two-lane roadway clear zone from 10 to 40 feet resulted in a reduction in single vehicle run-off-road injury crashes of 32 percent at tangent sections and 51 percent at horizontal curve locations (Ref. CMF Clearinghouse IDs [4127](#) and [4128](#)).
- **Maintenance to Control Vegetation Growth** — Vegetation management techniques and planting guidelines can help minimize the potential negative effects of roadside vegetation. The guidelines should consider and include maintenance of mowing limits within the clear zone as an initial activity to minimize future trees and shrubs. Tree removal should be prioritized at critical locations such as where trees are located close to the road at curves and intersections (Ref. [FHWA-SA-07-018](#)).

## Minimizing the Severity of Crashes

- **Shielding Trees** — Shielding trees by constructing longitudinal barrier, such as guardrails, can reduce the severity of Rwd crashes when it is not practical to remove roadside trees. Adding a barrier will likely result in more reported crashes because the barrier is closer to the traveled way and is a bigger target than the obstacle that it is shielding. For example, a Florida study determined that the total number of crashes for principal arterials other freeways and expressways increased by 6 percent with the installation of guardrail, but the fatal and severe injury crashes reduced by 16 percent (Ref. CMF Clearinghouse IDs [8391](#) and [8393](#)).



Guardrail shielding large tree. Source: FHWA

## For Additional Information

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

