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 tree¹ is the most harmful event in approximately 10 percent of all U.S. traffic fatalities each year and 19 percent of all roadway departure² (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.

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).

Figure 1 shows the key characteristics where trees are overrepresented in crashes.

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1 Crashes where the most harmful event is an impact with a tree (FARS code 42). Shrubs (FARS code 41) are not included.
2 Crashes in which the vehicle crosses an edge line or center line, or otherwise leaves the traveled way.

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The U.S. Department of Transportation
Federal Highway Administration
Reducing the Crash Potential When Vehicles Leave the Roadway

- **SafetyEdge℠** — 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℠ 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℠ 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 area provided beyond the edge of the 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 is it 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).

For Additional Information
For additional information, contact Joseph Cheung, FHWA Office of Safety, at joseph.cheung@dot.gov; or Tori Brinkly, FHWA Resource Center, at victoria.brinkly@dot.gov.

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