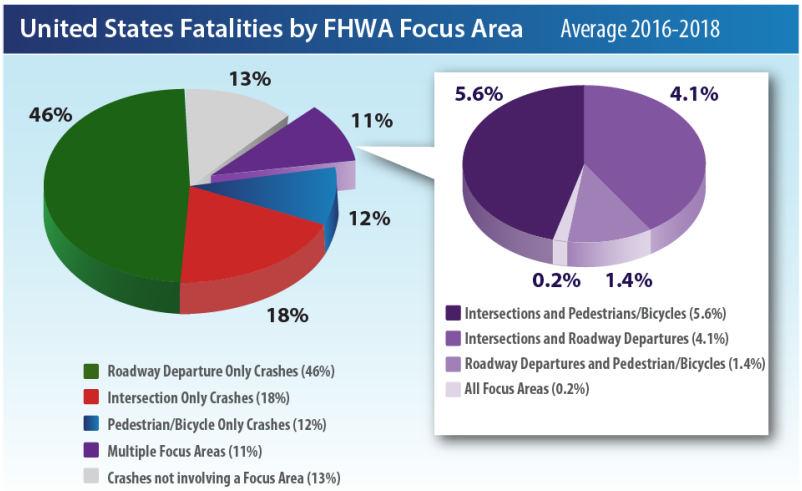
Roadway Departure Strategic Plan

June 2020

Each year Roadway Departures account for over half of all traffic fatalities in the United States. The Federal Highway Administration (FHWA) Roadway Departure (RwD) Team developed this Strategic Plan to provide a common vision for research, policy, and implementation to address these crashes.



SOURCE: FARS
FHWA definitions available at safety.fhwa.dot.gov/fas
NOTE: The total in the secondary pie chart does not exactly add up to 11% due to rounding.

The FHWA Roadway Departure Vision, Mission, and Goal

Vision

Pursue a proactive approach to addressing lane departure crashes on the Road to Zero.

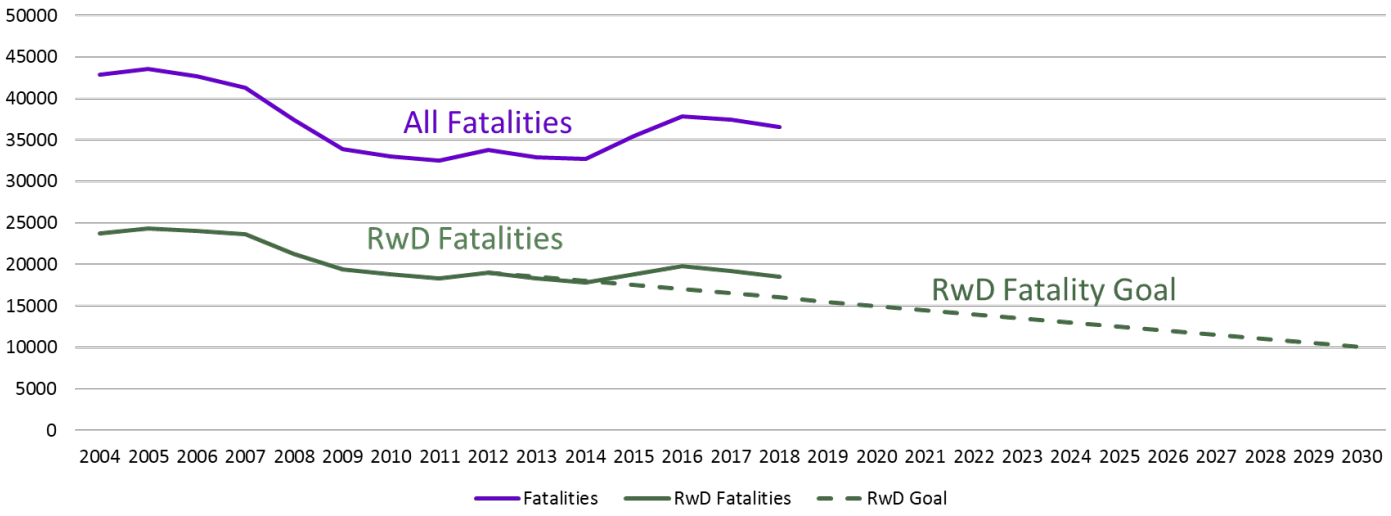
Mission

Exercise leadership in the highway community to reduce the risk of RwD-related fatalities and serious injuries. The FHWA's primary leadership role is with the engineering community and aims to assist transportation agencies to achieve their RwD-related SHSP goals through:

- Development, evaluation and deployment of life-saving countermeasures; and,
- Promoting data-driven application of safety treatments.

Goal

Reduce annual average national RwD fatalities to 10,000 by the year 2030. The FHWA RwD Team will pursue this goal by influencing both internal and external partners to plan strategically, implement RwD countermeasures systemically based on data, and promote safety performance in all facets of transportation decision-making.

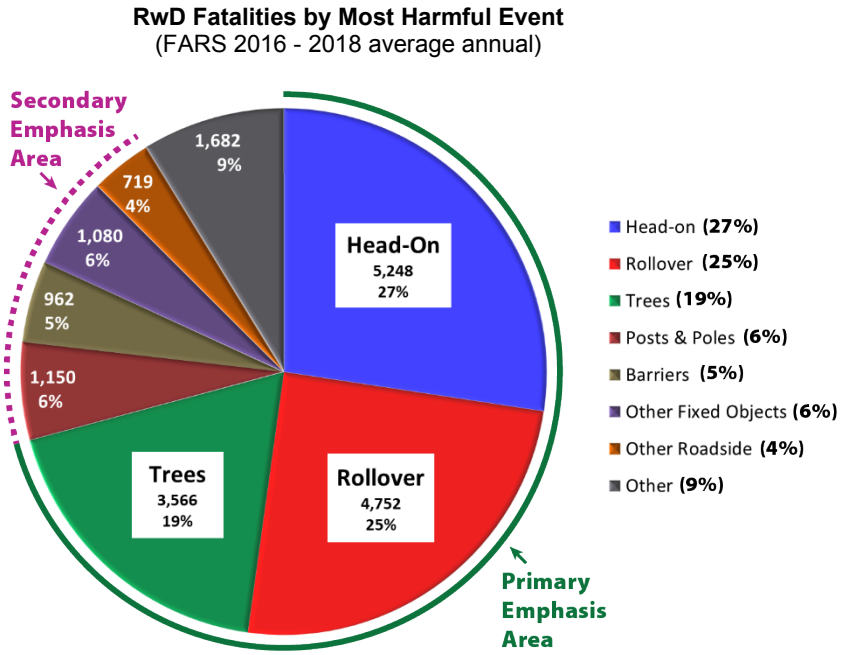


U.S. Department of Transportation
Federal Highway Administration

Safe Roads for a Safer Future
Investment in roadway safety saves lives
http://safety.fhwa.dot.gov

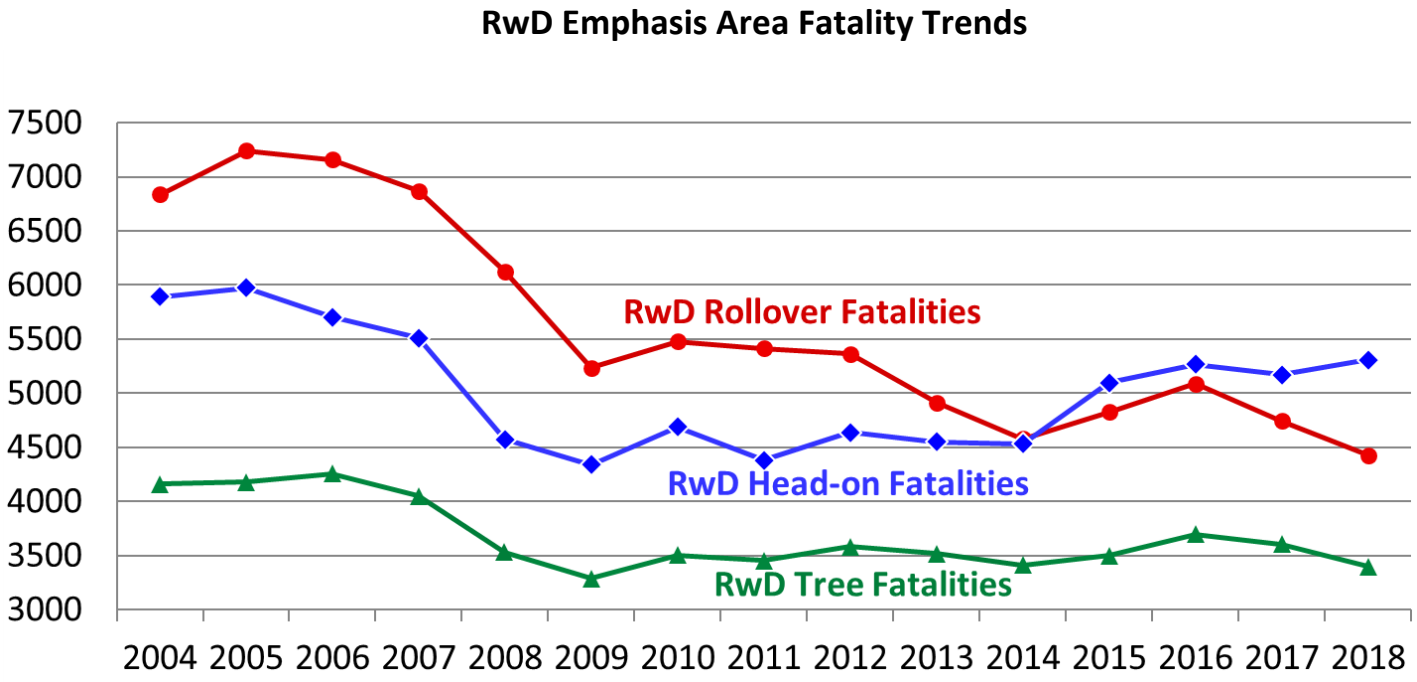
The Role of the Roadway Departure Strategic Plan

This Strategic Plan primarily serves as a tool to provide long-term focus for the FHWA RwD Team efforts using a data-driven approach. The FHWA defines RwD Crashes as those in which a vehicle crosses an edge line, a center line, or otherwise leaves the traveled way (also called lane departure by AASHTO). When considering the most harmful event in RwD fatalities, three crash types make up over 70 percent of the crashes. These three, head-on collisions, rollovers, and trees, are the **primary emphasis** of this strategic plan. **Secondary emphasis** is placed on reducing crashes with other fixed objects, including signs, poles, signals, and barriers as well as crashes involving roadside ditches and embankments. Some headway has been made in reducing the severity of rollover crashes as shown below.



Defining Roadway Departure Crashes (aka Lane Departure):

"A crash in which a vehicle crosses an edge line, a center line, or otherwise leaves the traveled way."



Internal Efforts

The RwD Team includes core members from three safety units within FHWA, each of which provide support and resources to Division Offices. Each of these units and the Divisions fulfill varying needs in FHWA's efforts to reduce RwD fatalities. The primary roles of each follow.

- The Office of Safety develops and updates policy and guidance related to new and existing research, and to market best practices and innovative solutions to State and local transportation agencies.
- The Office of Safety R&D analyzes RwD issues through research and development.
- The Resource Center Safety and Design delivers knowledge critical in saving lives via technical assistance and training.
- Division Offices provides guidance, oversight and assistance in the implementation of RwD safety countermeasures within specific States or federal land agencies.

The RwD Team uses an integrated roadmap process to specify short-term and mid-term efforts to achieve the goals of the Strategic Plan. It is reviewed and updated annually. Efforts in the RwD Roadmap include projects aligned under three objectives:

1. Keep vehicles on the roadway and in their directional lane,
2. Reduce the potential for crashes when vehicles leave their lane or the roadway, and
3. Minimize the severity when roadway departure crashes occur.

The RwD Roadmap also includes projects in RwD analysis, research and outreach that span all three objectives. Because the roadmap process is integrated, there are teams considering projects for each primary emphasis area that coordinate with other headquarter, research and field offices within FHWA and other DOT agencies to gain technical and policy knowledge in planning and implementation.

Influence on External Efforts

The FHWA does not own or operate highways. However, they can exert their influence in the form of partnering with highway agencies and organizations that do have that jurisdiction and serve as a conduit to spread noteworthy safety practices and improve the knowledge base of agencies to improve safety. The RwD Team's key focus with its partners will include:

- Assistance to develop action plans in cooperation with States, LTAP Centers, local, federal and tribal agencies to systemically apply highly effective RwD countermeasures to the road network based on the best available data. The plans will consider the three primary emphasis areas and where proven lane departure countermeasures are most appropriate.
- Research proposals submitted and supported through NCHRP and internally as appropriate to gain a better understanding of the RwD problems and treatment options.
- Technology Transfer through training, technical assistance, and Peer Exchanges to accelerate deployment of proven countermeasures through effective communication.
- Partnerships to increase experiments, demonstrations, and evaluations of new technologies and treatments.

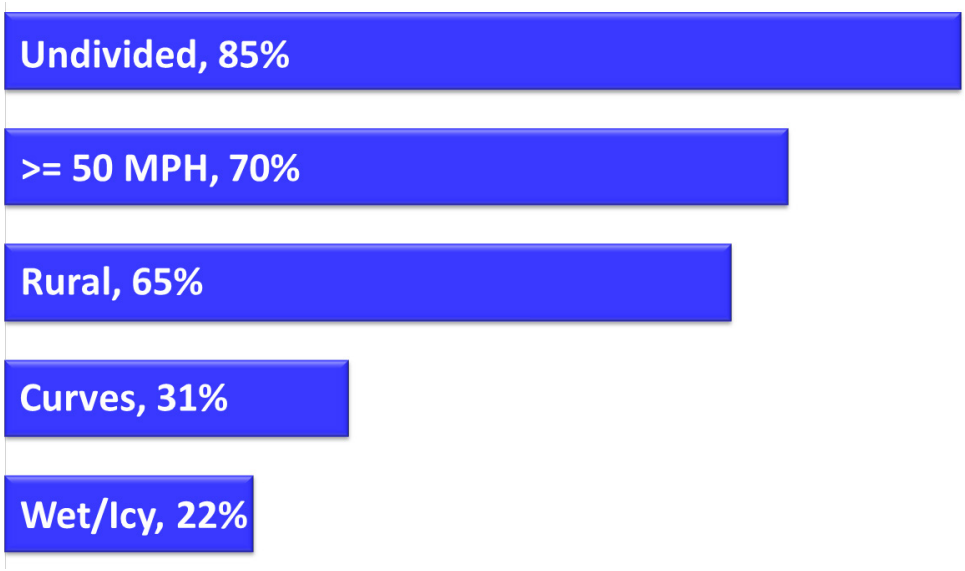
Roadway Departure Head-On Collisions

Credit: skalapendra/iStock/Thinkstock

RwDs involving cross center line or cross median events that resulted in vehicle collisions were the most harmful event in 27 percent of RwD fatalities. Since 85 percent of these head-on roadway departure fatalities are on undivided roadways, a major focus of this primary emphasis area is addressing cross-centerline crashes and with less weight placed on cross median issues. Additional research and development of countermeasures for undivided highways will continue to be a focus for the foreseeable future. Crash data also indicates that the focus should remain on high-speed roadways, with more emphasis in rural areas while not ignoring urban areas. Detailed analysis found that in rural areas, the non-interstate freeways and expressways are significantly over-represented for this crash type, and other principal arterials and minor arterials are also somewhat over-represented compared to all roadway departures and all crashes.

Curves are only slightly over-represented for head-on roadway departures compared to all crashes, indicating focus should be on both tangents and curves. Detailed analysis showed that a common issue in urban areas is head-on lane departures due to drivers cutting to the inside of the curve, across the center line, while in rural areas these head-on crashes were in over-represented in tangent sections. Detailed analysis showed that while lane departures are only slightly over-represented in wet, snowy, and icy conditions, this is more of an issue in rural areas.

RwD Head-on Fatalities as percent of all RwD Fatalities
(FARS 2016 - 2018 average annual)



Strategies to **keep vehicles in their lane to prevent head-on collisions** include installation of:

- Center line rumble stripes; and
- Friction treatments in curves.

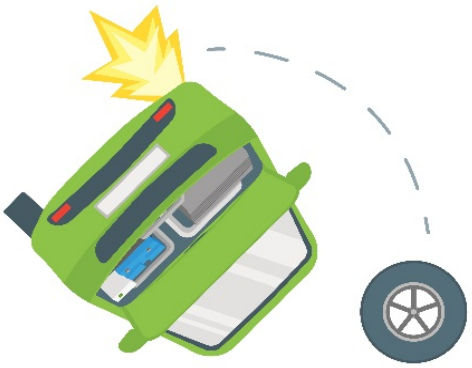
Strategies to **reduce the potential for head-on collisions** when vehicles do leave their lanes include application of:

- Increased Separation between Opposing Lanes, particularly in curves.
- Inclusion of SafetyEdge^{SM} on all paving projects.

Strategies to **minimize the severity of roadway departures into opposing traffic lanes** include appropriate:

- Design and placement of barriers in medians
- Barrier usage in narrow medians

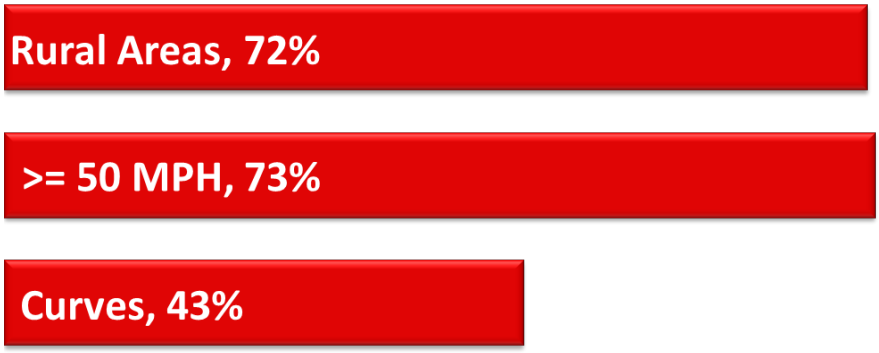
Roadway Departure Rollovers



Credit: Bigmouse/iStock/Thinkstock

The most harmful event in 26 percent of fatalities resulting from a roadway departure is a rollover. Approximately three-quarters of these fatal crashes occur in rural areas and 72 percent are where posted speed limits are at or above 50 mph. While these crashes have been reduced slightly in recent years in tangent sections, they continue to be significantly over-represented in curves. Detailed analysis found that rollovers are problematic both in curves in either direction for the vehicle, although they do happen somewhat more frequently on the outside of the curve. As with all crashes, the majority occur in dry pavement conditions. These fatalities are also somewhat over-represented on rural two-way undivided roads, especially collectors and local roads.

RwD Rollover Fatalities as percent of all RwD Fatalities
(FARS 2016 - 2018 average annual)



Strategies to **keep vehicles on the roadway to prevent rollovers** include installation of:

- Improved curve delineation;
- Friction treatments in curves and other spot locations; and
- Edge line and shoulder rumble strips.

Strategies to **reduce the potential for rollovers** when vehicles do leave the roadway include application of:

- SafetyEdge^{SM} on all paving projects;
- Maintained clear zones, especially on the outside of rural curves; and
- Traversable roadside slopes.

Strategies to **minimize the severity of roadway departures by reducing the potential for rollovers** include appropriate specifications and installation of:

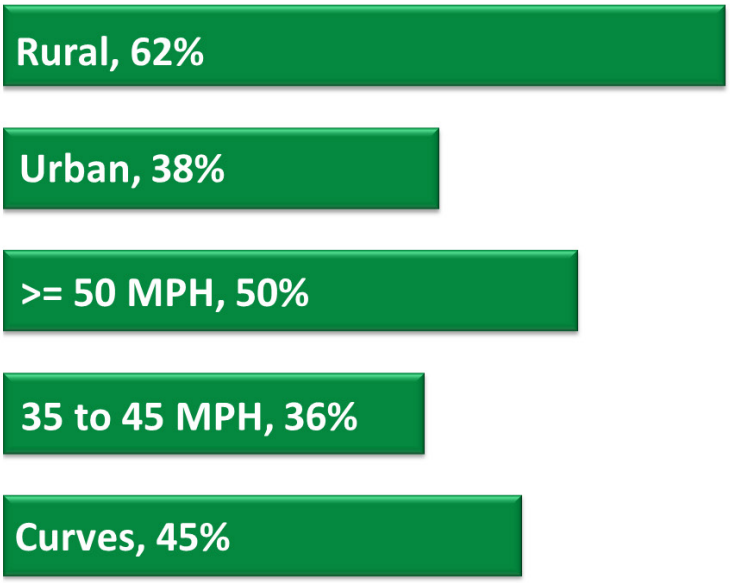
- Barriers to shield hazards, including:
  - Trees and shrubbery
  - Other fixed objects
  - Slopes, particularly on the outside of curves
- Other Safety Hardware

Tree Crashes

Credit: skalapendra/iStock/Thinkstock

The most harmful event in 19 percent of RwD fatalities involves trees or shrubs on the roadside. A continued emphasis on removing or otherwise addressing these roadside obstacles and maintaining the clear zone is in order. The crash data indicate the need to address this on high- and medium-speed roadways in both rural and urban areas, to meet the RwD goals. Trees are unique from other fixed objects in that (with some exceptions) they are not "installed". In addition, they present a greater hazard the larger they grow, and they multiply over time, encroaching ever closer to the roadway if maintenance is not addressed. While context is important to roadside designs, trees have not been proven to slow traffic. Detailed analysis indicates that in rural areas these fatalities are somewhat over-represented in wet and icy conditions. Since tree crashes are particularly over-represented in curves, agencies can initially focus clearing efforts on the outside of curves and consider if they are applying the recommendations of the AASHTO Roadside Design Guide to apply wider clear zone on the outside of curves.

RwD Rollover Fatalities as percent of all RwD Fatalities
(FARS 2016 - 2018 average annual)



Strategies to **keep vehicles on the roadway to prevent tree crashes** include installation of:

- Edge line and shoulder rumble strips;
- Improved curve delineation; and
- Friction treatments in curves.

Strategies to **reduce the potential for collisions with trees** when vehicles do leave the roadway include application of:

- Clear zone improvements and maintenance, particularly on the outside of curves.

Strategies to **minimize the severity of roadway departures by reducing the potential for tree crashes** include appropriate specifications and installation regarding:

- Design, Selection and Placement of Barriers.

FHWA Roadway Departure Team Action Items within the Next Five Years

Objective 1: Keep vehicles on the roadway, in their appropriate directional lane.

A. Continue to promote and provide training on retroreflectivity, lighting design, curve signing, HFST, and rumble strips.
B. Develop materials to assist local agencies with systemic analysis and application of RwD countermeasures, particularly curve signing, pavement markings, HFST and rumble strips.
C. Encourage transportation agencies to develop safety action plans to identify and prioritize RwD countermeasure implementation.
D. Evaluate the effectiveness of newer delineation practices for reducing curve crashes.
E. Demonstrate Continuous Friction Measurement tools for testing and screening pavement friction.
F. Develop an installation checklist for HFST and improved methods for testing HFST materials.
G. Evaluate sinusoidal rumble strips and develop recommendations for where to use instead of conventional designs.

Objective 2: Reduce the potential for crashes when vehicles leave their lane or the roadway.

A. Continue to promote and provide training on clear zones and SafetyEdge[SM].
B. Promote best practices and develop case studies of clear zones practices that reduce rollover potential.[1]
C. Encourage wider implementation of SafetyEdge[SM], particularly to local agencies.
D. Promote experimentation and evaluation of increased separation between opposing traffic on undivided highways.
E. Evaluate the effectiveness of removing trees and other fixed objects in curves, including maintenance practices such as mowing and clearing.
F. Develop joint guidelines with the Office of Planning, Environment, and Realty for landscaping clear zones, and encourage States to adopt and implement them.
G. Evaluate effectiveness of the delineation for addressing objects in the clear zone.

Objective 3: Minimize the severity of crashes that do occur.

A. Continue to promote and provide training on designing and installing hardware
B. Assist transportation agencies in updating their standards and policies.
C. Continue to provide national eligibility determinations for hardware systems until an alternative national process is developed.
D. Assist transportation agencies in development of multi-State or national In-Service Performance Evaluations.
E. Develop, improve, and utilize finite element models of vehicles, hardware, and roadside to aid in RwD research, which will explore potential benefits and develop guidance for strategically recognized issues.
F. Develop guidance for tradeoffs to reduce rollovers, especially on curves, using various slope shapes and various types of barriers.
G. Develop case studies and data-driven guidance on the use of barrier on previously undivided roads.
H. Explore the trade-offs of performance and maintenance issues for barrier in narrow medians.

[1] NCHRP Report 911, *Guidelines for Traversability of Roadside Slopes*, 2019.