



Project Summary

Texas Department of Transportation

0-6031: Analysis of Roadway Departure Crashes on Two-Lane Rural Roads in Texas

Background

Nearly 80 percent of the roadways that are operated and maintained by the Texas Department of Transportation (TxDOT) are two-lane highways located in rural areas. Between 1997 and 2001, more than 12,000 fatal collisions occurred on Texas highways, about 40 percent of which occurred on rural two-lane roads. About 40 percent (1,900) of those crashes are categorized as single-vehicle crashes. A thorough understanding of factors contributing to roadway departures on two-lane highways will allow TxDOT to proactively implement crash remediation measures, saving lives and money.

This three-year research effort was undertaken to identify factors that influence the number and severity of roadway departure crashes on Texas' rural two-lane highways and provide engineering countermeasures to reduce such crashes. This study presents a comprehensive investigation focused on causal and geometric design features associated with roadway departure crashes. In short, the investigation provides information on where, when (e.g., time of day), and why this type of crash occurs. Furthermore, this research builds on recent work by the FHWA on this category of single-vehicle collisions.

This research effort was undertaken to address two objectives:

1. Identify contributing factors associated with roadway departures on rural two-lane highways in Texas.
2. Provide engineering countermeasures to reduce the number of injuries and severity related to this type of crash.

What the Researchers Did

This research has two primary components—analyses based on crash data collected between 2003 and 2008 using state databases, and a detailed engineering study based on a sample of 20 rural two-lane highway segments located in four different districts in Texas. The first component sought to identify global factors that influence this type of crash by region and district. The second component focused on identifying factors that may not be captured by the state databases, but can be extracted from site visits and the analysis of original crash reports. Input from the various districts was also obtained for this component.

The research team conducted the analyses using traditional and advanced statistical tools for estimating potential causal factors. Six tasks were performed to satisfy the objectives listed above including: 1) Examine related material, 2) Assemble crash data by district, 3) Synthesize assembled data to identify crash patterns and trends on rural two-lane roads, 4) Contact districts, 5) Investigate causative factors, and 6) Establish potential remedial engineering countermeasures.

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Project Completed: 8-31-11

What They Found

The study results showed that the proportion of roadway departures varied from 25 to 52 percent for all crashes occurring on the rural two-lane highway network, though the annual number of roadway departure injury crashes (KABC) has slightly diminished between 2003 and 2008. Proportionally more crashes occur on horizontal curves than on tangents and during nighttime. Distracted driving and speeding were found to be important contributing factors. Wider shoulders have a positive impact on safety; curve density has a negative effect.

An engineering study of 394 crash reports from the sample of control sections with high crash rates indicated that horizontal curves were commonly found at crash sites. Motorcycles frequently were involved in crashes on curves. Over half of the observed crashes (205) were due in some part to a vehicle traveling at a speed unsafe for conditions, and another 21 crashes were influenced by a driver exceeding the speed limit. Impaired drivers contributed to more than a third of fatal crashes, compared to 14 percent of non-fatal crashes. Driver fatigue and nighttime conditions were also notable common factors in the observed crashes.

What This Means

To help reduce the number and severity of roadway departure crashes, the research team proposed three categories of medium- to low-cost countermeasures, shown below, that can realistically be implemented by TxDOT. For each treatment, the information focused on the general characteristics, key design features, safety effectiveness, cost (when it is available), and additional resources where the reader can find more detailed information about the treatment.

Horizontal Curve Treatments

- Edge Line Markings
- Advisory Signs
- Chevrons
- Post-Mounted Delineators
- Flashing Beacon
- Reflective Barrier Delineation
- Profile Thermoplastic Markings
- Dynamic Curve Warning System
- Speed Limit Advisory Marking Lane
- Paved Shoulders
- Install/Improve Lighting
- Skid Resistive Pavement Surface Treatment

General Treatment

- Modify Lane Width
- Modify Shoulder Width and Type
- Shoulder Rumble Strip
- Centerline Rumble Strip
- Raised Pavement Markings (RPM)
- Install Barriers/Shielding
- Reduce Driveway Density

Innovative and Experimental Treatments

- Optical Speed Bars
- PENNDOT Curve Advance Marking
- Safety Edge

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