



Project Report O-4048-4

Project O-4048: Low-Cost Design Safety

Improvements for Rural Highways

<http://tti.tamu.edu/documents/O-4048-4.pdf>

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## Handbook Details Crash Treatments for Rural Highways

### Information on Crash Treatments

The Texas Department of Transportation (TxDOT) sponsored the development of a document to provide a reference tool for designers, area engineers, maintenance foremen, and others with information on crash characteristics for rural roads in Texas with an emphasis on low-cost countermeasures for low-volume roads. The report, entitled *Treatments for Crashes on Rural Two-Lane Highways in Texas* (Report 4048-2), includes information on rural crashes and how to conduct a crash study in Texas (see [Table 1](#) for a list of key elements).

The document presents discussion on low-cost safety treatments used on highways and at intersections along with their known effectiveness. The treatments discussed for rural highways are listed in [Table 2](#), and the treatments discussed for rural intersections are listed in [Table 3](#).

Experiences with selected treatments in Texas, including whether the treatment would be



considered elsewhere, are also included in the report.

Treatments in use in Texas that are discussed in the document are listed in [Table 4](#).

### Rural versus Urban Crashes

Crashes that occur in rural areas of Texas differ from urban crashes. Most crashes in rural areas occur away from intersections and driveways (60 percent), while most urban crashes occur at or are related to either intersections or driveways (57 percent). The distribution of crashes by first harmful event also

clearly shows an urban versus rural division. In urban areas, most of the crashes involve another vehicle (81 percent) while only about half of the crashes in rural areas involve another vehicle (51 percent). Striking a fixed object is more common in rural areas (25 percent) than in urban areas (14 percent).

The distribution for injury severity shows some differences between rural and urban crashes. The percentage of fatal crashes is higher in rural areas (3 percent to 1 percent) as well as the percentage of incapacitating crashes (10 percent to 5 percent). The percent of non-





injury crashes is slightly higher in rural areas (37 percent compared to 31 percent). Urban areas have a higher proportion of possible injury crashes (46 percent) than rural areas (28 percent).

Most of the crashes in both urban and rural environments occur during daylight (69 and 63 percent, respectively). A higher percent of the rural crashes, however, occur during “dark, no lights” condition – 27 percent in rural areas and 6 percent in urban areas. Distributions for surface conditions and weather conditions were similar between rural and urban areas—over 80 percent occur on dry pavement and in clear weather.

## Project Findings

In addition to developing the *Treatments for Crashes on Rural Two-Lane Highways in Texas* document, Project 0-4048 found answers to the following questions regarding crashes on low-volume rural highways.

### How often do crashes occur?

In 1999, there were 45.7 KAB crashes/100 million vehicle miles traveled (MVMT) (28.4 KAB crashes/100 million vehicle kilometers traveled [MVKMT]) on low-volume, rural two-lane highways in Texas. KAB crashes include fatal (K), incapacitating

injury (A), or non-incapacitating injury (B) crashes. For all on-system roads, the rate was 31.5 KAB/100 MVMT (19.6 KAB/100 MVKMT). For 1999, 31 percent of the 44,606 KAB crashes in Texas occurred on two-lane highways with approximately 75 percent of those crashes occurring in rural areas. Approximately 11 percent of all KAB crashes in Texas in 1999 occurred on low-volume (2000 average daily traffic [ADT]), rural two-lane highways.

### Where do crashes occur?

More KAB crashes occurred in eastern counties of the state than western counties. In general, sites with higher crash rates have more vertical curves, more horizontal curves, more narrow lanes and/or shoulders, higher access density, a higher average roadside environment score (reflecting the greater presence of many or continuous rigid objects), and roadside development that can more easily restrict sight distance and that may be more difficult to clear from the roadside (e.g., trees versus farmland).

**Table 1. Key Elements in Performing a Crash Study in Texas.**



- Identify sites and crash characteristics
- Gather existing conditions
- Collect additional field data
- Assess situation and select treatments
- Implement and evaluate

## What types of crashes occur more often?

In general, crashes on low-volume, rural two-lane highways occur between intersections by a single vehicle running off the road and then overturning or striking a fixed object (fence, tree/shrub, culvert). Crashes on curves (level) and in dark, no-light conditions are more common on low-volume, rural two-lane highways than on urban roads.

## Recommendations

Based upon the findings from the comparison of the crashes at the state and district levels, the

following are key directions a district or area engineer may want to pursue when considering various types of low-cost improvements:

- treatments that either decrease the number of vehicles leaving the roadway, especially on tight horizontal curves, or treatments that better communicate the nature of the curve;
- improvements to reduce the number of nighttime crashes;
- treatments that reduce crashes at driveways; and
- improvements to minimize severity of crashes if a vehicle leaves the road.

## Report Availability

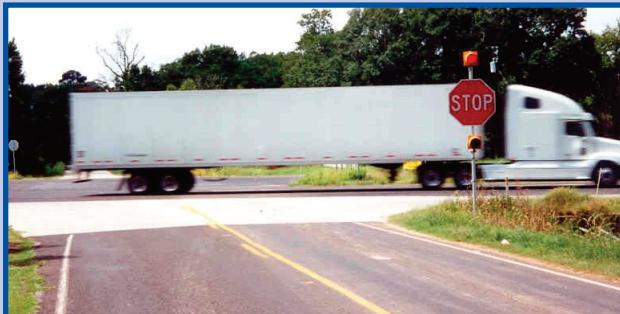
The *Treatments for Crashes on Rural Two-Lane Highways in Texas* document (Report 4048-2) is available from Research and Technology Implementation (RTI) for TxDOT employees and from Texas Transportation Institute (TTI) for others. TxDOT employees may contact RTI business manager Charmaine Richardson at 512-465-7646. To order the report from TTI, contact Nancy Pippin at 979-458-0481, email [n-pippin@ttimail.tamu.edu](mailto:n-pippin@ttimail.tamu.edu), or visit the online catalog at <http://tti.tamu.edu/product>. The report is also available in PDF format at: <http://tti.tamu.edu/documents/4048-2.pdf>.

**Table 2. Treatments Discussed for Rural Highways.**



- Rumble strips
- Passing improvements
- Two-way left-turn lanes
- Lane or shoulder widening
- Pavement edge drop-off improvements
- Pavement markings
- Mowing
- Skid resistance improvements
- Side slope flattening
- Recovery distance improvements
- Tree mitigation
- Culvert modifications
- Advance warning for horizontal curves
- Delineation
- Barrier reflectors
- Animal countermeasures

**Table 3. Treatments Discussed for Rural Intersections.**



- Advance warning for intersections
- Approach rumble strips
- Left-turn lanes
- Shoulder bypass lanes
- Intersection flashing beacons
- Signalization
- High-intensity strobe lights
- Backplates on traffic signals
- Illumination
- Sight obstruction reduction

**Table 4. Experiences with Treatments Installed on Rural Highways in Texas.**



- Barrier reflectors
- Intersection reconfiguration and new safety end treatments
- Rumble strips and advance signing at intersection
- Super 2 roadway with edge line rumble strips
- Shoulder treatment
- Rumble strips approaching T-intersection
- Speed detection and notification device
- All-way stop control and warning signs
- Roadway widening
- Pavement edge drop-off improvements
- Profile markings and other treatments
- Traffic signals on high center
- Systematic intersection improvements

### For More Details . . .

#### Handbook

[Report 4048-2, Treatments for Crashes on Rural Two-Lane Highways in Texas](#)

#### Related Reports

[Report 4048-1, Characteristics of and Potential Treatments for Crashes on Low-Volume, Rural Two-Lane Highways in Texas](#)

[Report 4048-3, Additional Characteristics of Crashes on Rural Two-Lane Highways](#)

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