

May 2004

# HIGHWAY SAFETY

## Federal and State Efforts to Address Rural Road Safety Challenges



G A O

Accountability \* Integrity \* Reliability



Highlights of [GAO-04-663](#), a report to congressional committees

## Why GAO Did This Study

Traffic crashes are a major cause of death and injury in the United States. In 2002, there were 42,815 fatalities and over 2.9 million injuries on the nation's highways. Crashes on rural roads (roads in areas with populations of less than 5,000) account for over 60 percent of the deaths nationwide, or about 70 deaths each day. Further, the rate of fatalities per vehicle mile traveled on rural roads was over twice the urban fatality rate.

GAO identified (1) the factors contributing to rural road fatalities, (2) federal and state efforts to improve safety on the nation's rural roads, and (3) the challenges that may hinder making improvements in rural road safety. GAO obtained information from the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), and other organizations with knowledge of these issues. In addition, GAO analyzed fatal crash data on rural roads from Department of Transportation databases and visited five states that account for about 20 percent of the nation's rural road mileage. GAO also contacted academic experts and examined legislative proposals for improving rural road safety. We provided copies of a draft of this report to the Department of Transportation for its review and comment. In discussing this report, agency officials noted that safety should be part of every project designed and built with federal-aid highway funds.

[www.gao.gov/cgi-bin/getrpt?GAO-04-663](http://www.gao.gov/cgi-bin/getrpt?GAO-04-663).

To view the full product, including the scope and methodology, click on the link above. For more information, contact Katherine Siggerud, (202) 512-2834 or [siggerudk@gao.gov](mailto:siggerudk@gao.gov).

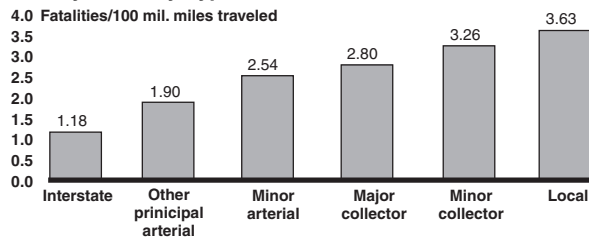
## HIGHWAY SAFETY

### Federal and State Efforts to Address Rural Road Safety Challenges

#### What GAO Found

Four primary factors contribute to rural road fatalities—human behavior, roadway environment, vehicles, and the care victims receive after a crash. Human behavior involves the actions taken by or the condition of the driver and passengers. Human behaviors are important because almost 70 percent of the unrestrained (unbelted) fatalities between 2000 and 2002 occurred in rural crashes. Additionally, the majority of alcohol- and speeding-related fatalities occurred on rural roads. Roadway characteristics that contribute to rural crashes include narrow lanes, sharp curves, trees, and animals. Vehicle factors include problems that arise due to the design of vehicles and are important for both urban and rural roads. Care of crash victims also contributes to rural fatalities because of the additional time needed to provide medical attention and the quality of rural trauma care.

**Fatality Rates by Type of Rural Road, 2002**



Source: GAO presentation of NHTSA and FHWA data.

In fiscal year 2003, FHWA provided about \$27.4 billion in federal-aid highway funds to states. While many projects using these funds have safety features, the amount used for safety is not tracked. However, about \$648 million of these funds went to the Hazard Elimination and Rail-Highway Crossings Programs and were specifically provided for safety purposes—about \$330 million of which went to improve rural road safety. NHTSA provided about \$671 million to states for activities that influence both rural and urban drivers' behavior in such areas as safety belt use, drunk driving, or speeding. States are ultimately responsible for selecting the projects to support with federal funding. The five states we visited used a portion of the funding received for rural road safety.

Many challenges hinder efforts to improve rural road safety—for example, not all states have adopted safety belt and drunk driving laws that might curb behavior contributing to rural road fatalities. In addition, states are limited in using federal-aid highway funds for certain rural roads, and most rural roads are the responsibility of local governments that may lack the resources to undertake costly projects to improve road safety. Further, some states lack adequate crash data to support planning and evaluation of safety projects. Lastly, the nature of rural areas makes it difficult to provide adequate emergency medical care.

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**Abbreviations**

AASHTO	American Association of State Highway and Transportation Officials
BAC	blood alcohol concentration
DOT	Department of Transportation
EMS	emergency medical services
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
GAO	General Accounting Office
HPMS	Highway Performance Monitoring System
NHTSA	National Highway Traffic Safety Administration
SAFETEA	Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2004
SUV	sport utility vehicle
TEA-21	Transportation Equity Act for the 21 <sup>st</sup> Century
TEA-LU	Transportation Equity Act: A Legacy for Users

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United States General Accounting Office  
Washington, D.C. 20548

May 28, 2004

The Honorable Ernest J. Istook, Jr.  
Chairman  
The Honorable John W. Olver  
Ranking Minority Member  
Subcommittee on Transportation and Treasury,  
and Independent Agencies  
Committee on Appropriations  
House of Representatives

The Honorable Richard Shelby  
Chairman  
The Honorable Patty Murray  
Ranking Minority Member  
Subcommittee on Transportation, Treasury  
and General Government  
Committee on Appropriations  
United States Senate

Traffic crashes are a major cause of death and injury in the United States. In 2002 alone, there were 42,815 fatalities and more than 2.9 million injuries on the nation's highways. Crashes on rural roads (roadways in areas with populations of less than 5,000) account for over 60 percent of these fatalities—25,849 deaths, or about 70 each day. Further, the rate of fatalities per vehicle mile traveled on rural roads was more than twice the urban fatality rate. The magnitude of rural road mileage and the widespread dispersal of crashes makes preventing and responding to rural road crashes difficult. The federal government provides funds for states to use in addressing highway safety problems. These include construction and safety project funds administered by the Federal Highway Administration (FHWA) to eliminate roadway hazards and improve rail-highway crossings and grants administered by the National Highway Traffic Safety Administration (NHTSA) to encourage safe driving.

The Conference Report accompanying the 2003 Consolidated Appropriation Resolution directed us to review aspects of rural road safety and report to the House and Senate Appropriations Committees. To meet this requirement, we identified (1) the factors contributing to rural road fatalities, (2) federal and state efforts to improve safety on the nation's rural roads, and (3) the challenges that may hinder making improvements in rural road safety. To identify the factors contributing to rural road

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fatalities, we used an earlier GAO report, *Highway Safety: Research Continues on a Variety of Factors That Contribute to Motor Vehicle Crashes* (GAO 03-436, March 2003) and supplemented it by obtaining information from FHWA, NHTSA, and other organizations familiar with this issue. In addition, we analyzed fatal crash data on rural roads from Department of Transportation (DOT) databases. We assessed the reliability of these databases and determined that the data were sufficiently reliable for the purposes of this report. To identify federal and state efforts to improve rural road safety, we interviewed and obtained documentation from officials in FHWA and NHTSA and visited five states that, in total, accounted for about 20 percent of the nation's rural road mileage. To identify challenges that may hinder making improvements in rural road safety, in addition to interviewing the above officials, we contacted experts from academia and from advocacy groups and reviewed various legislative proposals that may help address the issues. For each of the selected studies that are used in this report, we determined whether the study's findings were generally reliable. To do so, we evaluated the methodological soundness of the studies using common social science and statistical practices. We performed our review in accordance with generally accepted government auditing standards. Appendix I provides more details on our scope and methodology.

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## Results in Brief

One or more of four factors contribute to rural road fatalities: human behavior, roadway environment, vehicles, and the medical care victims receive after a crash. Human behaviors are the actions taken by or the condition of drivers and passengers, including the use or nonuse of safety belts, alcohol impairment, and speeding. Human behaviors are important to rural safety because, according to NHTSA data for 2000 through 2002, rural crashes accounted for about 68 percent of unrestrained (unbelted) fatalities, about 63 percent of all alcohol-related fatalities, and 62 percent of speeding-related fatalities. In addition, over 80 percent of fatalities at speeds of 55 miles per hour or higher occurred in rural areas in 2001. Roadway environment characteristics that contribute to crashes and fatalities include the design of the roadway and roadway conditions: narrow lanes, sharp curves, lack of medians, small or non-existent shoulders, trees, utility poles, and animals. Such factors are important in rural crashes—more than 70 percent of the nation's fatalities from single-vehicle run-off-the-road crashes occur on rural roads. Vehicle factors include any vehicle-related failures that may exist in the vehicle or the design of the vehicle and are important in both rural and urban crashes. For example, when heavy sport utility vehicles or pickup trucks collide with

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small compact cars, the occupants in the lighter and lower vehicle are more likely to die as a result of the crash, particularly if struck in the side. Finally, the lack of prompt and effective emergency medical services contributes to rural road fatalities. For example, NHTSA data for 2002 show that for 30 percent of the fatal crashes on rural highways, victims did not reach a hospital within 1 hour of the crash, while only 8 percent of victims in fatal urban crashes did not reach a hospital within 1 hour.

Federal and state agencies' efforts to improve rural road safety are generally included within programs that address broader aspects of highway construction or highway safety. For example, in fiscal year 2003, FHWA provided the states and the District of Columbia approximately \$27.4 billion in federal-aid highway funds, most of which can be used to construct new highways or to maintain or improve existing highways. While many of these highway improvement projects may include safety features that affect rural roads, the safety features are not specifically segregated for reporting purposes. Within the overall federal-aid highway funding for states, about \$648 million was specifically identified for safety purposes—about \$330 million of which went to rural road safety for highway Hazard Elimination or Rail-Highway Crossing Programs. These programs enable states to address safety concerns on all rural roads through construction improvements. In addition, in fiscal year 2003, FHWA budgeted about \$10.9 million for research into safety advancements and provided oversight and assistance to states that benefits both urban and rural roads. In fiscal year 2003, NHTSA provided states with about \$671 million for use in programs designed to reduce both rural and urban crashes caused by human behaviors. The five states we visited used a portion of the federal funding they received to support rural road safety improvements. However, the states did not track all funds used by rural and urban categories so the total amount spent on rural road safety is unknown. Most state officials we spoke with supported the current flexibility they have to use the funds provided in areas they determine are the most important and did not favor having a separate rural road program or initiative.

Many challenges hinder efforts to improve rural road safety. For instance, not all states have adopted safety belt and alcohol laws that meet federal standards. For example, 30 states have not enacted primary safety belt laws, which allow police officers to pull over and cite motorists exclusively for the infraction of not using their safety belts, and 23 have not enacted alcohol laws that meet federal requirements relating to penalties for repeat drunk driving offenders and prohibiting open containers of alcohol in

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vehicles. In addition, the sheer volume of rural roads and the low volume of traffic on some of them, combined with the high cost of major construction improvements, make it difficult to rebuild rural roads with safer designs. Furthermore, while states can use federal safety funds for any public road, they are limited in using their federal construction funds on certain rural roads—particularly two-lane rural roadways that provide access to farms, rural residences, and other rural areas. Efforts to improve rural road safety are further complicated because most rural roads are not owned by states but rather are the responsibilities of municipal, county, or township governments. These local governments may not have resources available to undertake significant projects to increase rural road safety. Further, some states lack information upon which to make informed decisions on potential road safety solutions, regardless of whether the road is rural or urban. In addition, the ability to reduce rural road fatalities is hampered by difficulties in providing prompt medical services in rural settings. For example, rural areas are less likely to have 911 emergency dialing and it may take longer to reach a hospital. Legislation has been introduced in the Congress as it considers the reauthorization of Transportation Equity Act of the 21<sup>st</sup> Century, which would address some of the factors that contribute to rural fatalities or that make it difficult to improve rural road safety. Some of the proposals include provisions for providing incentives for enacting stronger state traffic safety laws; funding for high-risk rural roads, state safety data systems, new safety research, and emergency medical services; and additional flexibility in states' use of some federal funds.

We provided copies of a draft of this report to the Department of Transportation for its review and comment. The department generally agreed with the report's content. In discussing this report, agency officials noted that safety should be part of every project designed and built with federal-aid funds. In addition, the department provided technical clarifications, which we incorporated as appropriate.



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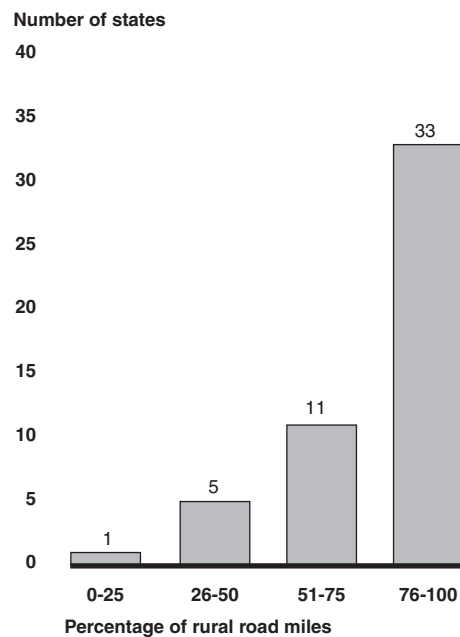
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## Background

There are more than 3.9 million miles of roadway in the United States, of which about 3.1 million miles, or about 77 percent, are considered rural roads.<sup>1</sup> Rural roads are defined as those roads that are located in or near areas where the population is less than 5,000.<sup>2</sup> As figure 1 shows, rural roadways make up more than half of the road miles in 44 states.

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**Figure 1: Proportion of Rural Road Mileage in the 50 States, 2002**



Source: GAO presentation of FHWA data.

Rural roads can be further divided into six functional classifications—interstates, other principal arterials, minor arterials, major collectors, minor collectors, and local roads. Interstates and arterials allow the highest

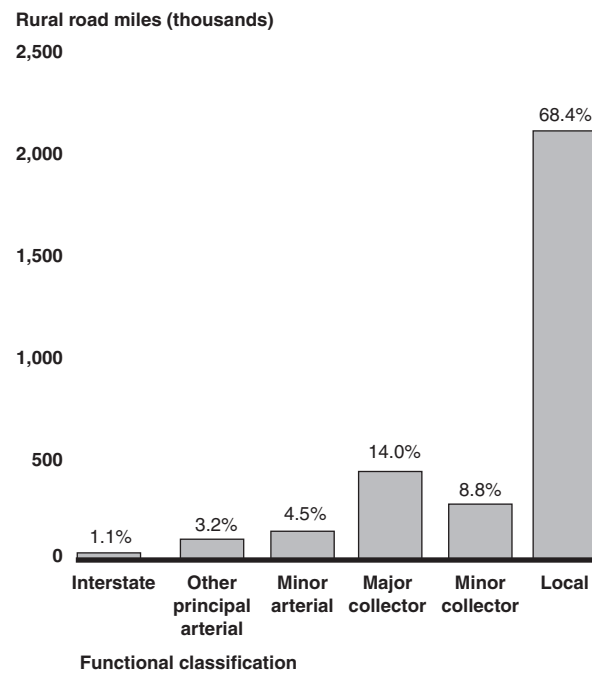
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<sup>1</sup>For purposes of this report, rural road data refers to roads in the 50 states. The District of Columbia has no rural roads and we do not include Puerto Rico's 8,000 miles of rural roads in our computations.

<sup>2</sup>Urban areas are those places within boundaries set by the responsible state and local officials that have a population of 5,000 or more. Rural areas are those areas outside the boundaries of urban areas.

traffic speeds and often have multiple lanes and a degree of access control. Collector roads are designed for lower speeds and shorter trips and generally link areas to arterial roads and interstates. They are typically two-lane roads that extend into residential neighborhoods. Local roads are any roads below the collector system and may be paved or unpaved roadways that provide access to farms, residences, and other rural property. As shown in figure 2, local roads make up the majority of the nation's rural roads.

**Figure 2: Rural Miles by Type of Rural Road Functional Classification, 2002**



Source: GAO presentation of FHWA data.

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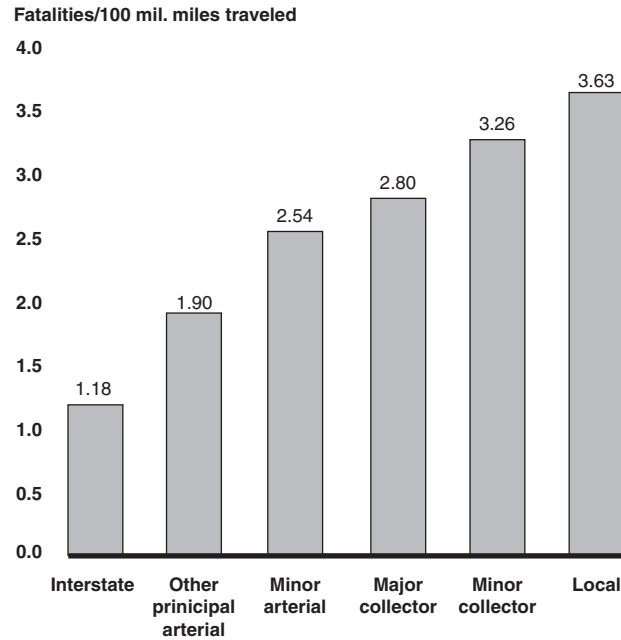
Rural roads have more fatalities and a greater rate of fatalities than urban roads, when considering vehicle miles traveled.<sup>3</sup> In 2002, of the 42,815 fatalities on the nation's roadways, 25,849 (60 percent) were on rural roads. Based on miles traveled, the overall fatality rate from traffic crashes on rural roads was about 2.29 fatalities for every 100 million miles traveled, while urban fatality rates were about .97 fatalities for every 100 million miles traveled.

Fatalities occurred at higher rates on rural roads that have lower roadway functional classifications. As shown in figure 3, during 2002, rural local roads had the highest fatality rates at 3.63 per 100 million miles traveled, while rural interstates had fatality rates of 1.18. In an urban setting, the lowest rates are for urban interstates—.60 fatalities per 100 million miles traveled—about one-sixth the level of rural local roads.

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<sup>3</sup>In presenting information on traffic fatalities, we used data contained in NHTSA's Fatality Analysis Reporting System database for 2002, the most recent available. This database contains state-reported data on all fatalities in the United States.

**Figure 3: Fatality Rates by Type of Rural Road, 2002**

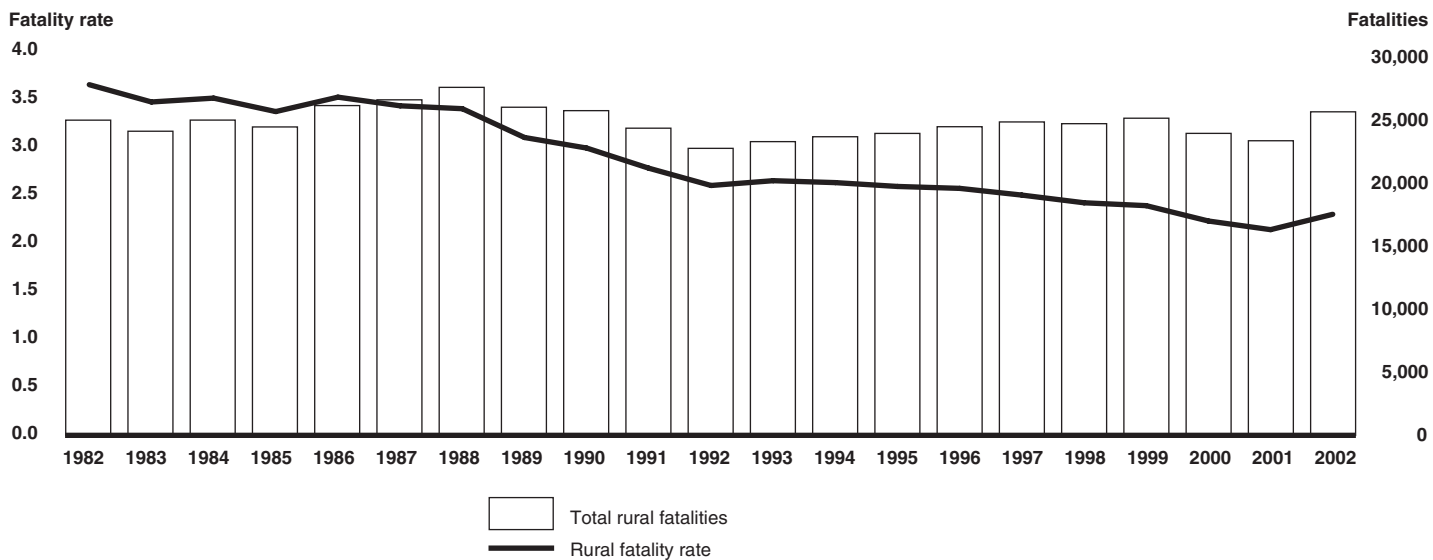


Source: GAO presentation of NHTSA and FHWA data.

In the past two decades, the total number of fatalities on the nation’s roadways fell from 43,945 in 1982 to 42,815 in 2002. However, during this period, fatalities on rural roadways rose slightly from 25,005 in 1982 to 25,849 in 2002. As shown in figure 4, during the period from 1982 to 2002, the fatality rate per 100 million vehicle miles traveled on rural roads declined about 37 percent. During the same period, the fatality rate on urban roads declined about 54 percent.<sup>4</sup>

<sup>4</sup>While the number of fatalities rose during this period, the fatality rate declined. FHWA officials attribute the decline to the increased vehicle miles traveled coupled with many other factors, such as increased safety belt use, decreased alcohol-impaired driving, safety improvement in vehicles and on the highways, and more congested highways leading to lower speeds.

**Figure 4: Fatalities and Fatality Rates per 100 Million Miles Traveled for Rural Roadways, 1982 through 2002**



Source: GAO presentation of NHTSA data.

FHWA and NHTSA are two agencies within the U.S. Department of Transportation responsible for road safety. FHWA’s mission is to provide financial and technical support to state, local, and tribal governments for constructing, improving, and preserving the highway system. As part of this mission, FHWA seeks to reduce highway fatalities and injuries through research and by implementing technology innovations. In addition, its Office of Safety develops and implements strategies and programs to reduce the number and severity of highway crashes involving both motorized and nonmotorized travelers on the nation’s highways, streets, bicycle and pedestrian facilities, and at intermodal connections. NHTSA’s mission is to reduce deaths, injuries, and economic losses resulting from motor vehicle crashes. The agency sets and enforces safety performance standards for motor vehicles and motor vehicle equipment and provides grants to state and local governments. NHTSA, among other things, also investigates safety defects in motor vehicles, helps states and local communities reduce the threat of drunk drivers, promotes the use of safety belts and child safety seats, and provides consumer information on motor vehicle safety topics. Under the Transportation Equity Act for the 21<sup>st</sup>

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Century (TEA-21),<sup>5</sup> NHTSA provided the states with about \$2.7 billion for efforts to improve driver behaviors and safety data from fiscal year 1998 through fiscal year 2003.

Other organizations such as the American Association of State Highway and Transportation Officials (AASHTO) and the Governors Highway Safety Association also play important roles in highway safety. As an organization representing state transportation departments, AASHTO provides engineers with guidance on how to design safe and efficient roads through a publication referred to as the Green Book.<sup>6</sup> In addition, AASHTO recently published a special guide on alternative designs for very low-volume roads.<sup>7</sup> Furthermore, in 1997 AASHTO also focused attention on improving roadway safety by developing a Strategic Highway Safety Plan that identified 22 key or emerging highway safety emphasis areas. Topics included (1) aggressive and speeding drivers, (2) keeping vehicles on the roadway and minimizing the consequences of leaving the roadway, and (3) supporting better state coordination and planning for behavioral and construction programs. For each of these areas, publications are being developed under the National Cooperative Highway Research Program that address the issues and potential countermeasures.<sup>8</sup> Another organization that plays a major role in highway safety is the Governors Highway Safety Association, which represents the highway safety programs of states and territories on the human behavioral aspects of highway safety. Areas of focus include occupant protection, impaired driving, and speed enforcement, as well as motorcycle, school bus, pedestrian and bicycle safety, and traffic records.

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<sup>5</sup>P.L. 105-178, 1998.

<sup>6</sup>*A Policy on Geometric Design of Highways and Streets*. The most recent update of this publication was in 2001.

<sup>7</sup>*Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT $\leq$ 400)*, 2001.

<sup>8</sup>The National Cooperative Highway Research Program is a part of the Transportation Research Board of the National Research Council. It is also undertaking a project to develop a highway safety manual, in response to AASHTO's safety plan.

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## Four Factors Contribute to Rural Road Fatalities

One or more of four factors contribute to rural road fatalities—human behavior, roadway environment, vehicles, and the degree of care for victims after a crash.<sup>9</sup> Human behavioral factors involve actions taken by or the condition of the driver and passenger of the automobile, including the use or nonuse of safety belts, the effects of alcohol or drugs, speeding and other traffic violations, and being distracted or drowsy when driving. Roadway environment factors that contribute to rural road fatalities include the design of the roadway (e.g., medians, lane width, shoulders, curves, access points, lighting, or intersections); roadside hazards (e.g., utility poles, trees, and animals adjacent to the road); and roadway conditions (e.g., rain, ice, snow, or fog). Vehicle factors include vehicle-related failures and vehicle design issues that contribute to a crash and are important in both rural and urban crashes. Lastly, victim care includes the quality of the emergency response and the hospitals that provide medical treatment for those involved in a crash.

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## Several Human Behaviors Contribute to Rural Road Fatalities

Several human behaviors contribute to rural road fatalities, including nonuse of safety belts, alcohol-impaired driving, speeding, and being distracted or drowsy when driving. In general, human factors are considered the most prevalent in contributing to crashes.

- Not using safety belts contributes to fatalities in rural crashes. For example, of the approximately 53,000 unrestrained (unbelted) vehicle occupant fatalities that occurred from 2000 through 2002, about 36,000 or 68 percent occurred in rural areas. NHTSA research on safety belt use in rural areas shows that rural areas are essentially similar to urban areas in safety belt use rates. In 2002, NHTSA data showed about 73 percent belt use in rural areas and 72 percent in urban areas.<sup>10</sup>

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<sup>9</sup>*Highway Safety: Research Continues on a Variety of Factors That Contribute to Motor Vehicle Crashes*, GAO-03-436, (Washington D.C.: Mar. 31, 2003). This report categorized the factors contributing to motor vehicle crashes as human behavior, roadway environment, and vehicle factors. It also notes that in addition to crashes, roadway fatalities are affected by use of safety belts and the care provided after the crash occurs.

<sup>10</sup>Estimates are based on the National Occupant Protection Use Survey, an observational survey of safety belt use, conducted in June 2002. The data collectors in this survey assessed urbanization subjectively and the occupants in rural areas might or might not have lived in rural areas. The sampling error for this data was plus or minus 4.9 percent for urban and plus or minus 4.3 percent for rural, at the 95 percent confidence level.

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- Alcohol-impaired driving contributed to 27,775 rural road fatalities from 2000 through 2002—about 63 percent of the 44,403 alcohol-related fatalities nationwide. While, according to NHTSA data, there is little difference between blood alcohol concentrations (BAC) of rural and urban drivers involved in fatal crashes, state officials told us that risks from drinking and driving in rural areas are increased because of longer driving distances and the lack of public transportation options available to intoxicated drivers.
  - From 2000 through 2002, about 62 percent of the nation’s speeding related fatalities were on rural roads, amounting to about 24,000 of the 39,000 fatalities where speed was a contributing factor, according to NHTSA data. According to Insurance Institute for Highway Safety officials, speed influences crashes by increasing the distance traveled from when a driver detects an emergency until the driver reacts; increasing the distance needed to stop; increasing the severity of an accident (i.e., when speed increases from 40 to 60 miles per hour, the energy released in a crash more than doubles); and reducing the ability of the vehicles, restraint systems, and roadside hardware, such as guardrails and barriers, to protect occupants.
  - Drivers who are distracted or drowsy also contribute to rural crashes. For example, a 2002 NHTSA national survey found that drivers involved in a distracted-related crash attribute their distraction to such items as looking for something outside the car (23 percent of drivers in a distracted-related crash), dealing with children or other passengers (19 percent), looking for something inside the car (14 percent), or another driver (11 percent).<sup>11</sup> A Virginia Commonwealth University pilot study of distracted drivers found that for rural drivers in the study, crashes often involved driver fatigue, insects striking the windshield or entering the vehicle, and animals and unrestrained pet distractions.<sup>12</sup> The study

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<sup>11</sup>*National Survey of Distracted and Drowsy Driving Attitudes and Behaviors: 2002*, The Gallup Organization, March 2003. The Gallup Organization conducted the survey. The sampling errors for the percentages reported in this report are about plus or minus 4.3 points, at the 95 percent confidence level. The responses were self-reported responses to a 2002 survey asking for recall over the past 5 years.

<sup>12</sup>Andrea L. Glaze, M.A., and James M. Ellis, M.S., *Pilot Study of Distracted Drivers*, Survey and Evaluation Research Laboratory, Center for Public Policy, Virginia Commonwealth University, January 2003. The results are based on Virginia drivers involved in a crash between June 15 and November 30, 2002, where one or more of the drivers were identified as inattentive and/or distracted.



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found that in urban areas distracted driving crashes often involved drivers looking at other crashes, traffic, or vehicles, or using cell phones.

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## Roadway Environment Factors Contribute to Rural Road Fatalities

Roadway factors also contribute to rural road fatalities. Rural roads can be narrow; have limited sight distance due to hills and curves; have small or nonexistent shoulders; have no medians; and may have hazards or objects near the roadway such as trees, utility poles, or animals. As a result of these features, fatal crashes on two-lane rural roads are significant. For example, FHWA reports that over 70 percent of single-vehicle run-off-the-road fatalities occur on rural roadways and that about 90 percent of these were on two-lane rural roads. Similarly, crashes involving vehicles crossing the centerline and either sideswiping or striking the front end of oncoming vehicles are a major problem in rural areas, accounting for about 20 percent of all fatal crashes on rural two-lane roads.<sup>13</sup> In addition, crashes with animals—specifically larger animals such as deer and elk—are also prevalent in rural areas. For example, according to the Deer-Vehicle Crash Information Clearinghouse, there were more than 130,000 deer-vehicle crashes reported in five states in 2000.<sup>14</sup> In addition, a Highway Safety Information System report examined five states' experiences with motor vehicle collisions involving animals and found that from 1985 through 1990, 74 percent to 94 percent of reported crashes involving animals occurred on rural roads.<sup>15</sup> The report also found that collisions involving animals ranged from about 12 percent to 35 percent of all reported crashes on two-lane rural roads. Rural roadway conditions can also contribute to rural crashes and resulting fatalities. Surface conditions that can impair a driver's ability to control the vehicle include snow, ice, standing water, and oil, in addition to such road surface features as potholes, ruts, and pavement edge drop-offs. Lack of lighting also contributes to rural road fatalities. For example, a

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<sup>13</sup>Bhagwant N. Persaud, Richard A. Retting, and Craig Lyon, "Crash Reduction Following Installation of Centerline Rumble Strips on Rural Two-Lane Roads," Insurance Institute for Highway Safety, September 2003.

<sup>14</sup>Keith K. Knapp, *Development of a Deer-Vehicle Crash Countermeasure Toolbox*, Deer-Vehicle Crash Information Clearinghouse. The five states included are Illinois, Iowa, Michigan, Minnesota, and Wisconsin. The study notes that the numbers cited are reported crashes and that actual crashes with deer could be much higher.

<sup>15</sup>Warren E. Hughes, *Investigation of Crashes with Animals*, Highway Safety Information System, March 1995, FHWA-RD-94-156. Results are applicable to crashes in Illinois, Maine, Michigan, Minnesota, and Utah.

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study performed for the Minnesota Department of Transportation found that the installation of street lighting at isolated rural intersections reduced both nighttime crash frequency (25 percent to 40 percent) and crash severity (8 percent to 26 percent).<sup>16</sup>

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## Vehicle Design Contributes to Rural Road Fatalities

The design of the vehicle can contribute to rural road fatalities. The wide variances in vehicle sizes and weights, as well as vehicle configurations, sometimes result in greater damage and injury to smaller vehicles and their occupants if a collision occurs. For example, when heavy sport utility vehicles (SUV) or pickup trucks collide with smaller cars, the occupants in the lighter and lower vehicles are more likely to die as a result of the crash, particularly if struck in the side. Vehicle design has been shown to affect vehicle handling in particular types of maneuvers. In rural settings this is important because the roads may be narrow and have sharp curves. The design of the vehicle in these types of crashes can make a difference in whether a run-off-the-road vehicle rolls over, one of the most serious types of crashes. Almost three-fourths of fatal rollover crashes occur in rural areas, according to a 2002 NHTSA study.<sup>17</sup> In 2002, rollover crashes killed 10,666 occupants in passenger cars, pickup trucks, SUVs, and vans. A study by the Insurance Institute for Highway Safety that examined single-vehicle rollover crashes concluded that the combined rollover crash rate for pickup trucks and SUVs was more than twice the rate for passenger cars.<sup>18</sup> In addition, a NHTSA study found that in 2002, nearly two-thirds of the 3,995 SUV occupant fatalities occurred in rollover crashes.

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<sup>16</sup>Howard Preston and Ted Schoenecker, *Safety Impact of Street Lighting at Isolated Rural Intersections*, Minnesota Department of Transportation, April 1999.

<sup>17</sup>William Deutermann, *Characteristics of Fatal Rollover Crashes*, DOT HS 809 438, April 2002.

<sup>18</sup>Charles Farmer and Adrian Lund, "Rollover Risk of Cars and Light Trucks after Accounting for Driver and Environmental Factors," *Accident Analysis and Prevention*, vol. 34, 2002.

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## Lack of Effective and Available Emergency Medical Services Contribute to Rural Road Fatalities

Lack of effective and available emergency medical services (EMS) also contribute to rural road fatalities. For example, victims did not reach a hospital within an hour of the crash in about 30 percent of the fatal crashes on rural roads, according to NHTSA data for 2002. This compares with 8 percent of the fatal crashes on urban highways where victims did not reach a hospital within an hour. In addition, the Emergency Medical Services Division Chief at NHTSA told us that providing adequate medical care in rural areas is more challenging due, in part, to the lack of trauma services. A 2001 GAO report found that rural areas are more likely to rely on volunteers rather than paid staff, and these volunteers may have fewer opportunities to maintain skills or upgrade their skills with training.<sup>19</sup> According to an opinion survey of state EMS directors in 2000, rural areas received significantly less coverage by emergency medical technicians, paramedics, enhanced 911 services, and emergency dispatchers.<sup>20</sup> Finally, a 1995 Montana study concluded that the absence of an organized trauma care system contributed to preventable deaths from mechanical trauma, including motor vehicle crashes.<sup>21</sup>

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## Federal and State Efforts to Improve Highway Safety Include Rural Roads

Each year FHWA and NHTSA provide billions of dollars to states to improve roadways and eliminate roadway hazards, as well as to improve driver behavior. In addition to funding, FHWA and NHTSA provide technical guidance and support for state safety programs and conduct research on roadway safety. Neither agency has specific rural road safety programs, but efforts to improve rural road safety are generally included within programs that address broader aspects of highway construction or highway safety. The states are ultimately responsible for deciding on the use of the funding provided. The five states we contacted funded projects

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<sup>19</sup>*Emergency Medical Services: Reported Needs Are Wide-Ranging, With A Growing Focus on Lack of Data*, GAO-02-28 (Washington, D.C.: Oct. 12, 2001).

<sup>20</sup>National Association of State EMS Directors, "Challenges of Rural Emergency Services: Opinion Survey of State EMS Directors," June 2000. State EMS Directors were asked to use their own definition of "rural," and their answers reflect an estimate of coverage based on their opinions. Enhanced 911 allows emergency responders to automatically locate people who call 911 from cellular telephones.

<sup>21</sup>Thomas Esposito, "Analysis of Preventable Trauma and Inappropriate Trauma Care in a Rural State," 1995. A multidisciplinary review panel judged the preventability of deaths occurring in Montana between October 1, 1990, and September 30, 1991, that were attributed to mechanical trauma. Half of the deaths reviewed were attributed to motor vehicle crashes.

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that improved rural road safety. However, not all the states could identify all funds used for rural road safety because the data were not collected nor maintained in that manner. Therefore, it is not possible to determine the relative emphasis that states place on rural road safety and whether the emphasis has changed over time.

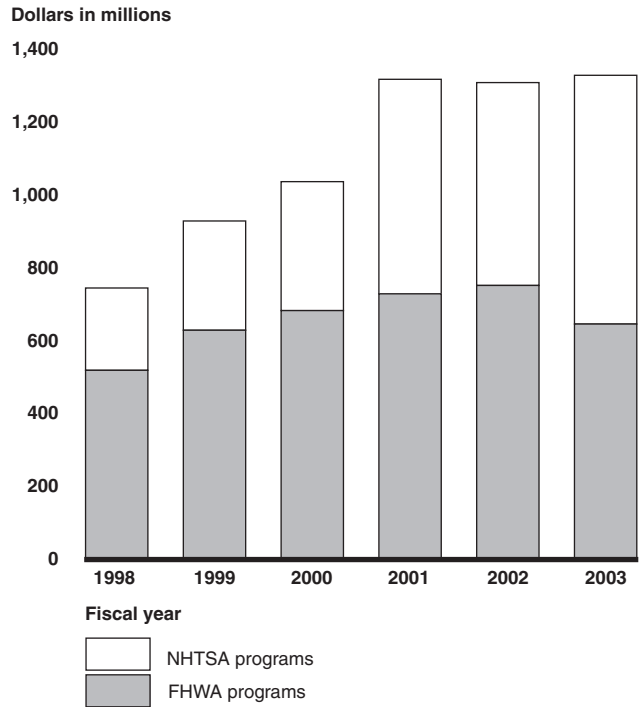
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**Funding Is Provided to States to Eliminate Roadway Hazards and Improve Driving Behavior but Portion Used for Rural Safety Is Unknown**

FHWA and NHTSA provide the states funding to support a variety of programs, part of which was used to improve rural road safety. In fiscal year 2003, FHWA provided states and the District of Columbia with about \$27.4 billion in federal-aid highway funds. Under TEA-21, from fiscal year 1998 through fiscal year 2003, federal-aid highway funding totaled about \$167 billion. States use these funds to, among other things, construct new roadways; maintain the interstate highway system through resurfacing, restoring, rehabilitating, or reconstructing activities; and replace or rehabilitate highway bridges. While many of these highway improvement projects may include safety features that affect rural roads, the safety features are not specifically segregated for reporting purposes. For example, expanding a stretch of roadway to ease congestion could have an added impact of improving safety but could be reported as reconstruction or rehabilitation, depending on the actual project. In addition, construction projects may include items that can improve or upgrade safety features such as installing new guardrails or impact barriers but may not be identified or accounted for as a safety improvement. However, the federal-aid highway funds include two specific safety programs—Hazard Elimination and Rail-Highway Crossings—that can be used for rural road safety improvements. In addition, NHTSA also provided states with funds under TEA-21 to address driver behaviors.

As shown in figure 5, under TEA-21, from fiscal year 1998 through fiscal year 2003, FHWA and NHTSA provided states about \$6.7 billion specifically to improve roadway safety and improve driver behavior.

**Figure 5: FHWA and NHTSA Funding for State Safety Programs under TEA-21**



Source: GAO presentation of NHTSA and FHWA data.

From fiscal year 1998 through 2003, under TEA-21, FHWA provided about \$4 billion to states specifically for highway safety construction under two programs—Hazard Elimination and Rail-Highway Crossing Programs. Highway safety projects built with these funds include construction projects to eliminate highway design hazards, such as narrow lanes or sharp curves; improve intersections; or improve rail-highway grade crossings. Under these programs, states can spend funds to address safety construction issues on any public state or local roadway. Nationwide, about \$1.4 billion, or 49 percent, of the funds spent by states were used for rural purposes. For fiscal year 2003, about \$648 million went to the states for hazard elimination and highway-rail crossings programs—about \$330 million of which went to improve rural road safety.

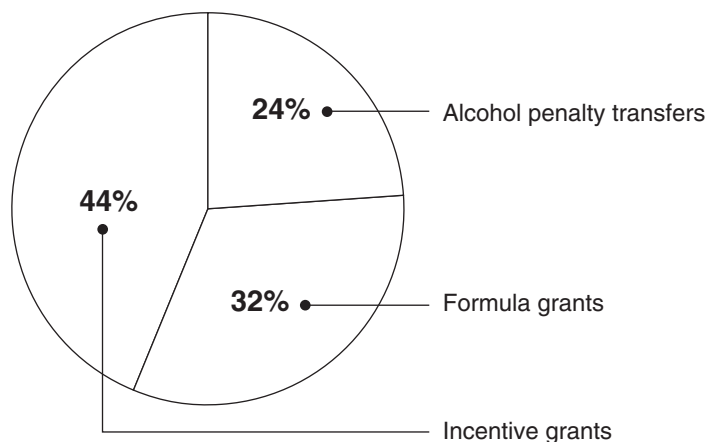
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Under TEA-21, from fiscal year 1998 through fiscal year 2003, NHTSA provided about \$2.7 billion to states and the District of Columbia for programs addressing driving behavior through formula grants, incentive grants, and penalty transfer funds.<sup>22</sup> (See fig. 6.) Under the formula grants program, about \$859 million was provided to the states to carry out traffic safety programs designed to influence drivers' behavior in such areas as safety belt use, alcohol-impaired driving, regional traffic safety initiatives, traffic records and safety data collection systems, and pedestrian safety. Incentive grants of about \$1.2 billion under TEA-21 were provided to states for achieving improvements in safety belt use, reducing drunk driving, and improving highway safety data. Penalty transfer of funds was required under TEA-21 for states that did not adopt specific laws prohibiting open alcohol containers in passenger compartments or setting minimum penalties for repeat drunk driving offenders. Under these requirements, states that are currently subject to either penalty must transfer 3 percent of their federal-aid highway construction funds to the NHTSA programs. The transferred funds can be used to support behavioral programs to limit drunk driving or can be spent on highway hazard elimination projects. In fiscal year 2004, 23 states were subject to one or both penalty transfer programs. From fiscal year 2001, when the penalties began, through fiscal year 2003, about \$637 million has been transferred under this program. NHTSA does not collect information on the funds used for rural roads because it is difficult to distinguish between urban and rural benefits of many efforts, such as drunk driving television or radio spots or billboard ads.

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<sup>22</sup>For fiscal year 2003, NHTSA provided about \$671 million to states for these behavioral programs.

**Figure 6: How NHTSA Provided \$2.7 Billion of Safety Program Funding to States under TEA-21, Fiscal Years 1998 through 2003**



Source: GAO presentation of NHTSA data.

### FHWA and NHTSA Provide Technical Guidance and Support for State Safety Programs that Include Rural Road Projects

FHWA provides safety training and technical assistance to state and local governments, some of which pertains to rural road safety. For example, FHWA's National Highway Institute offers training for state transportation department staffs. Some training focuses on rural road safety issues, such as the 3-day course entitled "Safety and Operational Effects of Geometric Design Features on Two-Lane Rural Highways," which addresses the safety impacts of highway features like lane and shoulder width, curves, and intersection designs. FHWA also offers training and technical assistance to states and others through its Resource Center offices in Baltimore, Chicago (Olympia Fields), Atlanta, and San Francisco. For example, in 2003, the Safety and Design National Technical Service Team from the Chicago center conducted 23 different workshops, some of them multiple times, for state and local officials. An example of a Resource Center activity that pertained to rural roads was a 1-day workshop on low-cost safety improvements. The workshop addressed more than 40 improvement measures and how they might reduce crashes.

FHWA also offers training to local communities through its Local Technical Assistance Program. Under this program, FHWA established a center in every state to provide technical assistance to local highway program managers. In addition, seven centers have been established to provide technical assistance for tribal governments. The centers provide training

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courses, outreach visits, newsletters, and technical resources to local highway managers. Program officials said they have a constant demand for a number of safety-related courses. Examples of course topics include road safety fundamentals, road safety audits, data collection, safety management systems, and construction zone flagger training. In addition, FHWA, along with the Federal Transit Administration, has funded a Safety Conscious Planning training course offered to state DOT officials and others that helps them integrate safety as a key planning factor. Lastly, FHWA provides guidance to states by issuing standards for traffic signs and signals in a publication called the *Manual for Uniform Traffic Control Devices*. The manual sets minimum standards for topics like traffic sign size, placement, support, and nighttime visibility. In 2000, FHWA revised the manual and included a new section called “Traffic Control Devices for Low-Volume Roads.”

NHTSA provides technical assistance to state traffic safety programs through its 10 regional offices. This assistance does not have a focus on rural road safety but rather is intended to help states identify their most important traffic safety problems, establish goals and performance measures, and review annual safety plans and reports. NHTSA regional offices provide training programs for state safety officials and encourage them to participate in national programs like the “Click It or Ticket” safety belt campaign.<sup>23</sup> NHTSA staff from the regional offices and headquarters also provide technical assistance to rural and other areas of the states by participating in or supporting state assessments and forums on safety topics like safety belt use, impaired driving, or data improvements. For example, NHTSA’s Region III provided local governments in their five states and the District of Columbia with a communication kit for conducting a sobriety checkpoint campaign. It included background information on drinking and driving, suggestions for core messages that the localities could share with news organizations, sample news releases for increasing public awareness of drunk driving and the checkpoint campaign, and suggestions for preparing op-ed articles in local newspapers. In addition, NHTSA published “Partners for Rural Traffic Safety Action Kit” in 2001, in conjunction with the National Rural Health Association. This action kit is based on the experience of 15 rural community demonstration sites that conducted 30-day campaigns to increase safety belt use. The association developed, tested, and revised a

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<sup>23</sup>“Click It or Ticket” is a highway safety program that uses increased enforcement along with a media campaign to encourage safety belt use.



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step-by-step guide based on a community development process model and created the Action Kit, which is available online and through NHTSA's resource center.

In fiscal years 2003 and 2004, the Congress also provided NHTSA \$3 million to support state efforts to increase safety belt use in minority, teen, and rural populations. Two initiatives to address rural populations are under way. One involves a 3-year demonstration program that tests community-based infrastructure development and delivery systems to increase rural safety belt use. Demonstration projects are being conducted in Michigan, Tennessee, Wisconsin, and Wyoming. The second is a 2-year program designed to demonstrate the impact of various strategies to increase safety belt use in pickup truck occupants, with concentrated activities in rural areas. This demonstration program includes Arkansas, Louisiana, New Mexico, Oklahoma, Texas and Indian Nations.

NHTSA has also been involved with the "First There, First Care" program to increase bystander care for the injured. NHTSA, the Department of Health and Human Services, Health Resources and Services Administration, and the American Trauma Society developed this program to give motorists information, training, and confidence to provide basic lifesaving care at the scene of a crash, increasing the chances of survival for crash victims. Distribution of the program and its material to states and others has focused on rural implementation.

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### **FHWA and NHTSA Conduct Research That Includes Rural Road Safety Issues**

In 2003, FHWA budgeted \$10.9 million, or about 12 percent of its research budget, for highway safety research and technology. This research addressed four key safety topics: run-off-the-road crashes, intersection crashes, pedestrian and bicyclist safety, and speed management. From a rural roadway perspective, research on run-off-the-road and speed-related crashes is particularly relevant. Over 70 percent of single-vehicle run-off-the-road fatalities occurred on rural roadways, and, according to a NHTSA official, in 2001 over 80 percent of fatalities at speeds of 55 miles per hour or higher occurred in rural areas. Many safety research efforts apply to both rural and urban roads, but FHWA's work on the Interactive Highway Safety Design Model specifically addressed two-lane rural roads. This computer model provides a means of measuring the safety and operational impacts of various design decisions that might be used in stretches of two-lane roadway. It is anticipated that state and local highway planners and designers will use the model to help them evaluate various construction and improvement options.

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FHWA also provides funding for highway research by others. For example, under TEA-21, from fiscal year 1998 through fiscal year 2003, FHWA provided states \$3.1 billion for Statewide Planning and Research. Under this program, TEA-21 required that the states use at least 25 percent of these funds, or \$769 million, for transportation research, which includes conducting research on improving highway safety. Two of the states we visited provided examples of such research. For example, Texas sponsored research into crashes on low-volume rural two-lane highways and potential alternatives to avoid them, and Minnesota sponsored research on driver response to rumble strips and innovative research to address lane departures and intersection collisions, both safety issues on the state's rural roads.<sup>24</sup> FHWA has also provided funding through the states for the National Cooperative Highway Research Program, conducted by the National Research Council, which has been working on a safety design model for multilane rural roads and a Highway Safety Manual that would provide commonly accepted safety guidance on rural and urban highway design.

NHTSA conducts research that addresses both driver behavioral and vehicle safety issues. NHTSA's behavioral highway safety research program had a 2003 budget of \$7.4 million. It focused on areas such as impaired driving, occupant protection, pedestrians, bicyclists, and motorcycle riders. According to NHTSA officials, their research generally addresses safety problem areas rather than rural or urban localities, but the results may be applicable to both rural and urban areas. Furthermore, in 2003, NHTSA's vehicle safety research program received \$69 million to, among other things, collect and analyze crash data. The Fatality Analysis Reporting System (FARS) tracks fatality data at a cost of about \$5.7 million per year, and the General Estimates System provides descriptive statistics about traffic crashes of all severities at a cost of up to \$3 million per year, according to NHTSA officials.

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<sup>24</sup>Rumble strips are grooves rolled or ground into the centerlines, edges, or shoulders of roads. They are designed to alert drivers when they drift out of the traffic lane and thereby prevent head-on and run-off-the-road crashes.

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## States Are Responsible for Identifying and Implementing Improvements to Rural Road Safety

While DOT provides states with funding, research, oversight, and guidance, ultimately states are responsible for identifying and addressing their roadway safety problems. The five states we visited had plans and initiatives that addressed what they determined to be their most important safety problems on all roadways, including rural roads. State efforts to improve rural road safety include eliminating rural roadway hazards through construction projects to widen lanes and shoulders and through lower-cost approaches, such as adding shoulder and centerline rumble strips, expanding clear zones along the roadways, installing intersection beacon lights, and improving signage and road markings. In addition, each state had programs that attempted to alter driver behavior through such efforts as increasing enforcement of traffic laws and conducting community awareness campaigns that include the use of paid advertising on television and radio. Two states also increased enforcement by conducting sobriety checkpoints. All but one of the states could not provide details on all the funds used to address rural road safety because data were not collected and maintained in that way. Most state officials we spoke with supported the current flexibility they have to use the funds provided in areas they determine are the most important and did not favor having a separate rural road program or initiative. One official in Pennsylvania told us that having a separate rural road program would help bring needed attention to rural road safety.

The following are examples of rural-related projects supported in the five states we visited. Appendix II has additional information on the funding received by these states and the activities they support.

- California—The California Highway Patrol is leading a task force that is examining the safety of all state corridors based on fatality and accident data. This effort has identified 20 high-risk corridors in the state, of which 16 were two-lane roads with a majority of the corridors in rural areas. The task force is responsible for making both infrastructure and behavioral improvement recommendations to address the safety issue with these high-risk corridors. In addition, California is supporting a Traffic Collision Reduction on County Roads Project. For this effort, the Highway Patrol received \$1.9 million from the California Office of Traffic Safety to reduce crashes on county roads by increasing enforcement of traffic violations that often lead to collisions: speeding, right-of-way violations, failing to drive on the right half of the road, improper turning, and driving under the influence of alcohol or drugs. California also uses sobriety checkpoints to discourage drinking and driving.

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- Georgia—Using FHWA hazard elimination funding, the state has undertaken several roadway improvement programs that address aspects of rural road safety. For example, Georgia identified four problem areas that it focused on in 2003—run-off-the-road crashes, intersection crashes, car-train crashes, and animal crashes. A Georgia official said that the run-off-the-road and animal crashes were particularly prevalent in rural settings. A Georgia official said that the state is adding shoulder rumble strips and centerline reflectors to help reduce the run-off-the-road crashes, and, to reduce animal crashes, the state is expanding the recovery zone beyond the clear zone along some roads, culling deer herds, and researching light and sound devices to warn drivers of deer presence.
  - Minnesota—State traffic safety officials have implemented several construction and behavioral initiatives to improve rural road safety. The “Towards Zero Deaths” initiative, for example, is an ongoing collaborative program among the Minnesota Department of Transportation, Public Safety, State Patrol, and local safe community organizations to provide grants to localities that work with safety officials to develop a plan to reduce traffic fatalities. In addition, the state Department of Transportation completed a statewide audit of intersections and corridors in 2003. The audit identified and ranked the top 200 intersections and 150 corridors with the highest crash costs. Rural areas accounted for 54 of the intersections and 53 of the corridors. The Department of Transportation’s goal is to address 40 of these high crash cost intersections and corridors for safety improvements each year in the State Transportation Improvement Plan. Further, the Department of Transportation has made extensive use of shoulder rumble strips and is beginning to use centerline rumble strips on two-lane roadways.
  - Pennsylvania—Pennsylvania has installed 300 miles of centerline rumble strips on rural roadways in an effort to help warn drivers that they have strayed from their lane. State transportation officials estimated that rumble strips could reduce vehicle run-off-the-road crashes by 25 percent. In addition, Pennsylvania implemented a Tailgating Treatment program in which dots are painted on the state’s rural roadways to help drivers determine a safe following distance.<sup>25</sup>

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<sup>25</sup>The state painted “dots” on the pavement, along with guide signs, to help motorists maintain safe following distances in areas with high levels of aggressive-driver crashes.

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Pennsylvania officials told us they also funded over 100 rural projects that focused on improving occupant protection, reducing impaired driving, and supporting community traffic safety efforts, and they conducted 722 sobriety checkpoints and DUI roving patrols during fiscal year 2002.

- Texas—For fiscal year 2004, the state identified 235 hazard elimination projects that it plans on undertaking, most of which were on rural roads. These \$43.4 million in projects include such things as adding intersection beacon lights, widening lanes, and adding rumble strips to roadways. In addition, district engineers assessed 30,000 miles of rural two-lane highways in 2003, checking the appropriateness of speed limits and the condition of signs and pavement markings and assessing pavement edge drop-offs and curve warnings. Based on these assessments, changes will be made to address the most important findings.

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## Many Challenges Hinder Efforts to Improve Rural Road Safety

Many challenges hinder efforts to improve rural road safety. For example, some states have not adopted the most effective safety belt use and impaired driving laws. In addition, the sheer volume of rural roads and the low volume of traffic on some of them, combined with the high cost of major construction improvements makes it difficult to rebuild rural roads with safer designs. Also, while states can use federal highway funds provided for hazard elimination and rail-highway crossing safety improvements on any public roads or public crossings, most of the federal-aid highway funds cannot be used on certain rural roads—the rural minor collector and rural local roads. In addition, most rural roads are not state owned but rather are the responsibility of municipalities, counties, or townships, which may have limited resources. Further, some states lack information upon which to make informed decisions on potential road safety solutions, regardless of whether the road is rural or urban. Lastly, reducing fatalities on rural roads is also made more difficult because of limitations in emergency medical services in rural areas. Several proposals that the Congress is considering could potentially improve rural road safety.

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## Some States Have Not Enacted Laws on Safety Belt Use and Drinking and Driving

While the Congress has provided incentives and penalties to encourage states to pass various laws to increase safety belt use and reduce drinking and driving, many states have not done so. These two factors are particularly important given that, in more than 36,000 rural fatalities due to passenger car, light truck, or van crashes, victims were not using safety belts, and more than 27,000 rural fatalities were identified as alcohol related, from 2000 through 2002. While these laws are not directed specifically to rural road safety, the issues they address are applicable to all types of roadways. According to a report by the Advocates for Highway and Auto Safety, as of January 1, 2004:

- Thirty states have not enacted primary safety belt laws, which allow police officers to pull over and cite motorists exclusively for the infraction of not using their safety belts.<sup>26</sup> Twenty-nine of these states have enacted secondary safety belt laws. Secondary belt laws allow police to issue a safety belt citation only if the motorist is pulled over for another infraction, such as speeding or an expired license tag. One state allows occupants over 18 to not use safety belts. As noted in our prior report, states with secondary enforcement laws can increase safety belt use, but their success is limited by the difficulty in effectively enforcing the law.<sup>27</sup>
- Fourteen states have not enacted laws consistent with federal requirements for prohibiting open alcohol container in motor vehicles. Open container laws prohibit the possession of any open alcoholic beverage container or the consumption of any alcoholic beverage in the passenger area of a motor vehicle. In addition, 14 states have not enacted laws consistent with the federal requirement for penalizing repeat drunk driving offenders.<sup>28</sup> Taken together, 23 different states have

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<sup>26</sup>NHTSA officials told us that states enacting the primary safety belt laws have experienced an 8 to 10 percent increase in safety belt use.

<sup>27</sup>*Motor Vehicle Safety: Comprehensive State Programs Offer Best Opportunity for Increasing Use of Safety Belts*, GAO/RCED-96-24 (Washington D.C.: Jan. 3, 1996).

<sup>28</sup>To comply with federal program requirements, a repeat offender statute must include the following: (1) a minimum 1-year license suspension; (2) impoundment, immobilization or installation of an ignition interlock device on all vehicles owned by the offender; (3) assessment of alcohol abuse by the offender and an authorization of the appropriate treatment; and (4) a mandatory minimum sentence.

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not enacted laws that are consistent with at least one of these two program requirements.

- Three states have not established .08 blood alcohol concentration (BAC) as the legal limit for drunk driving.<sup>29</sup> In 2000, the Congress provided that states that did not do so would have 2 percent of their federal-aid highway funds withheld in 2004. The penalty grows to a high of 8 percent in 2007. States adopting the standard by 2007 would be reimbursed for any funds withheld.

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### Safety Improvements to Rural Roads Limited by the Combination of the Millions of Miles of Rural Roads, Low Volume of Traffic, and High Cost of Construction

Due to the extensive size of the rural highway system, the low volume of traffic on many rural roads and the high costs that would be incurred to make major safety changes, state and local governments find it difficult to undertake major safety construction programs on some rural roads. As a result, lower-cost alternatives are pursued to improve rural road safety in many situations.

Of the 3.9 million miles of the nation's road system, rural roads account for about 3 million miles (about 77 percent). In addition, most of the rural mileage is on the lowest functional class of rural roads—local rural roads—that account for about 68 percent of the rural roads (about 2.1 million miles). While making up three-fourths of the nation's road system, rural roads overall carry only about 40 percent of the traffic, with the rural local roads carrying about 5 percent of the traffic.

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<sup>29</sup>According to a NHTSA official, the Colorado General Assembly has recently passed a bill that, if enacted, would appear to meet federal program requirements, and this would reduce the number of states that have not established 0.08 BAC as the legal limit for drunk driving to two.

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Although use of rural roads is low, the costs associated with major construction projects on rural roads are high. For example, FHWA's Highway Economic Requirements System model estimates the cost of widening 11-foot lanes to 12-foot lanes at about \$186,000 per mile—over five times the cost of resurfacing the 11-foot lanes.<sup>30</sup> In addition, an official from FHWA's Kentucky Division Office told us it would cost about \$200,000 to \$250,000 per mile to widen low-volume rural roads by 1 foot. Further, a Transportation Research Board report noted that providing wider cross-sections (wider lanes, wider full-strength shoulders, and enabling 100 percent passing sight-distance) on a two-lane roadway could cost from about \$1 million to \$3 million per mile.<sup>31</sup> As a result, low-cost improvements are an option to be considered for many rural roads. For example, FHWA has identified more than 40 low-cost improvements that states can use on rural roads at high-crash locations. Examples include installing rumble strips to roadways, moving trees or utility poles away from the roadway, adding or improving roadside signs, and adding lighting or flashing beacons to intersections and rail-highway grade crossings. See appendix III for more information on the low-cost alternatives.

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### States Are Limited in Using Federal Aid Highway Funds for Certain Rural Roadways

Because of program requirements, states cannot use all categories of federal-aid highway funds for certain rural roads. These limitations specify that funds used for constructing new roadways or conducting major renovations of roadways cannot be used for rural local roads, rural minor collectors, or for urban local roads. These program restrictions were made to ensure that the interstate highway system and other roads with higher expected traffic have adequate funds to meet the transportation needs of the public, according to a FHWA official. While some other federal-aid highway funds are available for all rural roads, such as the Hazard Elimination and Rail-Highway Crossing Programs within the Surface Transportation Program, these roadways receive significantly less funding per mile than urban counterparts.<sup>32</sup> As shown in table 1, of the \$30 billion

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<sup>30</sup>Costs are default values for minor widening of a rural minor collector on flat terrain used in FHWA's Highway Economic Requirements System model.

<sup>31</sup>Transportation Research Board of the National Academies, *NCHRP Report 500, Volume 4: A Guide for Addressing Head-On Collisions*, 2003.

<sup>32</sup>States must set aside at least 10 percent of the State Transportation Program funds to support the Hazard Elimination and Highway-Rail Crossing Programs and can be used on any roadway for safety purposes.



provided to states in fiscal year 2002, about \$12.1 billion went to all rural roads, with \$541 million going to rural local roads.

**Table 1: State Use of Federal Highway Funds by Road Type, Fiscal Year 2002**

Functional roadway class	Federal-aid highway funding (in thousands)	Road miles
<b>Urban roads</b>		
Urban interstate	\$5,186,072	13,491
Urban freeway/expressway	990,277	9,323
Urban other principal arterial	4,904,704	53,439
Urban minor arterial	2,474,298	90,411
Urban collector	836,543	89,247
Urban local road	580,367	638,813
Urban other	2,127,437	
<b>Total urban</b>	<b>\$17,099,698</b>	<b>894,724</b>
<b>Rural roads</b>		
Rural interstate	2,726,350	32,992
Rural other principal arterial	4,220,132	98,853
Rural minor arterial	1,697,189	137,568
Rural major collector	1,582,700	430,946
Rural minor collector	243,670	270,700
Rural local road	541,219	2,100,702
Rural other	1,135,292	
<b>Total rural</b>	<b>\$12,146,552</b>	<b>3,071,761</b>
Unclassified other	1,555,771	
<b>Total</b>	<b>\$30,802,021</b>	<b>3,966,485</b>

Source: GAO presentation of FHWA data.

Note: This analysis includes only funding administered by FHWA and does not include funding from other federal agencies, state and local governments, or other sources. Fiscal year 2002 is the most current data regarding this information available from FHWA. Figures may not total precisely due to rounding.

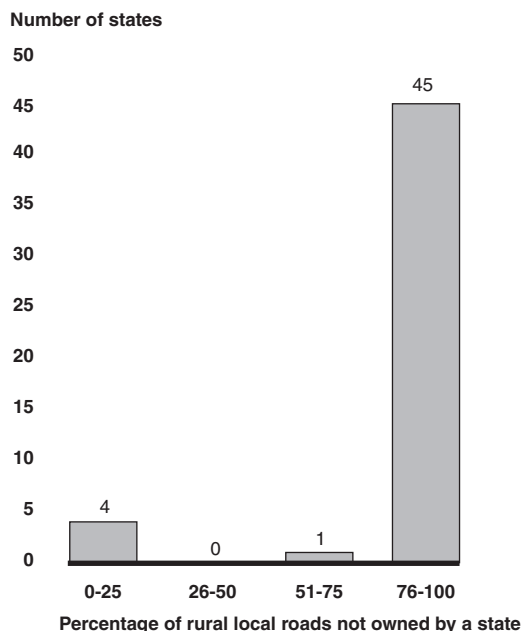
States are also challenged in making improvements in rural road safety because, in most states, large portions of rural roads are not directly under the responsibility of the state but rather fall under the jurisdiction of counties, municipalities, or townships. Nationwide, about 78 percent of all rural roads (2.4 million of the nation's 3.1 million rural miles) are not owned by the states. About 93 percent (about 2.0 million miles) of the rural local

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roads are not under state jurisdiction. In 45 states, jurisdictions other than the state own 75 percent or more of their rural local roads. (See fig. 7.)

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**Figure 7: Portion of Rural Local Roads Not under State Jurisdiction, 2002**



Source: GAO presentation of FHWA data.

Some local officials in states we visited said they were challenged to make costly rural road construction improvements without finding other sources of funds to supplement those provided by states, such as issuing bonds or increasing local taxes. In addition, a study for the National Cooperative Highway Research Program noted that many of the roads most in need of roadside safety improvements are under the control of local governments that have the least amount of resources to address the needs.<sup>33</sup>

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<sup>33</sup>R.G. McGinnis, *Strategic Plan for Improving Roadside Safety*, National Cooperative Highway Research Program, February 2001.

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## Information Lacking on Crashes and the Effectiveness of Countermeasures Used

Accurate, timely crash data are important for planning future urban and rural highway safety programs and assessing the impacts of recent projects or programs to improve safety. States rely on crash data from fatality crashes, injury crashes, and property-damage-only crashes to identify safety problems and plan safety improvements. Some states we visited identified problems with their crash data system and were trying to improve their crash data to make them more accurate, complete, and timely. For example, Texas is about 2 ½ years behind in entering crash data from police accident reports into its data system. State officials pointed out that without timely data, it is difficult to determine if the actions taken on a stretch of road had the intended effect. To make the data timelier, Texas plans to have a new system in place by fiscal year 2005, at a cost of \$14 million. The new Texas system would encourage local law enforcement agencies to collect, validate, and report crash data electronically. It would also provide centralized analysis, review, and data reporting to agencies that plan and conduct state highway safety programs. Georgia modified its crash data processing in 1998, but the changes were not successful, according to a Georgia State Auditor's report. In 2001, a new agency took over the crash data system and, after a data recovery effort, eliminated a multi-year backlog of crash data reporting by 2003. In addition, California is testing a system that would allow data recorded by police to be directly reported into a database through handheld electronic systems, thereby speeding the availability of the information. The information would be recorded in the Statewide Integrated Traffic Reporting System database that is used to help traffic safety officials select safety initiatives.

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## Difficulties in Providing Adequate Emergency Medical Services

Reducing rural road fatalities is also hampered by the difficulty of providing prompt emergency medical services in rural settings. For example, we reported in 2001 that state and local officials told us that rural areas are less likely than urban areas to have 911 emergency dialing, and their communication between dispatchers or medical facilities and emergency vehicles are more likely to suffer from “dead spots”—areas where messages cannot be heard.<sup>34</sup> The report also found that rural areas are more likely to rely on EMS volunteers rather than paid staff, and these volunteers may have fewer opportunities to maintain or upgrade their skills with training. In addition, the report noted that officials from national associations representing EMS physicians have indicated that long distances and potentially harsh weather conditions in rural areas can accelerate EMS vehicle wear and put these vehicles out of service more often. Survivability after a crash decreases as the time required for an injured person to receive medical treatment increases. Further, according to an Organization for Economic Cooperation and Development report, a lack of rapid trauma treatment is critical during the seconds and minutes that immediately follow a crash.<sup>35</sup> The report noted that the risk of dying before medical attention can be provided increases as the crash location is further removed from trained rescue staff and trauma medical facilities. A study of fatalities in Michigan also highlights the impact of providing emergency care in rural areas. The study found that of 155 fatalities in 24 Michigan rural counties in 1995, 12.9 percent of the fatalities were definitely preventable or possibly preventable if rapid and appropriate emergency treatment had been available.<sup>36</sup>

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## Proposals Being Considered to Improve Roadway Safety

Congress is considering legislation that includes proposals to improve highway safety, including safety on rural roads. The proposals include two bills for the reauthorization of TEA-21: (1) the Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2004 (SAFETEA), S. 1072, passed by the Senate in February 2004, and (2) the Transportation Equity

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<sup>34</sup>*Emergency Medical Services: Reported Needs Are Wide-Ranging, With A Growing Focus on Lack of Data*, GAO 02-28 (Washington D.C.: Oct. 12, 2001).

<sup>35</sup>Organization for Economic Cooperation and Development, *Safety Strategies for Rural Roads*, 1999.

<sup>36</sup>R.F. Maio, R.E. Burney, M.A. Gregor, and M.G. Baranski, “A Study of Preventable Trauma Mortality in Rural Michigan,” July 1996. Trauma fatalities were not necessarily due to traffic crashes.

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Act: A Legacy for Users (TEA-LU), H.R. 3550, passed by the House in April 2004. Each of these proposals has features that could impact highway safety and, in some cases, directly address rural roads.

- *Incentives for Enacting Stronger State Traffic Safety Laws.* Safety belt use and impaired driving are important factors in rural road fatalities. S. 1072 would provide grants to states for enactment of primary safety belt laws and would reward those states that already have this law. The proposal offers a maximum of \$600 million in potential grants to states that enact and retain primary laws. H.R. 3550 requires states that do not meet federal open-container laws or federal requirements for penalizing repeat drunk driving offenders to transfer 3 percent of certain federal-aid highway program funds to their Section 402 State and Community Grants Program.<sup>37</sup> H.R. 3550 requires the transfer of 3 percent of certain federal-aid highway funds to Section 402 programs in states that have not enacted a primary seat belt law or achieved 90 percent belt usage.<sup>38</sup> H.R. 3550 also includes a penalty provision that requires the withholding of 2 percent to 8 percent of certain federal-aid highway funds if a state has not enacted a law establishing .08 blood alcohol content as the legal limit for drunk driving.<sup>39</sup> Finally, H.R. 3550 provides 1 year of additional funding for seat belt and drunk driving incentive grants. In addition, S.1072 proposes to withhold 2 percent of certain highway construction funds to those states that have not enacted open-container laws for fiscal years 2008 to 2011.
- *Direct Funding for High-Risk Rural Roads.* Poor roadway design can contribute to rural road fatalities. H.R. 3550 would authorize \$675 million over 6 fiscal years for safety projects on high-risk rural roads. States could use federal funding to improve the safety of rural major collectors, rural minor collectors, or rural local roads that have, or that

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<sup>37</sup>FHWA's federal-aid highway program provides funds to states for highway construction and improvement projects, while NHTSA's Section 402 State and Community Grants Program provides funds to states for a wide variety of highway safety projects, such as projects to reduce alcohol-impaired driving and increase safety-belt use. Transfers under this provision would come from Interstate Maintenance, National Highway System, and Surface Transportation Program funds.

<sup>38</sup>Transfers under this provision would come from National Highway System, Surface Transportation Program, and Congestion Mitigation and Air Quality funds.

<sup>39</sup>Under this provision, funds would be withheld from the National Highway System, Surface Transportation Program, and Interstate Maintenance programs.

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are expected to have, higher than average statewide fatality and incapacitating injury rates.<sup>40</sup>

- *New Highway Safety Improvement Program.* Both S. 1072 and H.R. 3550 contain provisions for a new highway safety improvement program to replace the current statutory requirement that states set aside 10 percent of their Surface Transportation Program funds for carrying out Hazard Elimination and Rail-Highway Crossing Programs. S. 1072 would authorize \$8.2 billion over 6 years for the program and H.R. 3550 proposes a level of \$3.3 billion over 5 years. S. 1072 requires states to have crash data systems and the ability to perform safety problem identification and countermeasure analysis to use safety improvement funds. Both bills maintain state flexibility to use safety improvement funds for safety projects on any public road or publicly owned bicycle or pedestrian pathway or trail or public surface transportation facility. In both bills, states must identify roadway locations, sections, and elements that constitute a hazard to motorists, bicyclists, pedestrians, and other highway users and develop and implement projects to address the hazards identified.
- *Enhanced Federal Funding for State Safety Data.* Some of the states we visited had identified weaknesses in their highway data systems. S. 1072 and H.R. 3550 would each create a new State Traffic Safety Information System Improvement grant. Funding would be authorized at \$45 million per year under S. 1072 and \$24 million to \$39 million per year (for 5 fiscal years—2005 through 2009) under H.R. 3550. Larger states could qualify for larger grants, but the minimum grant amount would be \$300,000 per year. By comparison, federal funding for data improvement grants under TEA-21 was never more than \$11 million per year and was only available in fiscal years 1999 through 2002. H.R. 3550 also allocates \$4 million from NHTSA research authorizations to further develop a transportation safety information management system to provide for the collection, integration, management, and dissemination of safety data for state and local safety agencies.

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<sup>40</sup>Another proposal to advance rural road safety was recently introduced—H.R. 3743, which would authorize \$1 billion per year to improve safety on rural roads. States utilizing this funding would be obligated to conduct and systematically maintain an engineering survey of all two-lane rural roads classified as minor and major collectors and minor arterials. The survey would identify dangerous locations, assign priorities for the correction of such locations, and establish and implement a schedule of projects for improvement of such roads.

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- *Proposals for New Safety Research.* S. 1072 and H.R. 3550 would fund strategic highway research programs. S. 1072 would provide \$450 million for this purpose and H.R. 3550 would provide \$329 million. According to the related NCHRP planning study, 40 percent of the funds—\$180 million—would support safety research.<sup>41</sup> The goal of this safety research is to prevent or reduce the severity of highway crashes through more accurate knowledge of crash factors and of the cost-effectiveness of selected countermeasures in addressing these factors. The research plan focuses on road departure and intersection collisions, which represent 58 percent of traffic fatalities.
  - *Comprehensive Highway Safety Planning.* S. 1072 requires states to develop and implement strategic highway safety plans that are comprehensive, data driven, and based on a collaborative process involving state and local safety stakeholders. The plans must be comprehensive, including all aspects of highway safety—infrastructure, driver behavior, motor carrier, and emergency medical services. They must be based on improved crash data collection and analysis. While not directed specifically at rural road safety, the collaborative process required by this provision provides an opportunity for local rural officials and leaders to participate in developing the goals and investments included in the plan. H.R. 3550 would encourage comprehensive safety planning for both behavioral and construction safety programs.
  - *Flexibility in Moving Funds between FHWA and NHTSA Programs.* S. 1072 allows states to use up to a quarter of their Highway Safety Improvement Program funds for behavioral projects, if the projects are included in a state comprehensive highway safety improvement plan.
  - *Improving Emergency Medical Systems.* The presence of timely competent medical attention has been shown to reduce rural and other traffic fatalities. S. 1072 would create an Emergency Medical Services grant program to provide state EMS offices funds for conducting coordinated EMS and 911 programs. S. 1072 would provide \$5 million annually and would create a Federal Interagency Committee on Emergency Medical Services that would coordinate federal agencies’

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<sup>41</sup>*Interim Planning for a Future Strategic Highway Research Program*, NCHRP Report 510, 2003.

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involvement with state, local, tribal, or regional emergency medical services and 911 services and to identify the needs of those entities.

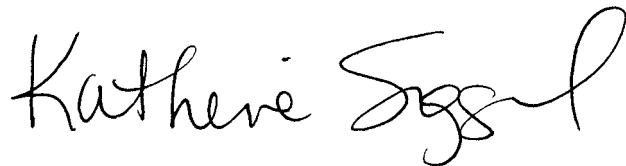
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## Agency Comments and Our Evaluation

We provided copies of a draft of this report to the Department of Transportation for its review and comment. The department generally agreed with the report's contents and provided some technical comments, which we incorporated where appropriate. In discussing this report, agency officials noted that safety should be part of every project designed and built with federal-aid funds.

We are sending copies of this report to the Secretary of Transportation, the Administrator of the National Highway Traffic Safety Administration, the Administrator of the Federal Highway Administration, and to interested congressional committees. We will also provide copies to others on request. In addition, the report will be available at no charge on GAO's Web site at <http://www.gao.gov>.

If you or your staff have any questions about the report, please contact me at (202) 512-2834. Key contributors to this report were Samer Abbas, Rick Calhoun, Colin Fallon, Sara Moessbauer, Stacey Thompson, and Glen Trochelman.



Katherine Siggerud  
Director, Physical Infrastructure Issues



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# Objectives, Scope, and Methodology

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The Conference Report accompanying the 2003 Consolidated Appropriation Resolution directed us to review aspects of rural road safety and report to the House and Senate Appropriations Committees. To meet this requirement, we identified (1) factors contributing to rural road fatalities, (2) federal and state efforts to improve safety on the nation's rural roads, and (3) challenges that may hinder making improvements in rural road safety.

To identify the factors contributing to rural road fatalities, we supplemented an earlier GAO report, *Highway Safety: Research Continues on a Variety of Factors That Contribute to Motor Vehicle Crashes* ([GAO-03-436](#), March 2003), with information from the Federal Highway Administration, the National Highway Traffic Safety Administration, and other organizations with knowledge of this issue, such as the National Association of Counties and the American Association of State Highway and Transportation Officials. We also reviewed studies identifying factors that contribute to rural road fatalities. For each of the selected studies that are used in this report, we determined whether the study's findings were generally reliable. To do so, we evaluated the methodological soundness of the studies using common social science and statistical practices. For example, we examined each study's methodology, including its limitations, data sources, analyses, and conclusions.

In addition, we updated the earlier report by obtaining more current information on traffic deaths by using data from NHTSA's Fatality Analysis Reporting System (FARS). This database provides information on all traffic-related fatalities. Each state provides NHTSA fatality data in a standardized format. To be included in the database, a crash must result in the death of an occupant or nonmotorist within 30 days of the incident. The states obtain this information from such sources as police reports, vehicle registration files, state driver licensing files, death certificates, coroner or medical examiner reports, and hospital records. It should be noted that while fatality data is useful in understanding crashes, other factors in addition to those involved in causing the crash might have contributed to the fatality. This would include whether safety belt or other occupant protection measures were used and functioned properly. Before using this data, we assessed the reliability of the FARS data by reviewing the data for obvious errors in accuracy and completeness, reviewing existing information about the data, and interviewing agency officials knowledgeable about the data. We determined that the data were sufficiently reliable for the purposes of this report.

Further, in providing information on factors contributing to rural road fatalities, we identified fatalities per million miles traveled. To do so, we used vehicle miles traveled data maintained by FHWA in its Highway Performance Monitoring System (HPMS). This system is a national-level highway information system that includes data on the extent, condition, performance, use, and operating characteristics of the nation's highways. In general, HPMS contains administrative and extent of system information on all public roads. The HPMS obtains vehicle-miles-traveled data from each state, and states have different methods for collecting certain travel information. We assessed the reliability of the HPMS data by reviewing it for obvious errors in accuracy and completeness, reviewing existing information about the data, and interviewing agency officials knowledgeable about the data. There are certain limitations associated with using these data. For example, the quality of the data in the system relies on state data collection techniques. HPMS guidance is flexible so that each state has its own approach, and some approaches do not require annual revisions. In addition, vehicle-miles-traveled data may not be comparable from state to state. However, we determined that the data were sufficiently reliable for the purposes of this report.

To identify federal and state efforts to improve rural road safety, we interviewed and obtained documentation from officials in the Federal Highway Administration and the National Highway Traffic Safety Administration. In addition, we reviewed state use of safety funds by meeting with safety officials in five states. We selected Minnesota, which DOT officials recommended as having a good rural road safety program, and the four states with the highest rural vehicle miles traveled: California, Georgia, Pennsylvania, and Texas. In each of these locations we met with state officials responsible for the FHWA and NHTSA programs, as well as some officials at the local level. We also reviewed recently issued guides, models, and training programs intended to help traffic safety officials improve their rural road safety programs, such as the Transportation Research Board's National Cooperative Highway Research Program 500 Report series that serves as guidance for implementing the American Association of State Highway Transportation Officials' Strategic Highway Safety Plan.

To identify challenges that hinder making improvements in rural roads, we interviewed federal and state officials identified above and contacted experts from academia and advocacy groups. In addition, we attended a Rural Road Safety Roundtable in West Virginia at which participants discussed challenges facing rural road safety. We relied on NHTSA and a

report by the Advocates for Highway Safety to identify the status of the 50 states' compliance with various federal highway safety statues. We also reviewed various legislative proposals that may help address the issues. The legislative proposals included bills for the reauthorization of TEA-21: (1) the Senate passed S. 1072, the Safe, Accountable, Flexible and Efficient Transportation Equity Act of 2004 (SAFETEA) and (2) the House passed H.R. 3550, the Transportation Equity Act: A Legacy for Users (TEA-LU). We also reviewed the administration's proposal, the Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2003; the Senate Committee on Commerce, Science and Transportation bill S. 1978, the Surface Transportation Safety Reauthorization Act of 2003; and the House Committee on Science bill H.R. 3551, the Surface Transportation Research and Development Act of 2004. However, the Senate and House passed S. 1072 and H.R. 3550, respectively, so we did not include them in the report.

We performed our review from July 2003 through April 2004 in accordance with generally accepted government auditing standards.

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# Examples of State Activities to Improve Rural Road Safety

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We obtained information from five states (California, Georgia, Minnesota, Pennsylvania, and Texas) on the number of fatalities on their roadways, the federal funding they receive for safety purposes, and a description of the types of projects these funds support.

## California

During 2002, 1,713 people were killed on rural roads in California—the second-highest total in the nation. When adjusted for miles traveled, California’s fatality rate on rural roads is about 2.67 fatalities per 100 million vehicle miles traveled—greater than the national average of 2.29. Rural fatalities accounted for approximately 42 percent of all state roadway fatalities in 2002.

In fiscal year 2003, California was provided over \$2.5 billion in federal-aid highway funds. About \$60.5 million of these funds were provided for Hazard Elimination and Rail-Highway Crossing programs. These programs provided construction-related safety improvements on public roads, transportation facilities, bicycle or pedestrian pathways or trails, and for rail-highway crossing safety programs. California also received about \$100.4 million in fiscal year 2003 to improve roadway safety through a variety of activities designed to influence driving behavior. About \$47.5 million of the funds California received were transferred from the state’s federal-aid highway program because the state’s repeat offender law did not meet federal standards.<sup>1</sup>

California officials told us that they estimate they spent about \$69.5 million on 58 rural road hazard elimination-related projects in 2003. Examples include:

- *The 2-3 Lane Safety Program.* The California Department of Transportation uses past crash analysis to identify cross-centerline crash locations on two- and three-lane roadways for safety investigations. The agency then attempts to utilize the most cost-effective solutions to make these roadways safer. In 2002, the agency identified 50 areas, 47 of which were located in rural locations.

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<sup>1</sup>Under 23 USC, section 164, states are required to have a repeat offender law that includes such things as a 1-year license suspension for a second offense; the impoundment, immobilization, or installation of an ignition interlock on an offender’s vehicle; an assessment of the individual’s degree of alcohol abuse and appropriate treatment; and specified minimum jail or community service sentences. California’s impaired driving law does not impose all these sanctions on repeat offenders.

- *Run-Off-the-Road Task Force.* The California Department of Transportation currently has a task force examining locations where a number of run-off-the-road crashes are occurring. The agency then attempts to utilize cost-effective strategies to reduce the number or severity of these types of collisions. In 2003, about 73 percent of the locations identified were in rural areas. The agency hopes to proceed with the run-off-the-road monitoring program by the end of 2004.

California is also using about \$48 million of the NHTSA provided funds to support 732 behavioral programs in fiscal year 2004. Of these funds, California officials identified about \$9.9 million being used to support 80 rural road-related programs. These projects include emergency medical initiatives such as the “First There, First Care” program, which will train young drivers in 54 schools in 11 counties on providing basic first aid at the scene of a motor vehicle crash. In addition, California’s Office of Traffic Safety has worked with the California Highway Patrol to implement two programs that have rural road safety impacts:

- *Corridor Safety Project.* The California Highway Patrol is leading a task force that is examining the safety of all state corridors, based on fatality and accident data. This effort has identified 20 high-risk corridors in the state, of which 16 were two-lane roads, mostly in rural areas. The task force is responsible for making both behavioral and infrastructure improvement recommendations to address the safety issue with these high-risk corridors.
- *Traffic Collision Reduction on County Roads Project.* For the 2004 fiscal year, the Highway Patrol received \$1.9 million from the Office of Traffic Safety to reduce crashes on county roads by increasing enforcement of traffic violations that often lead to collisions: speeding, right-of-way violations, failing to drive on the right half of the road, improper turning, and driving under the influence of alcohol or drugs.

## Georgia

During 2002, Georgia had 902 fatalities on its rural roadways. When adjusted for miles traveled, Georgia’s fatality rate on rural roads was 1.81 fatalities per 100 million vehicle miles traveled—below the national average of 2.29 fatalities per 100 million vehicle miles traveled. Rural fatalities accounted for approximately 59 percent of all state roadway fatalities in 2002.

In fiscal year 2003, Georgia received \$975 million in federal-aid highway funds. About \$25.3 million of these funds were provided for the Hazard

Elimination and Rail-Highway Crossing Programs. Using these funds, the state has undertaken several roadway improvement programs that address aspects of rural road safety. For example, Georgia identified four problem areas that it focused on in 2003—run-off-the-road crashes, intersection crashes, car-train crashes, and animal crashes. A Georgia official said that the run-off-the-road and animal crashes were particularly prevalent in rural settings. He said that they are adding shoulder rumble strips and centerline reflectors to help reduce the run-off-the-road crashes, and to reduce animal crashes they are expanding the recovery area along some roads, culling deer herds, and researching light and sound devices to warn drivers of deer presence. In addition, Georgia is developing a Lane Departure Strategic Action Plan with the goal of reducing the lane departure serious injury and death rate from 4.93 per 100 million miles traveled in 2003 to 3.29 in 2008 and preventing 750 serious injuries and deaths annually. A draft of this plan recognizes that roadway departures on rural highways are a predominate concern. To meet this goal, Georgia is developing an approach that will use low-cost construction improvement; corridor enforcement, education, and engineering enhancements; local lane departure safety initiatives, targeted use of medium- to high-cost improvements at high-crash locations, and statewide initiatives to improve safe driver behaviors.

According to Georgia officials, the state has also replaced its safety data system. It hopes to upgrade the current system of recording crash locations by use of more accurate global positioning technology at the crash scene, which would help them better identify problem areas throughout the state. In addition to these state initiatives, FHWA officials said Georgia is participating in AASHTO research projects that address run-off-the-road crashes and comprehensive state strategic highway safety plans.

The state has also participated in two major NHTSA-sponsored behavioral programs: the eight-state evaluation of the “Click It or Ticket” safety belt campaign in 2001 and the current impaired driving strategic evaluation study, according to NHTSA officials. Georgia identified a need to increase use of safety belts, booster seats, and child safety seats among rural and minority populations statewide, so it initiated efforts to involve rural and minority communities in local initiatives to increase safety belt usage rates. Under the impaired driving study, enforcement agencies conduct at least one sobriety checkpoint per month in every county.

## Minnesota

In 2002, 479 people were killed on Minnesota’s rural roads. When adjusted for miles traveled, Minnesota’s fatality rate on rural roads was about 1.8 fatalities per 100 million miles traveled—less than the national average of

2.29. Rural fatalities accounted for approximately 73 percent of all state roadway fatalities in 2002.

In 2003, Minnesota received about \$395 million in federal-aid highway funds. About \$12.1 million of these funds were provided for hazard elimination projects, for construction-related safety improvements, and for rail-highway crossing improvements. The state also received about \$14.7 million for NHTSA programs designed to improve behavioral activities. State officials could not provide a breakdown of how much of these funds was used for rural road safety projects.

While the state does not have a specific rural road safety program, state traffic safety officials have implemented several construction and behavioral initiatives to improve rural road safety. The “Towards Zero Deaths” initiative, for example, is an ongoing collaborative program among the state department of transportation, public safety, state patrol, and local “safe community” organizations to reduce highway fatalities. The program provides grants to localities that work with safety officials to coordinate a plan to reduce traffic fatalities. Other behavioral initiatives include the following:

- NightCAP is a program involving concentrated alcohol patrols scheduled in conjunction with local events that serve alcohol, for example, music festivals that attract big crowds and where alcohol is sold or allowed to be consumed. Local, county, and state law enforcement patrol roads to look particularly for drivers showing signs of impairment. Releases are sent out to local press and broadcast media informing the local population that enforcement will be present during the event. In fiscal year 2003, \$615,000 of federal funding was spent on the NightCAP program. About 50 percent of the events were in rural areas of Minnesota.
- Safe & Sober is a project involving municipal and county law enforcement agencies that target impaired driving and occupant protection issues through a combination of enhanced law enforcement and publicity. According to state officials, in fiscal year 2003, \$1,335,600 in federal funding was spent on the program. Approximately 50 percent of this program is carried out in rural areas of the state.

In addition, in 2003 the state Department of Transportation completed a statewide audit of high crash cost intersections and corridors. The audit ranked the top 200 intersections and 150 corridors with the highest crash

costs. Of the top 200 intersections identified, 54 were located in rural areas; of the top 150 corridors identified, 53 were located in rural areas. The Department of Transportation's goal is to address 40 of these high crash cost intersections and corridors for safety improvements each year in the State Transportation Improvement Plan. Further, according to state officials, the Department of Transportation has made extensive use of shoulder rumble strips and is beginning to use centerline rumble strips on two-lane roadways.

Approximately \$9 million in federal funds was transferred from construction to safety activities in 2003 because Minnesota's laws in regards to repeat drunk drivers did not meet federal requirements.<sup>2</sup> Officials at the state Department of Public Safety said that they plan to use half of those funds for hazard elimination projects such as replacing twisted-end guardrails and researching the visibility effects of installing wider edge lines and reflective wet pavement markings. Officials believe that this will have a major impact on preventing or reducing the severity of run-off-the-road crashes. The Department of Public Safety plans to use the other half to address impaired driving. Specifically, Minnesota plans to upgrade its driver license information system to improve the tracking of problem drivers, focusing on impaired driving. The state also plans to implement traffic safety programs promoting safety belt use and discouraging drinking and driving among 21 to 34 year olds. To improve emergency medical services in rural areas, Minnesota plans to reduce the amount of "dead spots"—areas where messages cannot be heard—so that law enforcement, emergency medical services, and transportation officials can communicate with each other in more remote areas of the state.

## Pennsylvania

In 2002, there were 1,001 fatalities on Pennsylvania's rural roads. When adjusted for miles traveled, Pennsylvania's fatality rate on rural roads is 2.15 fatalities per 100 million vehicle miles traveled—less than the national

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<sup>2</sup>Under 23 USC, section 164, states were required to have a repeat offender law that included such things as a 1-year license suspension for a second offense; the impoundment, immobilization, or installation of an ignition interlock on offender's vehicle; an assessment of the individual's degree of alcohol abuse and appropriate treatment; and specified minimum jail or community service sentences. States that do not meet the repeat offender requirement will have a percentage of funds transferred from their federal-aid highway program to their State and Community Grants programs. States may use the transferred funds for alcohol-related programs or they may allocate funds back to the federal-aid highway program where they are to be used for highway construction projects that address safety concerns. Minnesota does not have an impaired driving law that imposes the sanctions listed above on repeat offenders.



average of 2.29. Rural fatalities accounted for approximately 62 percent of all state roadway fatalities in 2002.

Pennsylvania received about \$1.4 billion in federal-aid highway funds in fiscal year 2003. Of these funds, about \$21.4 million were provided for hazard elimination projects for construction-related safety improvements and for improving safety at rail-highway crossings. During fiscal year 2003, Pennsylvania received about \$11.6 million in NHTSA funding designed to improve behavioral activities. State officials could not provide a breakdown of how much of these funds were used for rural road safety projects.

The Pennsylvania Department of Transportation has a goal of reducing road fatalities by 10 percent between 2002 and 2005. The department has begun several engineering and behavioral improvement initiatives to help reach this goal. For example, to maximize safety in the design and construction of highway projects, the department performs Roadway Safety Audits. These audits are formal examinations of roadways by an independent team of trained specialists that assess their crash potential and safety performance. The team identifies safety problems so that project officials can evaluate, justify, and select appropriate design changes. In 1997, the Pennsylvania Department of Transportation was the first transportation agency in the United States to pilot the program. Since its inception, about 40 audits have been completed. According to the state department of transportation, the audits have prevented undesirable changes during design or construction, maximized opportunities to enhance safety, and minimized missed opportunities to enhance safety.

Pennsylvania has introduced two other infrastructure safety modifications aimed at improving rural road safety. First, the state installed 300 miles of centerline rumble strips in an effort to help warn drivers that they have strayed from their lane. State transportation officials estimated that rumble strips could reduce vehicle run-off-the-road crashes by 25 percent. In addition, Pennsylvania implemented a “dot” tailgating treatment program in which dots are painted on the state’s roadways, including rural two-lane roads, to help drivers determine a safe following distance. The spacing of the dots is based on the roadway’s speed limit. Each vehicle is expected to maintain a distance equal to at least two dot lengths from the vehicle ahead of it.

The Pennsylvania Department of Transportation also has several initiatives to modify unsafe driving behavior to help reach its 2005 goal. Sobriety

checkpoints, roving patrols, and mobile awareness patrols have been implemented to combat drunk driving. In 2002, 129 mobile awareness patrols were conducted. The state also has a program to install ignition interlock devices on the vehicles of those convicted of second or subsequent driving-under-the-influence offenses. The device must remain in the vehicle for 1 year following a 12-month suspension of driving privileges. Since its inception in 2000, the state reports the program has stopped 10,142 attempts to operate a vehicle on the state's roadways when the operator had a blood-alcohol content equal to or greater than .025 percent. The state also has several initiatives to improve safety belt use. Although the state has a secondary safety belt law, it received approval to use the "Click It or Ticket" initiative encouraged by NHTSA.<sup>3</sup> Transportation safety officials are also involved in increasing safety belt use among middle and high school students and in improving the use and incidence of child passenger seats through educational and training programs. State traffic safety officials also informed us of programs targeting increased safety belt use among light truck and pickup truck drivers who state officials believe are more prevalent in rural areas and generally decline to wear safety belts.

## Texas

During 2002, 2,096 people were killed on rural roads in Texas—the highest total in the nation. When adjusted for miles traveled, the fatality rate on rural roads in Texas is about 2.68 fatalities per 100 million vehicle miles traveled—greater than the national average of 2.29. Rural fatalities accounted for approximately 56 percent of all state roadway fatalities in 2002.

In fiscal year 2003, FHWA provided Texas with about \$2.2 billion in federal-aid highway funds. About \$57.6 million of these funds were provided for Hazard Elimination and Rail-Highway Crossing Programs. The state's safety funding under the Surface Transportation Program provided construction-related safety improvements on public roads, transportation facilities, bicycle or pedestrian pathways or trails, and for the rail-highway crossing safety programs. Texas also received about \$26.4 million of federal funds administered by NHTSA in fiscal year 2003, mainly to improve roadway safety through activities designed to influence driving behavior. Texas has appropriated \$40 million in state funds to supplement FHWA

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<sup>3</sup>Secondary seat belt laws allow police to issue a safety belt citation only if the motorist is pulled over for another infraction, such as an expired license tag.

funding for the Hazard Elimination Program, according to Texas Department of Transportation officials.

Texas officials identified several initiatives being undertaken to reduce fatalities on the state's rural roads:

- Texas Department of Transportation officials identified 235 hazard elimination projects that they plan on undertaking in fiscal year 2004. These \$43.4 million in projects, most of which are on rural roads, include adding intersection beacon lights, widening lanes, adding rumble strips, and removing trees near roads.
- Due to concerns about high fatality rates on narrow rural two-lane highways, particularly those with limited or no shoulders, district engineers assessed 30,000 miles of rural two-lane highways in 2003, checking the appropriateness of speed limits, the condition of signs and pavement markings, and assessing pavement edge drop-offs or curve warnings. Based on these assessments, changes will be made to address the most important findings.
- The state is installing shoulder rumble strips on all rural four-lane divided highways and researching the use of edgeline and centerline rumble strips on other roads.
- Because the state's alcohol-related crashes were the leading cause of motor vehicle fatalities in Texas during 2001, state officials told us they have worked with NHTSA and others to identify the nature of the problem and assess programs that could reduce impaired driving. As part of this effort, the state funded 13 projects aimed at reducing impaired driving in rural areas through increased enforcement and education programs.
- The state has initiated programs to aid rural crash victims, including new training for emergency medical technicians and first-aid training for police officers and bystanders.
- Texas is in the process of upgrading its crash data system to make data more timely. Texas is about 2 ½ years behind in entering crash data from police accident reports into its data system. State officials pointed out that without more timely data, it is difficult to determine if the actions taken on a stretch of road had the intended effect. Texas plans to have a new system in place by fiscal year 2005, at a cost of \$14 million. The new

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**Appendix II**  
**Examples of State Activities to Improve**  
**Rural Road Safety**

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Texas system will encourage local law enforcement agencies to collect, validate, and report crash data electronically. It will also provide centralized analysis, review, and data reporting to agencies that plan and conduct state highway safety programs.

# Low-Cost Safety Improvements

The Federal Highway Administration (FHWA) has identified more than 40 low-cost best practices as alternatives to capital construction at high-crash locations. These improvements are presented to state and local traffic engineers in FHWA's Low-Cost Safety Improvements Workshops. In addition, FHWA has qualified the strategies as proven, tried, or experimental. Proven include those strategies that have been used in one or more locations and for which properly designed evaluations have been conducted that show them to be effective. Tried countermeasures are those that have been implemented in a number of locations and that may even be accepted as standards or standard approaches but for which there have not been found valid evaluations. Experimental strategies are those that have been suggested and that at least one agency has considered sufficiently promising to try on a small scale in at least one location. Table 2 summarizes the low-cost alternatives and identifies potential safety impacts that were identified in the course materials and whether the countermeasure is proven, tried, or experimental.

**Table 2: FHWA's Low-Cost Safety Improvements**

<b>Roadside hazards</b>	<b>Countermeasure</b>
Trees	Remove or relocate trees near roadway. Cited accident reductions as a function of proximity to roadway ranging from 22 percent for a 3-foot increase to 71 percent for a 15-foot increase. Proven.
Utility poles	Relocate utility poles away from the roadway. Cited 32 percent reduction in fatalities and 45 percent reduction in nonfatal injuries by relocating or installing breakaway utility poles. Proven.
Sign supports	Clear or relocate sign supports and obstacles away from roadway. Cited a range of reduction in obstacle crashes from 14 to 40 percent by moving the obstacles 3 feet to 10 feet, respectively. Proven.
Mail boxes	Ensure mailboxes comply with breakaway provisions of the postal services. Tried.
Single vehicle run-off-the-road	Install rumble strips and rumble stripes to address inattentive, drowsy, and drunk drivers. Cited crash reduction by using rumble strips of from 15 percent to 70 percent on interstates (proven) and 20 percent to 49 percent on two-lane roads (tried).
<b>Signing and marking</b>	
Warning signs	Add signs that call attention to unexpected conditions and situations that might not be readily apparent to road users. Cited reduction of fatalities by 39 percent and injuries by 15 percent. Tried.
Special emphasis signs	Enhance signage (color or size) to call attention to driver. Tried.
Right-of-way signs	Install more visible right-of-way controls to enhance effectiveness. Tried.
Guide signs	Install street name signs with adequate-sized lettering in rural areas to identify important roads. Tried.
Lane use signs	Install clear lane use signage, such as "Left Turn Only." Tried.

**Appendix III  
Low-Cost Safety Improvements**

*(Continued From Previous Page)*

<b>Roadside hazards</b>	<b>Countermeasure</b>
Safety message signs	Include safety messages such as "Targeted Enforcement Area" or "Be Alert Heavy Truck Traffic." Tried.
Centerline and edge markings	Add centerlines and edge lines to roadways. Cited a reduction of 29 percent in crashes by adding centerlines and an additional 8 percent with edgelines. Tried.
Innovative roadway markings	Add innovative markings to roadways for such items as advisory speed markings, left-turn lane markings, and roadway parking space markings. Tried. Also noted adding markings to roadways to help inform drivers about adequate following distances. Cited a 60 percent reduction in rear-end crashes on main line with use of this roadway marking. Experimental.
Roadway delineation	Use pavement markings to reduce incidence of crashes. Cited reductions of 15 percent in fatalities and 6 percent in injuries. Tried.
Innovative curve treatments	Pave inside shoulder on curves and add pavement markings to help guide drivers. Tried.
<b>Intersections</b>	
Configuration	Address configuration features related to safety at intersection including presence of left turn lanes, number of legs, intersection sight distance, angle of intersection, and intersection form. Proven.
Access management	Improve access management as a key to improving safety at, and adjacent to, unsignaled intersections. Tried.
Traffic control	Install all-way stop control to reduce right-angle and turning movement crashes. Cited reductions of 53 percent in total crashes with conversion from two-way to four-way stop control. Tried.
Signing	Use warning signs, such as changing yield to stop, or warning signs, for intersections to reduce incidents of crashes. Cited traffic signs as reducing fatalities by 39 percent and injuries by 15 percent. Tried.
Flashing beacons	Install flashing beacons to alert drivers to approach with caution or stop. Cited California study that found, among other things, that total crashes were reduced 43 percent and single vehicle crashes by 67 percent. Tried.
Sight distance	Improve sight distance at intersections. Cited 5 percent reduction in total intersection-related crashes per intersection quadrant in which limited sight distance restrictions are eliminated. Tried.
Turning lanes	Add left-turn lanes to reduce rear-end crashes. Cited an expected 28 and 48 percent reductions, respectively, in total crashes from installation of a left-turn lane on one or both major-road approaches to a four-leg stop-controlled intersection and 14 and 26 percent reductions from installation of a right-turn lane on one or both major-road approaches. Proven.
Shoulder widening	Widen the shoulder at rural intersections. Cited crash reductions of 2.8 percent per foot of shoulder widening at rural intersections. Tried.
Transverse rumble strips	Install rumble strips going across the traffic lane to alert drivers in advance of intersection. Cited up to 50 percent reduction in rear-end and stop violation crashes. Tried.
Lighting	Install lighting at rural intersections. Cited study that found 43 percent reduction in fatalities and 17 percent in injuries. Proven.
Innovative techniques	Add innovative items at intersections such as right turn lanes (proven), dynamic activated flashers (tried), and the median inside an acceleration lane (tried).

**Appendix III  
Low-Cost Safety Improvements**

*(Continued From Previous Page)*

<b>Roadside hazards</b>	<b>Countermeasure</b>
<b>Traffic signals</b>	
Yellow light clearance timing	Update yellow clearance timing of traffic signals to allow more time for traffic to clear intersection. Tried.
All-red light clearance phase	Add an all-red clearance interval. Cited 15 percent to 30 percent crash reduction by adding an all-red clearance interval. Tried.
Visibility	Improve visibility of traffic signals. Cited 33 percent to 47 percent reduction in crashes from using 12-inch lens and additional signal units (or heads). Tried.
Back plates	Install back plates behind the traffic signal to improve its visibility. Cited report of 25 percent reduction in red light running and 32 percent reduction in related crashes. Tried.
Left turn signals	Change left turn signals to allow only turning with specific left turn green light. Cited a report of 97 percent reduction in left-turning crashes. Tried.
Yield on green sign	Add activated "Yield on Green" signs to better inform drivers wishing to turn. One city reported a 22 percent reduction in permissive left turn crashes. Experimental.
Advance warning signs with active flashers	Add signs with flashers to warn driver, such as "Be Prepared to Stop." Cited several reports ranging from 29 to 67 percent reduction in crashes from this measure. Tried.
Supplemental signal heads	Add additional traffic signals units (or heads) to intersections. Tried.
Overhead red "T" heads	Use overhead red "T" heads on traffic signals. These types of signals have two red lights next to each other to increase their visibility. Tried.
Late-night traffic signals	Remove late-night use of signals that flash yellow on the main road and red on the side street and replace with full-time traffic signals. Cited 78 percent reduction in right angle collisions and 32 percent reduction in all collisions during time of operations. Tried.
Coordination of signals	Coordinate traffic signals. Noted very few reports on safety benefits, but cited one report showing 12 percent reduction in crashes during peak morning and evening driving periods. Tried.
Signal controller	Upgrade signal controller to allow for traffic actuated rather than pretimed operations. Cited 28 percent reduction in all collisions. Tried.
<b>Railroad grade crossings</b>	
Stopping sight distance	Provide adequate ability to see a train and/or the traffic control device at the crossing in sufficient time for the driver to safely stop if necessary. Tried.
Signing	Use appropriate signing at crossings including Cross Buck signs, signs in advance of the crossing, and yield and stop signs. Tried.
Sight distance visibility	Provide adequate visibility by such things as removing obstructions, reducing posted speed, reconfiguring or relocating the crossing or grade separating the crossing. Tried.
Lighting	Add lighting at and adjacent to the rail crossing to increase visibility. Cited a reduction in nighttime crashes by more than 50 percent at rural and urban crossings. Proven.
Innovative measures	Adopt innovative measures to increase safety at rail crossings such as providing an emergency escape lane out of the crossing area for trapped vehicles. Tried.

Source: GAO presentation of FHWA information.

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