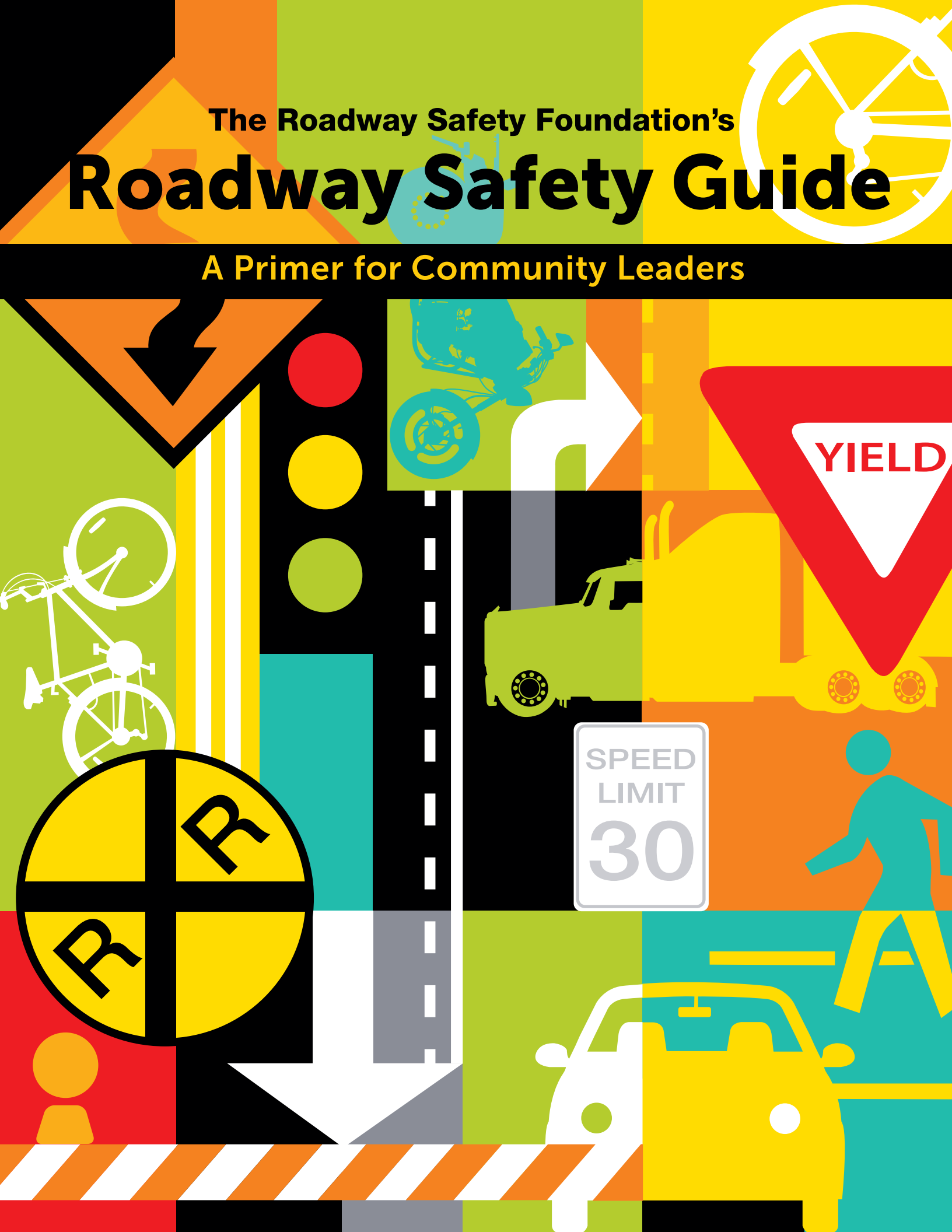
The Roadway Safety Foundation's

Roadway Safety Guide

A Primer for Community Leaders



The Roadway Safety Foundation is a 501(c)(3) nonprofit educational and charitable organization chartered in 1995 by the American Highway Users Alliance. Our mission is to reduce the frequency and severity of motor vehicle crashes, injuries, and fatalities through improvements to roadway systems and their environment.

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This material is based upon work supported by the Federal Highway Administration under cooperative agreements DTFH6114H00013 and DTFH6106H00032.

The Roadway Safety Foundation would like to thank the following sponsors for their support:

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SPECIAL ACKNOWLEDGEMENTS

The Roadway Safety Foundation would like to thank Bruce Hamilton for his tireless efforts and dedication to researching and writing this Guide.

We would also like to thank the members of the Roadway Safety Foundation Advisory Committee for their commitment to this project and for helping to review key sections of this Guide, including:

- **Dr. Wayne Allard DVM,** Vice President, Government Relations, American Motorcyclist Association, and Former Member U.S. Senate, U.S. House and Colorado Senate
- **Taylor R. Bowlden,** Manager, Federal Government Affairs, 3M Traffic Safety and Security Division
- **Anthony Giancola,** Former Executive Director of the National Association of County Engineers, Retired
- **Michael S. Griffith,** Director, Office of Safety Technologies, Federal Highway Administration
- **Jim Keaton,** Formerly with Lindsay Transportation Solutions, Retired
- **Lori Roman,** President, The Salt Institute
- **Sandy Spavone,** Former Executive Director of National Organizations for Youth Safety

RSF would also like to thank the following people who provided additional background information and photos for this Guide, including:

- **William P. Longstreet,** Highway Safety Engineer, Office of Safety Technologies, Federal Highway Administration
- **Jana Lynott, AICP,** Senior Strategic Policy Advisor, PPI Livable Communities Team, AARP
- **Dean Johnson,** President, Sandy Johnson Foundation

Last but not least, RSF would like to extend a sincere thanks to all of the organizations and individuals who provided interviews and materials for case studies, directed us to additional contacts, and helped add rich details to the many local efforts profiled in this Guide.

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PREFACE

A lot has changed since the Roadway Safety Foundation first published its *Roadway Safety Guide* in 2000. Technology has improved, various studies have helped refine our selection and construction of roadway safety features, and a reduction in overall highway deaths in recent years has been recorded.

Sadly, though, a lot hasn't changed.

Traffic crashes continue to be the leading killer of Americans ages 3-34, hitting the teenage demographic particularly hard.[1] The proliferation of increasingly-sophisticated mobile phones has given new meaning to the idea of "distracted driving." And, despite some overall positive trends in road user behavior and vehicle safety, studies have shown that deficiencies in *roadway* safety – the physical characteristics of roads themselves – contribute to more than half of the country's traffic fatalities each year.[2] As an organization dedicated to reducing motor vehicle deaths by promoting engineering improvements, we are naturally most troubled by this last point.

However, there is reason for cautious optimism.

In the 13 years since the *Roadway Safety Guide* was first published, numerous engineering treatments like modern roundabouts and median barriers have been devised or refined, with years of safety research now supporting their implementation. The Federal Highway Administration has been busy promoting crash countermeasures proven to save lives. In addition, the American Association of State Highway and Transportation Officials has also released its long-awaited Highway Safety Manual, a landmark document that provides tools for predicting and analyzing the safety impact of roadway projects.

Other major efforts are also underway.

Highway safety stakeholders across the country have coalesced around and adopted a National Strategy on Highway Safety, known as Toward Zero Deaths (TZD). This framework declares that even one death on America's roadways is unacceptable, and therefore insists that the only appropriate goal is to eliminate them entirely. On the international front, the United Nations has declared 2011 – 2020 the Decade of Action for Road Safety, a first-of-its kind effort to unite global partners in the fight to eradicate traffic crashes and save 1.3 million lives each year worldwide. In many ways, this is an exciting time in which road safety efforts have gained recognition and momentum.

In the summer of 2012, a bipartisan federal transportation bill was passed by Congress and signed by President Obama. The new law, "Moving Ahead for Progress in the 21st Century" (MAP-21), funds America's major roads, bridges, and mass transit systems for fiscal years 2013 and 2014. Notably, the bill's authors prioritized funding for safety investments like those discussed throughout the *Roadway Safety Guide.* MAP-21 nearly doubles the amount of funding available for the "Highway Safety Improvement Program" (HSIP), the core safety program created by Congress in 2006. Unlike many federal highway programs, which can only be used on major highways, the HSIP programs funds can be invested on all public roads.

We're just beginning, however.

Annual highway deaths still number over 30,000, representing an outrageous and largely-preventable loss. To help solidify our progress and build on it in coming years, we are pleased to offer the second edition of our *Roadway Safety Guide.* It has been thoroughly updated and revised to emphasize the most current thinking on topics ranging from rumble strips to youth outreach. New case studies, data, and best practices keep the Guide useful for a new decade, and make the case for continued safety progress on behalf of road users.

Of course, not everything has changed. Inside you will still find checklists for identifying roadway trouble spots, information on building successful coalitions, and tips for getting your concerns prioritized by the people who can address them. Written for non-engineers, it retains the readability that made the first edition so popular, and draws people from all backgrounds into the roadway safety conversation. We hope you enjoy reading our updated Guide and, most importantly, that it helps in your crucial efforts to improve highway safety in your community. •

INTRODUCTION

This Guide is designed to provide community leaders and local elected officials with basic information to improve roadway safety in their communities. It is intended to be a hands-on, user-friendly document, providing you with:

- **Strategies you can use to begin making roads, roadsides, and bridges safer.**
- **Basic information needed to work with state and local transportation departments, highway engineers, highway safety officials, civic groups, and other safety advocates.**
- **Clear descriptions of key funding and decision-making processes that affect roadway safety.**

An electronic version of the Guide, with periodic updates, is available on the RSF web site, www.roadwaysafety.org.

Why Is Roadway Safety Important to Me?

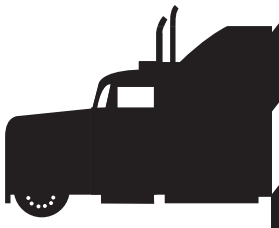
Before we proceed, you may be asking, "What do you mean by the term roadway safety and why is it important to me?" Certainly most road users want and expect safe roads, but their contribution to the overall health and safety of your community is not necessarily well understood by the general public.

The three major components of highway safety are road user behavior, vehicle safety, and roadway safety. Roadway safety refers to that portion of overall highway safety that is determined by the roadway's physical features and surrounding environment. Examples include road, bridge, and intersection design; signs; lighting; pavement markings; operating conditions; and roadside objects such as utility poles, trees, and guardrails.

The personal and economic costs of highway crashes to our citizens and communities are enormous. Here are a few points to consider:

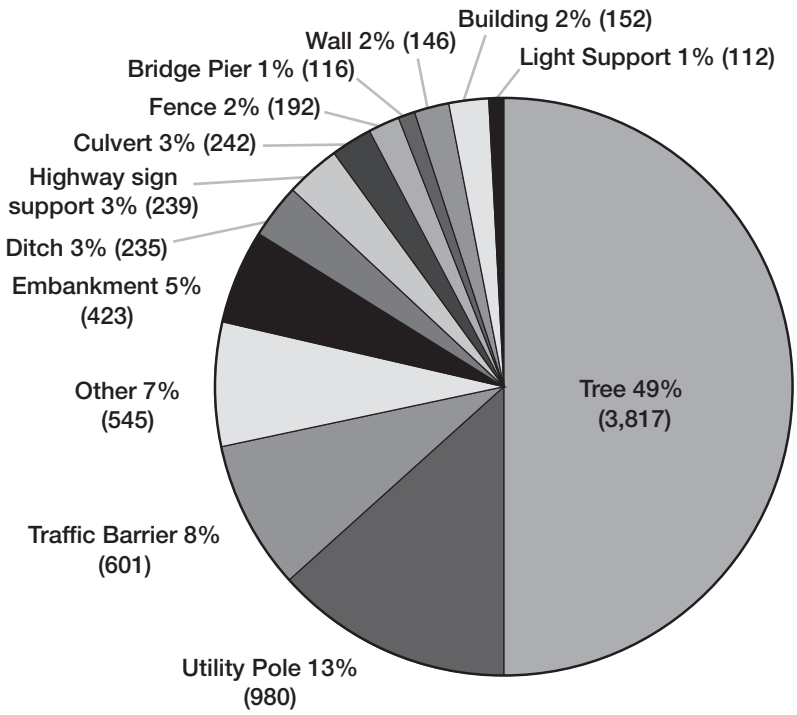
- **Nearly 53 percent of fatalities on America's highways occur in crashes in which the condition of the roadway is a contributing factor. The economic cost of these crashes is more than three times the amount invested annually by all levels of government nationwide in roadway improvements.**[2]
- **Roadway departure crashes account for over 50 percent of all U.S. highway fatalities each year. In 2011, 16,948 people were killed in fatal crashes of this kind. According to the Transportation Research Board (TRB), many of these casualties result from collisions with roadside objects, such as trees or poles that are located dangerously close to the side of the road.**[3]

Roadway safety refers to that portion of overall highway safety that is determined by the roadway's physical features and surrounding environment.



FATALITIES BY OBJECT STRUCK

Percent numbers below are out of a total 7,800 fatalities in fixed object crashes in 2009



Source: 2009 National Highway Traffic Safety Administration Data

- **In the nation's major urbanized areas, motor vehicle crashes cost society roughly $300 billion per year.[4] The economic costs in medical expenses, worker losses, property damage, and emergency services compound the personal tragedies resulting from highway crashes.**

There are a variety of cost-beneficial crash countermeasures and design strategies that have been shown to be effective in reducing the number and/or severity of highway crashes. Consider what the following strategies can achieve in your community:

- **Removing or relocating fixed roadside objects can reduce fatal or injury crashes by 64 percent.[3]**
- **Installing a median barrier system can reduce fatal/injury crashes by 88 percent.[5]**
- **Replacing traditional signalized intersections with modern roundabouts can reduce crashes by 35 percent and fatalities by up to 90 percent.[6]**
- **Rumble strips can reduce drift-off-road crashes by as much as 80 percent.[7]**
- **Restoring surface friction with timely removal of ice and snow reduces crash frequency by over 88 percent, and deicing pays for itself within 25 minutes of salt application.[8]**

The Highway Safety Improvement Program and the "Safe System" Approach

The bullets above are examples of crash reduction factors (CRFs), which provide an estimate of the impact that various engineering treatments can be expected to have on crash numbers. Increasingly, officials, policymakers, and the general public are appreciating the importance of addressing motor

vehicle crashes and fatalities from an infrastructure standpoint, and research shows such efforts are paying off. This document, therefore, is intended to help you build on these successes for the benefit of your community.

In 2005, 43,510 people were killed in traffic crashes in the United States. Beginning in 2006, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) began providing increased funding for safety-related investments on the nation's roadways under the Highway Safety Improvement Program (HSIP). This same year also marked the start of a consistent and steady decline in highway fatalities; by 2009, such deaths had fallen to the lowest level (33,808) since 1950. In June 2010, SAIC conducted a study that concluded this was not mere coincidence, but rather the direct result of HSIP funds being well invested in lifesaving projects. The study examined other potential reasons for the decline in fatalities, including increased seatbelt usage, increased airbag availability, and a reduction in travel due to the economic recession, and concluded that none of these factors statistically accounted for the sharp decrease in highway deaths. Moreover, the researchers concluded that for every $1 million increase in HSIP fund obligations, an additional seven lives were saved per year (yielding a benefit/cost ratio determined to be 42.7 to 1).[9]

Safe infrastructure is an integral component in an increasingly-championed concept known as the "Safe System" approach. Proponents of this idea acknowledge that road user behavior plays a major role in traffic crashes and therefore must be addressed, but also recognize that drivers will always be vulnerable to human error. The "Safe System" approach, therefore, reaches beyond the actions of the driver and calls for safe vehicles to be driven at safe speeds on infrastructure that is designed to be forgiving of inevitable mistakes. It thereby emphasizes eliminating traffic fatalities through the safe interplay of the various components of the road system such that when crashes do occur, they are not severe enough to cause death or serious injury.[10]

So what does all of this mean? It means that if you're looking to reduce motor vehicle crashes, fatalities, and injuries in your community, improving the physical and operational characteristics of your area's roadways is a terrific place to start. Such efforts work, and the payoff is priceless: lives saved in your community and nationwide.

Getting Started...

There are many sources of information and opinions about problems with our streets and roadways. Some come from the media, neighborhood blogs, or our own everyday experience driving around town. But how do these problems get fixed?

We may not be entirely certain what the problem is, what can reasonably be done about it, whose job it is to "fix it,"and how to pay for needed safety improvements. This Guide is designed to help you and other community leaders answer these questions.

- To whom should we turn?
- How do we decide which intersection, bridge, curve, roadside hazard, or operating condition poses the greatest safety risks to our community?
- Which one should "they" tackle first?
- Would it be more appropriate to institute a systemic, area-wide improvement?
- Who will pay for it?
- How soon can it be fixed?

The reality is that even though we believe that problems exist, we may not be entirely certain what the problem is, what can reasonably be done about it, whose job it is to "fix it," and how to pay for needed safety improvements. These are the types of real-world questions that come up every day in communities all across our nation. This Guide is designed to help you and other community leaders answer these questions. It does not contain all the answers, but it does tell you how to ask the right questions of the right people. It also acquaints you with the processes, tools, and techniques that highway planners and engineers use so that you will be able to work with them to address your community roadway problems. •

CHAPTER 1
A Primer on Roadway Safety

This chapter answers four basic questions:

1. How do you identify roadway safety problems?
2. Who is responsible for community roads and how do you contact them?
3. What kinds of information do you need to fully describe roadway safety problems?
4. How can you work with transportation professionals to get the job done?

The strategy that follows will help you:

- Identify those "problem" stretches of road, or "trouble spots."
- Identify unsafe operating conditions.
- Ensure that you have the information you need to describe roadway problems in your community.
- Ensure that your concerns get to the right people.

So Where Do You Begin? What are You Aiming For?

Community leaders like you have said:

"We want to…

... SEE A REDUCTION in the number and severity of crashes on particularly troublesome roadways and/or under hazardous operating conditions.

... BE ABLE TO TALK intelligently to the people responsible for building and maintaining our roads so that they will incorporate our concerns into their plans.

... PROACTIVELY FIX problems, preventing crashes *before* they occur.

... REDUCE SOCIETAL COSTS related to trauma, lives lost, and travel delays caused by preventable crashes.

... SAVE TAXPAYERS' MONEY by choosing cost-effective, lifesaving projects."

Such statements could be considered goals to work toward as you make your roads safer. What are the roadway safety goals specific to your community?

Keep these goals in mind as you begin the following steps toward getting your concern addressed.

Step 1: Understanding Safe vs. Hazardous Roadway Conditions

The highway system in the United States is one of the most advanced in the world, consisting of more than four million miles of roadway that provide over 8.5 million lane-miles of travel space.[11] The conditions of these roads, however, vary greatly, with the most dangerous (rural two-lane highways) seeing fatality rates on average two-three times higher than those of the safest roads, our Interstates.[12]

So What Makes a Road Safe?

A safe road is one that *helps reduce driver error, forgives inevitable mistakes, and mitigates the effects of unforeseen circumstances.* For example:

- **Rumble strips, paved shoulders, clear zones, and safety barriers protect drivers when they make mistakes.**
- **Generous sight distances and bright, retroreflective signs and lane markings help give drivers advance warning of unanticipated hazards and changes in the road environment.**
- **Applying high-friction surfaces at curves and proactively clearing ice and snow help improve stopping distance and keep the rubber on the road.**
- **Dedicated turn lanes, protected turn phasing, roundabouts, and proper access control from driveways and shopping centers prevent unsafe conflicts between vehicles.**

Rural roads are often twisting, with high speeds, blind curves, narrow shoulders, and abundant roadside hazards.

Interstates are built to the highest standards, and feature wide travel lanes, divided medians, crash barriers and other lifesaving treatments. In contrast, rural roads are often twisting, with high speeds, blind curves, narrow shoulders, and abundant roadside hazards. If you make a mistake on an Interstate and depart the roadway, chances are a safety barrier will protect you. The same mistake on a rural highway will likely send you into a tree, ditch, or utility pole.

There is no such thing (yet) as a risk-free road, but those that are engineered to predict driver error and protect against it boast the lowest fatality rates. This is one of the underlying ideas behind the Safe System approach, and highlights the importance of roadway safety efforts in all communities.

Seven Principal Safety Concerns

Despite carrying 25 percent of the nation's traffic, the Interstate system only makes up one percent of the highway mileage in the country.[13] This means all of us are likely to spend a good deal of time on riskier roads lacking the advanced safety features that are proven to save lives. Here, we discuss seven roadway concerns that safety experts agree are potentially dangerous, regardless of location. These are particularly noteworthy because they are underlying, systemic conditions that exacerbate the risk of other important crash factors, such as excessive speed, driver error, and bad weather. Remember to consider these concerns as you fill out the following checklist in step 2 and describe your trouble spot or hazardous operating condition. Does it relate to one or more of the seven roadway concerns described below? Circle those that are most applicable to your situation.

1. **Roadway departure hazards:**
   Vehicles leaving the roadway, regardless of cause, account for approximately 15,000-20,000 deaths per year, with 53 percent of fatal crashes involving a roadway departure.[14] These crashes, which can happen on straight or curved sections of roadway, occur when a vehicle leaves its travel lane and crosses a centerline or edge line (at a non-intersection location). Roadway departure is therefore an umbrella category that encompasses crossover crashes and run-off-the-road crashes, both of which tend to be severe and often involve vehicle rollover or collisions with fixed objects such as trees and utility poles.[14] Other roadside hazards include steep side slopes, drainage ditches along the roadway, and narrow shoulders not large enough to accommodate an errant or disabled vehicle.

2. **Road surface conditions:**
   Even well-engineered, well-constructed roadways can become treacherous when blanketed with snow, or when poorly maintained. Aberrations in the road surface – such as pavement edge drop-offs, potholes, and reductions in surface friction due to age, wear, poor drainage, and inadequate ice or snow removal – impair vehicle control, often leading to preventable crashes.

Metro

CROSS TRAFFIC
DOES NOT STOP

FRED SQUILLANTE | DISPATCH

Every year the state identifies the most-dangerous crash sites and decides which ones to correct. The intersection of Morse Road and Rt. 310 was on the priority list. But last month, Dean Johnson's wife and mother in-law were killed there in a crash he says never should have happened.

Deadly crossings, calculated risks

By Doug Haddix
THE COLUMBUS DISPATCH

Dean Johnson keeps a blue coffee mug stained with his wife's blood in a freezer bag in his

Accident scene

The intersection of Morse Road and Rt. 310 has been on the state's priority list of dangerous crossroads for the past five years.

Detail area
Cramville
Morse Rd.
310
LICKING COUNTY
Pataskala
16
3

3. Narrow roadways and bridges:
Narrow roadways make it difficult for drivers to safely maneuver in emergency and non-emergency situations; there simply isn't enough room to do so. Narrow bridges are particularly hazardous. Collisions with bridge ends are relatively infrequent, but they are often severe. Such crashes usually occur when the width of a bridge is less than that of the approaching travel lanes and shoulders. As a result, vehicles may strike the ends of bridges, guardrails, curbing, or traffic traveling in the opposite direction.

4. Railroad crossings:
A person or vehicle is hit by a train approximately every three hours in the United States, and people are 20 times more likely to die when involved in a collision with a train than with another motor vehicle.[15] Trains can't steer to avoid a collision, and a 150-car freight train traveling at 50 mph takes over 1.5 miles to stop. Railroad crossings are of critical concern, and they can be extremely hazardous, regardless of how busy they are.

5. Work zones:
Work zones are a necessary fact of life in our communities, but they create conditions – such as shifting traffic patterns, narrow lanes, suddenly-changing speeds, and congestion – that can be hazardous to drivers and highway workers. Roughly 700 people are killed and 40,000 are injured in work zones every year, with motorists themselves making up 80 percent of work zone-related fatalities.[16] Sometimes work zones are poorly marked, and warning signs can be hard to see, especially at night. Additionally, if such signs and traffic control devices do not accurately portray actual work in progress, drivers may disregard these warning signs with tragic consequences.

6. Intersections:
Over 20 percent of highway fatalities involve intersections, which are among the most complex sections of a roadway to navigate even under the best conditions.[17] Road users must process a great deal of information in a short amount of time; when confusing turn lanes, blind spots, visual obstructions, or lack of adequate signs, signals, and lighting are thrown into the mix, the challenge is even greater.

7. Roadway design limitations:
The safety of many local roads is limited because they were built to serve fewer cars traveling at slower speeds. Because of the explosion in vehicle miles traveled over the past 40 years, many of these roads are now high-speed commuter corridors. Their safety is compromised by hazards such as sharp curves, poor signs and markings, hidden intersections, and lack of medians to separate oncoming traffic. Fatality rates on these roads can be several times higher than on the heavily-traveled, high-speed Interstate system.[12] Local governments, which are responsible for over 75 percent of our entire road network,[18] usually target scarce resources to fix the most serious problems first. Drivers must therefore be aware of roadway hazards and drive with extra care.

Step 2:
Identify Your Trouble Area by Completing the Road Problem Checklist:

Date: _____

Your Name and Organization: _____

_____

_____

1. Location (Street name, names of intersecting streets, mileposts, other landmarks)

_____

_____

_____

Is your trouble area or hazardous condition

	Yes	No
A systemic condition present throughout the community?	_____	_____
Confined to a specific location?	_____	_____

If confined to a specific location, is it

A stretch of road?	_____	_____
A curve?	_____	_____
An intersection?	_____	_____

Other: _____

2. Is your trouble area or hazardous condition located on a road that serves

(Circle all that apply)

high-speed traffic	commuters
pedestrians	farm vehicles
local access to shopping, schools, etc.	bicyclists
truck traffic	other: _____

3. Are there obstructions that block a driver's view?

Yes ____ No ____

If so, do the obstructions block a driver's view of
(Circle all that apply)

other vehicles or crossing traffic	signals or stop signs
the road ahead	road markings or street signs
pedestrians or crosswalks	other: _____

What is causing the obstructions?
(Circle all that apply)

trees
shrubs or other vegetation
signs
other moving vehicles
curve or other roadway alignment issue
parked vehicles
snow
buildings
hill
other: _____

4. Are there roadside hazards that drivers can hit if they leave the roadway?
Yes ____ No ____

If so, are they
(Circle all that apply)

trees
utility poles / street lights
parked cars
buildings
guardrails
bridge supports
people
other: _____

5. Do poor pavement conditions contribute to the problem?

Yes ____ No ____

If so, what conditions exist?
(Circle all that apply)

slick pavement
potholes or deep ruts
other:_____
slow removal of snow, ice, and other debris
pavement drop-offs at road edge

6. Is the trouble area a particular problem

	Yes	No
At night?	____	____
In rain?	_____	_____
In snow?	_____	_____

Other (explain) _____

7. If your trouble area is located downtown or in a busy suburb, is enough parking available?

Yes ____ No ____

8. Are there other road conditions that could make driving hazardous?

Yes ____ No ____

If so, do they include
(Circle all that apply)

sharp or improperly-banked curves

narrow lanes

narrow or no shoulders to pull off for emergency stops

missing or hard-to-see signs or pavement markings

no median barriers

sunrise or sunset glare

lack of adequate lighting

missing or damaged guardrails or barriers

railroad crossings

other: _____

9. Does your concern involve a highway construction work zone?
Yes ____ No ____

If so, is work going on when traffic signs say it is?
Yes ____ No ____

Are drivers given enough warning of new traffic patterns?
Yes ____ No ____

Are drivers given enough warning of the need to slow down or take other actions?
Yes ____ No ____

Are there obstructions in or along the road that make it dangerous to drive?
Yes ____ No ____

If so, do they include
(Circle all that apply)

debris

work equipment or materials

other: _____

stopped or abandoned vehicles

workers in travel lane

10. Are there hazardous conditions for pedestrians and bicyclists?

Yes ____ No ____

If so, do they involve
(Circle all that apply)

lack of sidewalks

conflicts with vehicles

jaywalking

narrow lanes

frequent red light-running

lack of crosswalks

lack of bike lanes or paths

blind spots or obstructions/parked cars

insufficient time for pedestrian crossings

other: _____

By completing the roadway safety checklist, you are in a better position to think about possible countermeasures and discuss potential solutions with the right people. Remember that the more information you bring to the table, the more convincing your case will be to those who are balancing budgets, manpower, and equipment as they prioritize road projects. Before discussing your concerns with highway engineers and road agencies, though, it is important to learn about the kinds of countermeasures that are available.

Step 3: Learn About Current Thinking on Cost-effective, Practical Crash Countermeasures Supported by Safety Experts in the Field.

The Federal Highway Administration's (FHWA) Office of Safety identifies and publishes descriptions of crash countermeasures – such as median barriers, rumble strips, and dedicated left-turn lanes – encouraged for widespread implementation. Their adoption by transportation agencies across the country has been shown to reduce highway injuries and fatalities, and one or more of these countermeasures will likely be considered by the agency or engineers reviewing your concerns. The full list can be found at http://safety.fhwa.dot.gov, and many will be discussed in detail throughout this Guide. In the next chapter, for example, we'll take a look at real-world case studies and match some of these countermeasures to the various roadway hazards identified in Step 1.

It's beneficial, for a variety of reasons, to familiarize yourself early on with some of the engineering strategies and countermeasures you may encounter as you work with your local transportation officials and agencies. Having a sense of some of the current thinking in this field will help you to:

- **Approach this process with realistic, practical expectations about what can be achieved, at what cost, and in what period of time;**
- **Put resource constraints into context and better understand how officials might set project priorities;**
- **Demonstrate that you are not "just complaining" about a problem, but are determined to take time to think about possible solutions;**
- **Understand from the outset some of the terminology, statistics, and data that will be tossed around and cited when officials discuss and examine your trouble area; and**
- **Articulate why your concerns do not represent intractable problems, but rather challenges that can be sensibly addressed.**

This Guide is a great place to start learning about some of these countermeasures, particularly since it's written specifically for non-engineers. FHWA also maintains informative web pages, as do various traffic safety materials manufacturers, groups involved with maintenance and winter weather operations, and state Departments of Transportation. Additional suggestions, contacts, and resources are provided in Chapter 5.

Familiarize yourself early on with some of the engineering strategies and countermeasures you may encounter as you work with your local transportation officials and agencies.

Step 4: Work with Your Local, State, and Regional Highway Engineers and Other Relevant Agencies.

This Guide takes you through a process that will keep you on the right track as you move forward with improving roadway safety in your community. Because you have followed the first three steps in identifying roadway safety problems described in the preceding pages, you are already in a better position to ensure that the engineers and government officials who are responsible for your roads will understand your concerns and take action. Just who is responsible for your roads? This section will identify the local, state, and federal agencies that make it their business to address roadway concerns.

Below is a typical news item from a community frustrated with major roadway problems.

BOX 1.1: SAMPLE LOCAL NEWS CLIP

A multivehicle crash ensued yesterday on Simion Road after a portion of the road fell in. While there was significant property damage, there were no serious or fatal injuries. Families living near the site told reporters that an excessive number of potholes had been reported to local government officials just last week. Others interviewed stated the same problem occurs each year after the winter season, and complaints are waged annually. Crews typically come, patch up the holes, and leave, said Sylvester Smith, Simion Road resident. The community s Citizens Organization has been told that the repair time will be lengthy and costly. Residents are up-in-arms. Said Rose Lymer, a 50-year resident, There are a lot of older people here; how are we supposed to get out of the neighborhood while the construction goes on?

Elected officials and community leaders need not feel powerless in the face of such challenges. The government agencies that control our roads may appear to create a confusing web so perplexing at times that it seems easier to throw in the towel and live with the status quo. This section will help you to determine who has the authority to improve the safety of your roads so you won't give up on your efforts to get concerns addressed. The pages that follow will:

- **Describe the agencies responsible for the maintenance and safety of different types of roads, from the Interstate to local streets.**
- **List potential contacts to help identify those responsible for community roads.**

Functions and Agencies Responsible for Different Types of Roads

Road engineers, planners, and other professionals employ a variety of terms to describe the various "functions" of roads or the "jurisdiction" they fall under. For example, terms such as "collector roads" or "arterial highways" describe the function of specific roadways. But for the purposes of this Guide, it is more important for you to know who has the authority to make the safety improvements you want. The chart below gives you an overview of the names and symbols associated with roadway types, those responsible for such roads, and approximate roadway mileage for each type of road.

BOX 1.2: WHO IS RESPONSIBLE FOR OUR HIGHWAYS?

	State roadways (few are un-numbered)	Federal roadways (many are not-numbered)	Local roadways (most are not numbered)
Typical signage	  Interstates, State routes, State Park roads, State toll roads	 Federal Park roads, Federal Forest roads, Military and Indian Reservation Roads	 All other roads under the control of cities, counties, towns and townships
Approximate mileage	830,000	131,000	3,080,000
Jurisdiction or agency responsible	State Highway or Transportation Department (local district office and/or headquarters)	National Park Service, Bureau of Indian Affairs, Federal Highway Administration	County, municipal or other local Departments of Transportation/ Public Works

Source: Highway Statistics series Table HM-10

Potential Contacts to Help Identify Those Responsible for Community Roads

Determining which government agency, state or local, is responsible for a particular section of road or intersection is usually straightforward, but not always! To better ensure that your roadway initiative yields positive results:

- **Remember, who you contact will depend on where you live.**

  Centerville, South Dakota's local government agencies that deal with transportation problems will look very different from those located in New York City. Therefore, the information that follows is to help get you started and should not be taken as definitive truth, particularly relating to your own community's circumstances.

- **Take a good look at your Road Problem Checklist.**

  Does it clearly define your problem? If so, can you accurately and articulately describe it to appropriate government entities?

- **Be a savvy consumer.**

  Getting your questions answered and your concerns addressed requires finding out whom to talk to. "Becoming a savvy consumer is the first step toward having your concerns addressed effectively and efficiently," advises a planner in a local department of transportation. Make sure you know "who owns the road"—you need to know if the targeted road is state, municipally, or county-maintained. Your phone calls and letters should start with that particular level of government.

- **Be prepared to contact more than one agency.**

  Planning, building, operating, and maintaining roads are responsibilities shared among a variety of agencies. Never assume that these entities are talking to each other or working together. Be prepared to contact all agencies who play a role in addressing your trouble area or hazardous condition.

On the Local Level

About 75 percent of roads fall under local control, and many are not numbered.[18] A great place to start is with your city or county Department of Public Works and/or Transportation. Often, Public Works and Transportation are combined or transportation issues are addressed separately under individual "Public Works" and "Transportation" headings. Make sure you investigate both. The key is to match your trouble area with the department that has responsibility for the road. Here are examples of some of the offices you may encounter:

- **Street and Sidewalk Maintenance**
- **Roads Inspection**
- **Street Assessments**
- **Highway Services Division**
- **Traffic and Parking Services**
- **Neighborhood Traffic Issues**
- **Transit Services Division**
- **Road Repair/Snow Removal**
- **Pothole Repair**
- **Roadside Maintenance**
- **Street Construction**
- **Traffic Operations**

Local Elected Officials

Your elected officials can be key partners in addressing safety concerns. They can help you locate the right contact in the responsible agency.

Sheriff's or Police Department

The local sheriff or police chief is also an appropriate contact in smaller communities.

On the State Level

State Department of Transportation or Highway Department

State routes are generally numbered. Just as with the local departments of transportation or public works, go to the office that appears to be most applicable to your trouble area. Keep in mind that some state DOTs have highly-centralized operations out of offices located in major cities or state capitals, while others have a decentralized structure that relies on local or district offices throughout the state. It's important to find out if a centralized office handles projects in your state, or if you should focus on contacting your local office. When reaching out to your state DOT, some specific office titles you may find useful include:

- **Division of Highways**
- **Planning and Environment**
- **Traffic Operations or Engineering**
- **Safety and Loss Control**
- **Public Information Office**
- **Maintenance**
- **State Highway or Transportation Agency/ Department District Office**

Each state DOT can help you confirm whether a particular road is maintained locally or by the state. Contact your state DOT for assistance.

State Highway Safety Office

These agencies focus on highway safety issues related to driver behavior, such as impaired driving prevention; seat belt and child safety seat use; distracted driving; and motorcycle, pedestrian, and bicycle safety. The Governor's Highway Safety Representatives who head these offices can be very helpful in explaining state safety priorities and identifying state contacts for roadway safety and infrastructure issues. Other divisions you may encounter on the state level include traffic records, state highway patrol, and emergency medical services. These also play a role in ensuring the safety of our roadways.

On the Federal Level

Many people believe that Interstate highways are maintained by the Federal government, but they are not. In fact, Federal agencies maintain relatively few roads. Those they are responsible for include some in National Parks, National Forests, and on Indian Reservations.[18] These roads are often identifiable by their brown-colored signs. If your concern is on a Federal roadway, contact the Federal Lands Highway Office (FLH) in your region; information can be found at http://flh.fhwa.dot.gov/. FLH is part of the FHWA, the major Federal agency responsible for roads and highways.

Federal Highway Administration

FHWA plays a key role in developing best practices for roadway safety and promotes research into important roadway safety issues and crash countermeasures.

FHWA has division offices located in each state. Additionally, FHWA has established five resource centers that can provide community leaders and elected officials with roadway safety information. A complete description of division offices and resource centers is included in Chapter 5 of this Guide, along with appropriate contact information.

National Highway Traffic Safety Administration

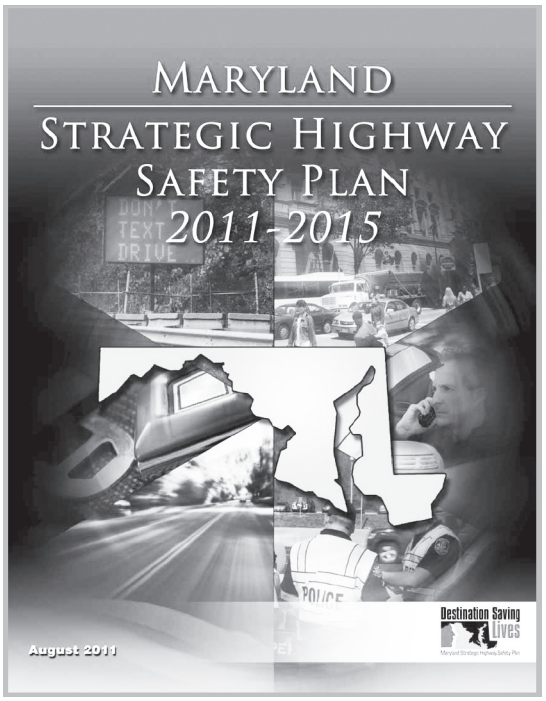
NHTSA is another federal agency that has an important role in ensuring driver and passenger safety on our roads. Like the State Highway Safety Offices described previously, NHTSA focuses on the behavioral aspects of traffic safety. In addition, it establishes

motor vehicle and child passenger safety seat standards, and maintains traffic safety records. The agency has 10 offices across the United States that implement NHTSA programs. Contact information for the offices can be found in Chapter 5.

Federal Motor Carrier Safety Administration
FMCSA provides leadership at the federal level to reduce crashes, fatalities, and injuries involving commercial motor vehicles. Responsibilities of FMCSA include enforcing safety regulations, developing commercial driver licensing standards, maintaining data on motor carrier safety, and providing states with assistance on roadside inspections. FMCSA is a good resource if your concerns involve trucks or buses. •

At this point you have compared your trouble area with the seven most hazardous roadway conditions, completed the Road Problem Checklist, and identified those "movers and shakers" in your community who can make changes happen.

What comes next? Collaboration! The information you have already collected can be put to good use here. It is time to provide the information you have collected to your community's transportation professionals so they can objectively study the road problem you have identified and put it in context with other highway problems known in your community. Then the process of determining the relative safety priority of each problem and when and how it can be fixed can begin.



Each state is required by law to develop a Strategic Highway Safety Plan.

How Do Highway Engineers Decide Which Road Safety Problems Deserve Attention First?

Clearly, data are needed to provide an objective basis for placing all roadway trouble spots or hazardous conditions in some priority order. In fact, each state is required by law to develop a Strategic Highway Safety Plan (SHSP) that establishes a statewide framework for reducing crashes, fatalities, and injuries on all public roads.[19] The SHSP is a data-driven approach that sets goals, objectives, and focus areas developed by diverse stakeholders addressing all four "E" areas – Engineering, Education, Enforcement, and Emergency Medical Services.[19]

The SHSP is a public document that should be available through your state's DOT. Consulting this document will give you a good overview of the priorities your state has set with regards to improving highway safety. You may even be encouraged to find that your community roadway concerns fit in with these established priorities. If, however, your problem doesn't seem to fit in with the SHSP, don't be discouraged! The SHSP is a framework; it doesn't dictate approval of specific projects, and you may be raising an important concern that has been overlooked.

What Highway Engineers Do

The pages that follow will show you the general process by which highway engineers prioritize road safety needs and conduct highway safety improvements. You don't need to learn all the details, but an appreciation for this process will help you understand the way they set priorities and work effectively with them. Typically, the following series of steps is taken:

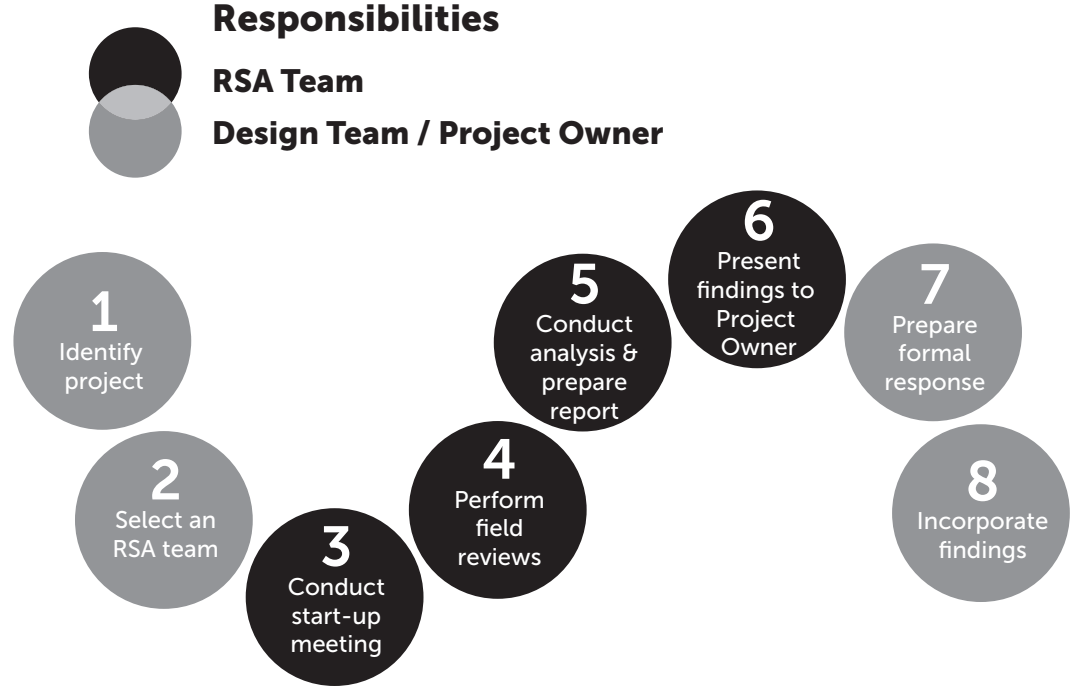
1. **Identify systemic problems, hazardous location(s) and conditions.**
   With the information you have collected in your Road Problem Checklist, you can assist your community's transportation professionals in identifying specific concerns.

2. **Conduct a Road Safety Assessment (RSA).**
   Once a particular hazardous location or condition has been identified, a Road Safety Assessment (or Audit) – one of the proven countermeasures named by FHWA – may be conducted. FHWA defines a RSA as a formal safety performance evaluation of an existing or future roadway by an independent team. RSA's are performed by professionals from diverse areas of expertise, and take into account all types of road users, as well as human factors such as abilities and limitations. Local police officers, paramedics, road design engineers, crash investigation experts, and human factors specialists all may be appropriate candidates for inclusion in the RSA team.[20] Supporting the completion of such a safety assessment is one of the best ways to ensure your trouble spot or hazardous condition will be selected for attention.

   While RSAs are the gold standard for addressing safety problems, not all state and local transportation agencies have adopted this high-level practice. The steps for a true RSA are shown in Box 1.6. Note that when a formal RSA is conducted, it will always entail preparation of a full report on the findings, including identifying possible safety deficiencies and recommending solutions.[20] Whether or not a formal RSA is conducted in your area, these are the general steps that will be taken to assess a roadway.

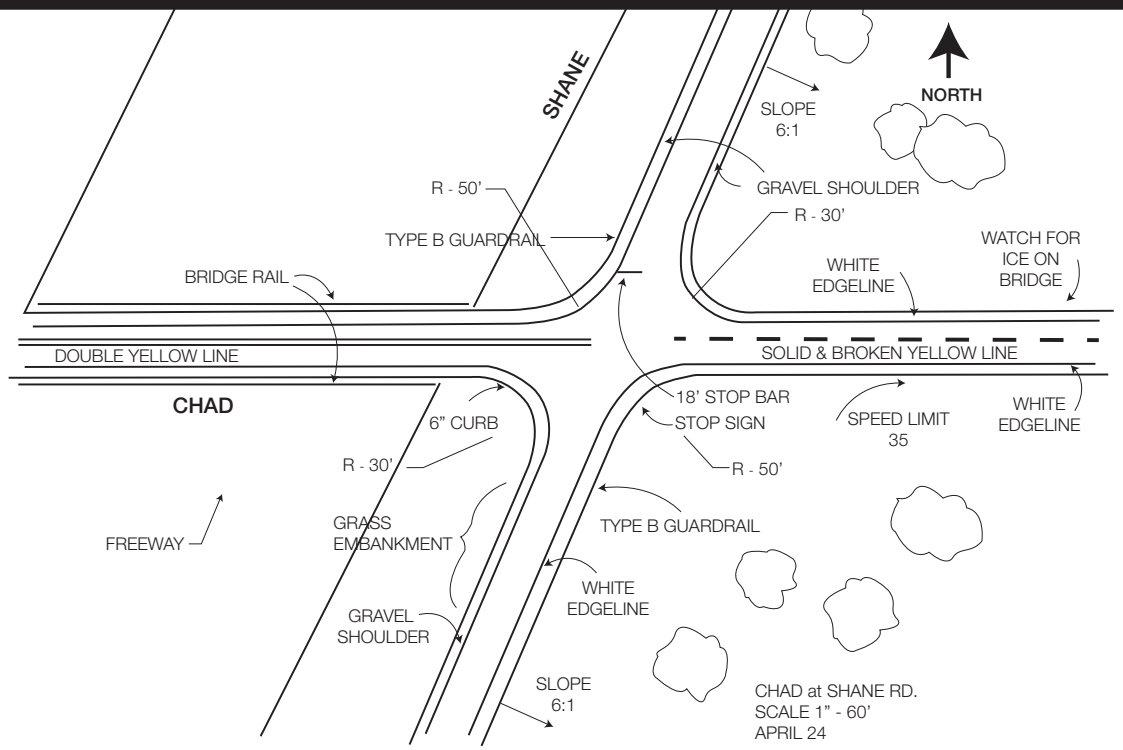
   a) Collect and analyze preliminary data.
   The type of data available on your trouble spot will be dependent on the record keeping practices of local and state agencies. Primary data types include police crash records, complaint files, maintenance records, and original construction and design plans if available. Additional information regarding data is provided in Chapter 5.

BOX 1.3: FORMAL PROCESS FOR COMPLETING AN RSA



Source: Federal Highway Administration

BOX 1.4: DIAGRAM FOR AN INTERSECTION



Condition diagram for the intersection of Chad and Shane Roads

BOX 1.5: FIELD OBSERVATION REPORT FOR INTERSECTIONS

Location:	Intersection of Wayland Boulevard and Newport Street		
Date:	June 11	Time	4:05 PM
Item #	Operational Checklist	NO	YES
1	Do obstructions block the drivers' view of opposing or conflicting vehicles?		X
2	Do drivers respond incorrectly to signals, signs, or other traffic control devices?	X	
3	Are there violations of parking or other traffic regulations?	X	
4	Do drivers have trouble finding the correct path through the location?	X	
5	Are drivers confused about routes, street names, or other guidance information?	X	
6	Are vehicle speeds: too high?		X
	too low?	X	
7	Is vehicle delay causing a safety concern?	X	
8	Are there traffic flow deficiencies or traffic conflict patterns associated with turning movements?	X	
9	Are problems being caused by the volume of: through traffic?	X	
	turning traffic?	X	
10	Are there other traffic flow deficiencies or traffic conflict patterns?	X	
11	Do the presence of existing driveways contribute to crashes or eratic movements?	X	
12	Do pedestrian movements through the location cause conflicts?	X	
13	Is there a lack of adequate lighting that causes safety problems?	X	
14	Are signs and markings easily visible in all lighting and weather conditions?		X

b) Identify and collect field data.
An initial visit may be made to the trouble area to identify possible safety deficiencies, gain familiarity with the site conditions and traffic operations, and construct a condition diagram or scaled drawing (See Box 1.4) of the important physical features of the roadway location. Experts may also use other tools, such as Google Maps or the risk and safety rating maps produced by the U.S. Road Assessment Program can also help. (usRAP – see Chapter 2 case studies and the resource listings in Chapter 5). See Box 1.5 for an example of a field-review checklist.

c) Conduct appropriate detailed studies and analysis.
Highway professionals can conduct a range of studies and collect roadway data depending on the type(s) of problems encountered. These may include:

- **Traffic Volume**
- **Spot Speed**
- **Ball Bank (determines maximum safe speed on a curve)**
- **Sight Distance**
- **Traffic Conflict and Event**
- **Travel Time and Delay**
- **Roadway and Intersection Capacity**
- **Skid Resistance**
- **Gap (between traffic)**
- **Queue Length (backups)**
- **Highway Lighting**
- **Weather-Related Factors**
- **School Crossing**
- **Railroad Crossing**
- **Traffic Control Device**
- **Bicycle and Pedestrian**

d) Determine safety and operational deficiencies.
This step determines if the results of the studies and data support or eliminate any of the possible safety or operational deficiencies. A list of probable causes or deficiencies is developed that will be used to identify appropriate countermeasures. Possible deficiencies may include lane channelization issues, poor signal timing, winter maintenance problems, inadequate drainage, roadside hazards, pavement drop-offs, and the like.

e) Identify potential safety and operational improvements.
The purpose of this step is to develop candidate solutions to the safety deficiencies that are identified. Box 1.6 shows potential solutions for two common crash types — rollovers and fixed objects.

f) Select appropriate improvements.
Decisions on the most appropriate countermeasures must be made recognizing the many fiscal and political constraints within a community. Chapter 2 provides examples of countermeasures to address the seven potentially hazardous roadway conditions described earlier in this chapter.

3. Establish priorities for project or policy implementation.
This is the step in the overall process in which the engineers juggle budget and other factors in order to determine which of many projects to implement first. In the real world where there may be dozens of important and worthy safety-related road projects, priority choices must be made. Those projects that address a well-documented need, are cost-effective, and have strong citizen support stand the best chance to be implemented sooner rather than later.

4. Schedule and implement safety projects.
As is true in all steps in this process, it pays to keep informed and stay involved. It takes a lot of work and people to get from a project plan to project execution. Be supportive and positive with the contacts you have made to see that your priority project stays on track.

5. Evaluate safety improvements.
Once the pavement is laid, the guardrail fixed, or the snow removal strategy refined, there is still work for you to do. Chances are that the roadway problem you identified has been fixed, but only time will tell. Over the next several years, the roadway professionals will be evaluating the safety

improvements they have made to determine if the problem has been solved. So should you, as you drive through that former trouble area. Keep in mind what originally made you take action. Was it crashes, traffic congestion, driver behavior, or a combination of factors? Has there been a recurrence of hazardous operating conditions? Have there been improvements? If not, now you know who to call.

By working constructively with the highway engineers, other road professionals, and government leaders, you can influence the attention given to your road problem and make it a higher priority. By staying involved and informed, you can play an important role at various stages during this process. •

BOX 1.6: CRASH PATTERN TABLES

Crash Type— Rollover

POSSIBLE CAUSE	POSSIBLE STUDY	SAFETY ENHANCEMENT
Roadside features	Determine sideslope Investigate recovery zone	• Provide traversable culvert end treatments • Extend culverts • Install/improve traffic barriers • Flatten slopes and ditches • Relocate drainage facilities
Inadequate shoulder	Determine shoulder dimensions and composition Check for shoulder dropoffs	• Upgrade shoulder surface • Remove curbing/obstructions • Widen lane/shoulder
Pavement feature	Check for potholes and rutting Check for water ponding	• Eliminate pavement edge dropoff with Safety Edge • Improve superelevation/crown

Crash Type— Fixed Object

POSSIBLE CAUSE	POSSIBLE STUDY	SAFETY ENHANCEMENT
Obstruction in or too ` close to roadway	Field observation to locate obstructions	• Delineation/reflectorize safety hardware • Remove/relocate obstacles • Install breakaway features to light poles, signposts, etc. • Protect objects with barrier/guardrail • Install crash cushions
Inadequate lighting	Check illumination	• Improve roadway lighting
Inadequate pavement markings	Review pavement markings	• Install reflectorized pavement lines/raised markers
Inadequate signs, delineators, and barriers/guardrails	Review signs, delineators, and barriers/guardrails	• Install reflectorized paint and/or reflectors on the fixed object • Add special signing • Upgrade barrier system
Inadequate road design	Check roadside shoulders and maintenance Check superelevation Perform ball-bank study	• Install warning signs/delineators • Improve alignment/grade • Provide proper superelevation • Provide wider lanes
Slippery surface	Check skid resistance Check for adequate drainage Perform spot speed study	• Reduce speed limit if justified by spot speed study • Provide adequate drainage & incorporate high-friction surfaces/pavements • Improve skid resistance
Weather conditions	Check winter maintenance program	• Optimize weather treatment schedule

CHAPTER 2

Ideas to Draw From: Case Studies & Best Practices

This Guide provides promising examples and strategies on how to make roadways safer. Chapter 1 gave you a framework to identify roadway hazards, and Chapter 2 takes a look at programs and countermeasures in action—effective initiatives, techniques, and best practices generated by safety experts and community leaders like you. These illustrations are by no means exhaustive; there are many other approaches to consider, but we list these as options to get you and your partners thinking about possible solutions.

WHAT DO YOU THINK?

Suppose you were told that a utility pole along the side of a road in your community had been hit by several vehicles over the years. It is generally agreed that the pole is too close to the roadway and its location on a tight curve adds to the danger. What should be done?

- ❏ Move the pole
- ❏ Bury the utility lines underground
- ❏ Install a breakaway pole
- ❏ Install a guardrail or crash cushion and warning signs
- ❏ Redesign the curve and/or resurface the road with skid-resistant pavement

All factors must be considered. What if the utility pole in question is just one of many hazards along a congested thoroughfare serving major industrial, commercial or residential developments? Relocating dozens of utility poles or burying utilities underground suddenly becomes a major project and a significant budgetary challenge.

A breakaway pole might improve safety for passing motorists, but what if just a few feet beyond the pole is a large tree? And while it is true that guardrails and other barriers are cost-effective crash countermeasures, think long-term and beyond the initial price tag: maintenance and repair costs will add up if vehicles hit these protective devices again and again.

If resources allow, the most comprehensive solution might be to redesign the entire curved roadway; if properly done, this could permanently solve the problem. Of course, this can also be very expensive, and major work will also likely result in the road being out of service for a time.

These are the kinds of questions that must be asked to address just about any roadway trouble area, and perhaps one or more of these choices will work just fine. The point, however, is that there is no "silver bullet" when it comes to roadway safety, and all of the costs, benefits, and alternatives for a given project must be taken into account.

As you read through Chapter 2, remember the "Best Practices Golden Rules."

- **One countermeasure seldom provides a total solution to a safety problem.**
- **Remain open to all options, and be prepared to use the strategies flexibly to meet your community's unique circumstances.**
- **In order to succeed, a countermeasure is usually part of a broad, long-term effort that may require changes in driver behavior as well as infrastructure and operating improvements.**
- **Decisions on the most appropriate countermeasures must be made while recognizing the many fiscal and political constraints within a community.**
- **The best approach is to collaborate with your local/state highway professionals to develop interim and long-term solutions, and to stay involved every step of the way.**

In this Chapter we highlight case studies and best practices for addressing each of the seven potentially hazardous conditions described in Chapter 1.

Roadway Departure Hazards

Over 53 percent of traffic fatalities are the result of roadway departure crashes, which occur when a vehicle leaves its travel lane and crosses a centerline (crossover crash) or edge line (run-off-road crash) at a non-intersection location.[14] *After departing the roadway, vehicles often hit oncoming traffic or roadside objects, such as trees, utility poles, embankments,*

BOX 2.1: CRASH REDUCTION FACTORS

Roadway engineering improvements save lives. Extensive research and testing is conducted to analyze the effects that roadway treatments, modifications, and crash countermeasures have on safety. Listed below is a sampling of such roadway enhancements, and the Crash Reduction Factors (CRF) corresponding with them. The CRF is a measurement of the percentage decrease in crashes one can expect to see if a given treatment is implemented. A CRF is, of course, an estimate, and location-specific studies factoring in multiple years of data would need to be conducted to determine what effect a given countermeasure had at a particular site. Still, this table provides a good overview showing the importance - and effectiveness - of solid investments in roadway safety.

Roadway Modification	Crash Reduction Factor (CRF)
Convert signalized intersection to modern roundabout	78% reduction in all injury crashes [CMF ID 226]
Provide bike lanes	35% reduction in all bicycle injury crashes [CMF ID 1719]
Install median barrier	86% reduction in all crashes [CMF ID 974]
Install centerline rumble strips	37% reduction in all head-on/side-swipe crashes on rural highways [CMF ID 3355]
Install lighting at interchanges	50% reduction in all crashes [CMF ID 1283]
Install sidewalk	75% reduction in all pedestrian crashes [CMF ID 1334]
Provide highway lighting	28% reduction in nighttime injury crashes [CMF ID = 192]
Road diet	29% reduction in all crashes on urban arterials [CMF ID = 199]
Pedestrian hybrid beacon (HAWK)	29% reduction in all crashes in urban and suburban areas [CMF ID = 2911]
Provide left-turn lane on both major road approaches	48% all rural crashes [CMF ID = 268]

Source: CMF Clearinghouse http://www.cmfclearinghouse.org, FHWA [Search for the CMF ID listed above to learn more about each CMF.]

guardrails, ditches, or bridge supports; they may also roll over.

Two aspects of this national safety problem are particularly challenging: keeping drivers on the road and protecting drivers when they do leave the road. Community leaders should work with their transportation professionals to tackle both the prevention and mitigation of crashes. An investigation of the reasons for roadway departures in a given area, and an assessment of the impact of collisions with roadside obstacles are essential for devising an appropriate strategy for improving safety.

The initial price tag for the project of $59,000 translated into an annual economic benefit of $3.7 million.

KEEPING DRIVERS ON THE ROAD – CENTERLINE RUMBLE STRIPS IN ARKANSAS

Overview

Highway 7, a rural, two-lane road in north central Arkansas, had been experiencing a particularly high crash and fatality rate due to its location in a mountainous national forest and its frequent curves. However, a statewide effort to install 382 miles of rumble strips on major multi-lane routes provided the perfect opportunity to undertake a cost-effective and efficient project: installing centerline rumble strips on a 74-mile stretch of Highway 7. At a cost of only 15 cents per linear foot, Arkansas was able to add low-cost protection for vehicles traveling this scenic route.

Results

The project was evaluated using crash data from the three-year period before the centerline rumble strips were implemented, and the three years immediately following installation. The results were impressive: head-on and opposite-direction sideswipe crashes dropped 56 percent, from 25 to 11, and fatal crashes fell 64 percent, from 11 to four. There was a 41 percent reduction in all crashes, and the initial price tag for the project of $59,000 translated into an annual economic benefit of $3.7 million due to crash, injury, and fatality reductions.

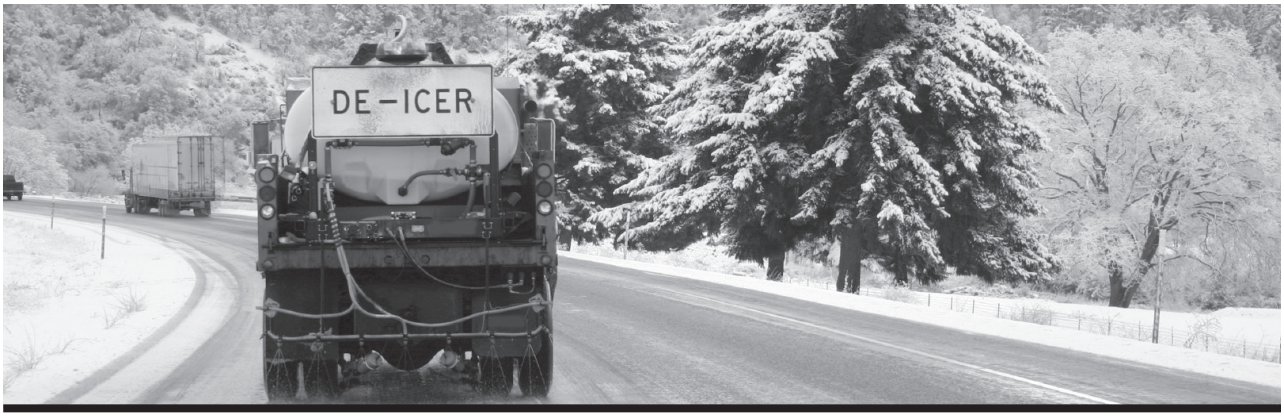
THE MIDWEST GUARDRAIL SYSTEM

Overview

Traditional W-beam guardrails, standard on American roadways since the 1960s, were shown in the 1990s to provide inadequate protection for light trucks and vehicles with high centers of mass.[21] Light trucks have a greater chance of going through such guardrails, or of rolling over after striking them.[21] From research and modeling that began in 2000, the Midwest Roadside Safety Facility (MwRSF) concluded that modest changes to the existing design could achieve dramatic safety gains and, together with the Midwest states Pooled Fund Program, developed the Midwest Guardrail System (MGS). In comparison with the traditional design, the MGS features a four-inch rail height increase, a four-inch increase in blockout depth, and splices in the midspan of the rails rather than at the posts.[21]

Results

Through crash testing, the MGS has been shown to have more than twice the capacity of conventional guardrails. In addition to stopping light trucks successfully, the MGS is less susceptible to rupture, and vehicles impacting it remain close to the guardrail rather than ricocheting back into traffic. This reduces the likelihood of secondary crashes, and keeps the vehicle involved in a safer resting place. As a result of this improved performance and the system's modest cost, more than a dozen states are in the process of implementing the MGS in place of the traditional designs.



Road Surface Conditions

Even roadways engineered to the highest standards become hazardous when wet, poorly maintained or when operating conditions deteriorate. Every winter in the United States, for instance, over 1,300 people are killed and 116,000 are injured due to snowy, slushy, or icy pavement.[22] *Effective road salting and plowing can reduce injury crashes by up to 88 percent, highlighting the critical role that operating conditions play in the roadway safety equation.*[8] *And 70 percent of wet*

> **Road salt can reduce crashes by 88%, injuries by 85%, and crash costs by 85%.**

pavement crashes can be affected by friction improvements. Community leaders can help by advocating for adequate investments in road maintenance projects and winter operations programs. It is important to work in your community both with transportation officials who are formulating strategies, and with the general public, whose appreciation for the safety and economic benefits of non-slick and clear, open roads can help ensure that the issue receives the attention it deserves.

IOWA MUNICIPALITIES PROTECT LIVES, LOCAL ECONOMIES, BY JOINTLY STORING ENOUGH ROAD SALT TO LAST FULL WINTER[23]

Overview

In the nation's Snow Belt, impassable roads due to snowstorms are more than just a cause for celebration for children who don't have to attend school. Snow-related shutdowns put lives at risk and damage local economies, and Iowa is no stranger to this problem. One study of freeways in the state, for example, found that snowstorms increased the crash rate 1,300%.[24]

On the economic front, a study conducted by IHS Global Insight for the American Highway Users Alliance found that snowstorms cost the state of Iowa as much as $70 million per day in direct and indirect costs, even before crash costs are considered. In more populous Snow Belt states, this figure can reach as high as $700 million per day.[25]

Iowa's municipal snowfighting agencies were well aware of the effectiveness of proper road salting as a method for mitigating these damages. A Marquette University study of four Snow Belt states, for example, found that road salt can reduce crashes by 88 percent, injuries by 85 percent, and crash costs by 85 percent.[8] Given the potential for difficulty in purchasing road salt mid-winter, it is recommended by salt experts to have 100 percent of anticipated winter road salt needs bought and stored before roads become treacherous.

Limited resources and lack of sufficient storage space for road salt presented challenges to many Iowa municipalities struggling to acquire an adequate annual supply. According to an official with the city of West Des Moines, an unfortunate cycle would play out year after year: First, a couple of massive ice storms would hit a region of the country that was woefully unprepared to apply salt, and a week or so later winter storms would develop in another region. Soon salt supplies would deplete and Iowa agencies without enough stored road salt would make urgent requests for emergency shipments, discovering that their orders came at the worst time to purchase salt.

"After many years in the public works industry, it amazed me, despite all of the available information and the repetitious pattern over numerous years, that so many agencies would still have these 'surprise'

moments," the official said. Yet a seemingly-feasible and effective approach surfaced: perhaps Iowa municipalities would be able to end this cycle if they could work together to increase salt storage capacity for everyone. After several meetings, nine municipal agencies created the $1.2 million Central Iowa Salt Storage Facility in Grimes, IA.

Results

With this new regional salt storage facility, all participating agencies had sufficient space to have the recommended annual supply of salt. The annual savings these agencies have seen by being able to order and store their salt early has been greater than the annual payment for the facility. In short, the regional storage facility more than pays for itself.

Intangible results are also felt, such as decreased anxiety levels for winter maintenance managers who have all of their salt "in the barn" before winter, thereby avoiding the high-stress game of ordering and anxiously waiting while the snow is falling.

The regional cooperation undertaken by the Iowa municipalities has also earned praise from the Salt Institute, which has recognized the City of West Des Moines with its "Excellence in Storage" award, and encouraged other communities to follow its example.

HIGH FRICTION SURFACE TREATMENTS ON CURVES SAVING LIVES IN PENNSYLVANIA AND KENTUCKY

Overview

In addition to making sure roads are clear of ice and snow, transportation departments across the country are working to improve roadway surface conditions on an everyday basis, and especially in slippery conditions. Drivers may never notice such impovements, but they are safer because of them.

One such area where these improved surface conditions are noticeably paying off is on curves. It is a common driver error to approach a curve too fast, which can cause the vehicle to skid, spin, and/or run off the road. Vehicles that approach a curve too fast require greater pavement friction to maintain controlled contact with the road. To address this, engineers are using what is referred to as "High Friction Surface Treatments (HFST)." HFST projects are used in the toughest road conditions and in small sections to increase pavement grip and keep vehicles on the road. Post-construction crash evaluations have shown phenomenal results, such as 60 to 70 percent crash reductions in several states, including Pennsylvania and Kentucky.

In Pennsylvania, engineers identified a location on Route 611 as one of their worst crash sites in Northhampton County. This location has a sharp right turn with vehicles skidding into the north bound lane during wet and dry conditions. Common crash types in the area included head on, side swipe, and fixed object crashes. Three deaths, four injury crashes and 20 total crashes occurred in this area in under eight years. While several mitigation strategies had been tried, crashes were still occurring and the Pennsylvania DOT was willing to try a different course of action to reduce and avert further injuries on this rural route.

It was decided that the best option was to increase the pavement's surface friction on the approach to and the apex of this horizontal curve. A method of increasing the friction had to be chosen that could be installed quickly, due to the curve's location on a heavily-trafficked roadway on a truck route. The HFST also needed to be able to perform in the winter months and survive carbon tipped snow plow blades.

HFST was installed on a total of 600 linear feet of 12-foot-wide roadway to increase the pavement surface friction and reduce crashes. The project application started at 9 a.m. and the road was opened back to traffic by 2:30 p.m. the same day.

In Kentucky (KY), HFST has been used on nearly 30 curves, much more than any other state at this time, with phenomenal results. On KY 22 at Bridge Hill in Oldham County, for example, there were 56 total crashes over the course of three years before the installation of HFST. In the 2.5 years following the installation of HFST there were only five crashes.

While signs and markings such as chevrons are effective and reduce crashes at curves, adding HFST adds an extra layer of protection. Enhanced signing and pavement markings usually work well for prudent drivers, requiring active driver participation in ensuring their own safety by slowing down and properly judging the curve. However, even good drivers sometimes err by driving too fast, getting distracted or failing to recognize a dangerous situation. Safer curves passively protect these drivers, their passengers, and others on the road. The application of HFST enhances the vehicle's performance by allowing it to stop in a shorter distance and maintain the lane better — thereby creating a more forgiving roadway environment.

Over a three-year period following the initial safety improvements, Vasco Road saw a 36% decrease in crashes.

Results

Post construction crash results on Route 611 in Pennsylvania show no reported crashes or skid-off-the-road incidents since the HFST application was completed. In Kentucky, as stated above, on KY 22 at Bridge Hill in Oldham County, there were 56 total crashes over the course of three years before the installation of the HFST. In the 2.5 years following the installation of HFST there were only five crashes.

Narrow Roadways and Bridges

Run-off-the-road crashes and head-on collisions are frequently associated with narrow roads and bridges. Such crashes are related to lack of maneuvering room due to narrow lanes, inadequate shoulders, or roadside hazards. Combine these factors with common driver errors and the results may be deadly.

Crashes involving narrow bridges are not as frequent as roadway crashes but they are often fatal. For both narrow roadways and bridges, crash rates may be lowered by increasing lane and shoulder width or completely replacing the roadways and bridges. However, space or funding constraints may limit options for such expansion or replacement, leaving highway officials, traffic engineers, and community leaders with the task of identifying more cost-effective approaches.

VASCO ROAD IMPROVEMENTS IN CALIFORNIA

Overview

Vasco Road in Contra Costa and Alameda counties in California has experienced a major boom in vehicular traffic due to population growth in the area and high demand for new housing developments. In less than 20 years, the daily traffic more than doubled as the route became increasingly popular with commuters, creating a difficult driving environment along the winding roadway. With few guardrails, short sight distances, and a lack of safety features, a segment of Vasco Road was the site of more than 72 crashes in just three years.[26]

To combat this high crash rate, various county and city agencies with jurisdiction over the road began a comprehensive, coordinated safety effort. Important features were added to the heavily-trafficked route, including speed display signs, centerline rumble strips and delineators, and soft median barrier striping. This was done in conjunction with coordinated speed enforcement, and was followed by additional infrastructure upgrades in both counties.[26] Alameda County completed a multi-mile realignment project that included installation of a concrete median barrier, widened shoulders, and the addition of truck climbing lanes.[27] Contra Costa County widened nearly 5,000 linear feet of roadway to accommodate a concrete median barrier that extended passing lanes, improved roadside infrastructure, and widened a 113-foot-long single-span bridge.[28,29]

Results

Over a three-year period following the initial safety improvements, Vasco Road saw a 36 percent decrease in crashes. This bottom-line success, coupled with the close multijurisdictional coordination and efficient use of resources, won the agencies involved a National Roadway Safety Award for Infrastructure Improvements. Alameda County's subsequent realignment project was successfully completed several months ahead of schedule, with head-on collisions dropping to zero on the segment with the new median barrier. The realignment even allowed for the establishment of bus service on Vasco Road between Alameda and Contra Costa counties, which had previously been impossible due to the roadway's tight curves.[29]

BOX 2.2

Narrow bridges are very expensive to replace or widen. Communities may want to consider the following strategies to lower bridge crash potential:

Bridge improvements. These can involve improvements to the structure and to potentially hazardous features. Improving bridge rails and sidewalks, eliminating potholes and poor skid resistance on the deck surface, and formulating better connections between bridge abutments and guardrails are all examples of potentially beneficial bridge treatments.

Bridge approach improvements. The safety of bridge guardrails and roadway approaches can be improved by installing crash cushions, changing the location of guardrails, and ensuring that guardrails on the approaching roads are appropriately attached to bridge guardrails.

Operational improvements. These include improved signs, pavement markings, and delineation in the bridge approach area and on the bridge. They must be placed well in advance of the bridge to alert drivers to potentially hazardous conditions.

Railroad Crossings

Highway-rail intersections and train tracks can present dangerous situations for drivers and pedestrians, according to Operation Lifesaver, Inc., a national organization devoted to educating the public about safety around tracks and trains. Driver inattention and impatience are common factors contributing to collisions, and since it takes a freight train traveling at 55 mph more than a mile to stop, there is nothing

Highway-rail grade crossing incidents in the state dropped more than 50 percent.

a conductor can do to avoid a crash when motorists make mistakes. Although improvements in engineering, enforcement, education and Emergency Medical Services have reduced the deaths and injuries resulting from vehicle-train crashes in recent years, a train still collides with a person or a vehicle approximately every three hours in the United States.[15] *This translates to roughly 2,000 crashes, 250 fatalities, and over 700 injuries each year at highway-rail grade crossings.*

NORTH CAROLINA'S *SEALED CORRIDOR PROGRAM*

Overview

North Carolina regularly ranks in the top 15 states for highway-rail crossing collisions and deaths, and is among the top 10 states for pedestrian rail trespass deaths. To aggressively address the crossing safety issue from an engineering standpoint, the state initiated its *Sealed Corridor Program,* by which crossings in a corridor stretching from Charlotte to Greensboro to Raleigh have been targeted for upgraded highway-rail safety warning devices, or closed entirely to eliminate the most dangerous crossings. The entire corridor contains 172 public and 46 private railroad crossings. The North Carolina *Sealed Corridor Program* improvements have been made since 1992 through a special federal funding program.

Results

Thanks to efforts like these, highway-rail grade crossing incidents in the state dropped more than 50 percent between 2000 and 2009. In addition a new Operation Lifesaver campaign aimed at pedestrian safety titled, "Don't Walk That Line," helped reduce fatalities in such instances from eight to one.

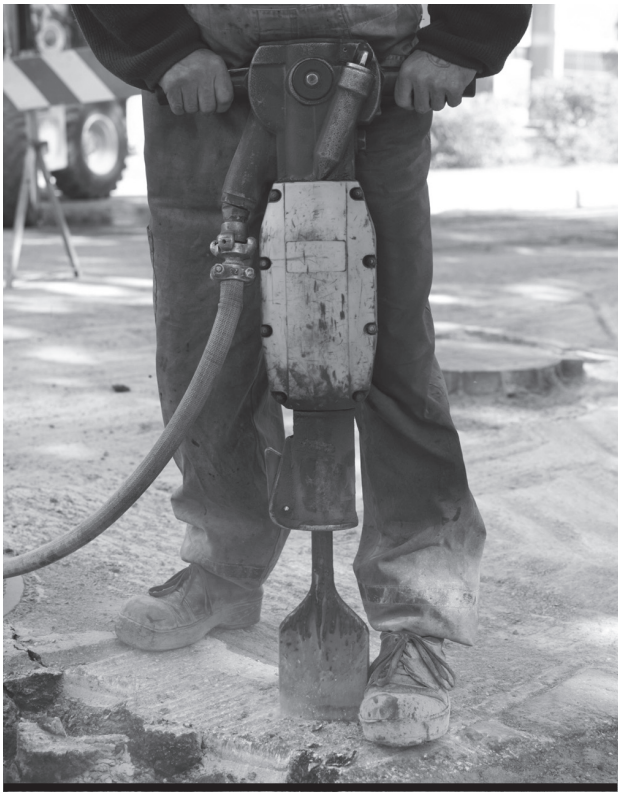
Work Zones

Work zones can be dangerous places for motorists and highway workers. With traffic patterns changing due to lane shifts, sudden speed reductions, and an influx of personnel and equipment, even the most familiar roadways can become nearly unrecognizable. Crashes in work zones account for around 700 fatalities each year, with a death occurring every 10 hours and an injury every 13 minutes.[16] *Despite road signs asking drivers to, "Let 'Em Work, Let 'Em Live," motorists are actually the ones facing the greatest danger: they account for over 80 percent of work zone fatalities.*[16] *This, of course, doesn't diminish the very real hazards posed to road workers, who perform their tasks just feet from moving traffic and who face a risk of death seven times higher than that of the average worker.*[30] *With road projects underway around the country, work zone safety is of utmost concern. Positive protection that fully keeps highway workers and motorists in defined spaces for physical separation is critical. Communities undertaking significant roadwork need to ensure appropriate actions are taken to protect highway workers and motorists alike.*

MOVABLE BARRIERS IMPROVE SAFETY, EFFICIENCY IN UTAH CONSTRUCTION CORRIDOR

Overview

In Salt Lake City, Utah, a major roadway project requiring significant work zone management was undertaken on State Route 171, a heavily-traveled, six-lane highway. The road work included an expansion of the roadway to eight lanes, and improvement



of roadside infrastructure with brand-new curbs, gutters, and sidewalks.[31] When construction commenced, two lanes of traffic were maintained in each direction, with the work zone delineated by orange traffic barrels. Within a short time, it became apparent that this traffic control plan was not working. It created a narrow, unprotected construction area, with work crews exposed to moving vehicles and confused drivers occasionally entering the work zone.[31]

To address these concerns, a new traffic control plan was devised utilizing a reversible lane with moveable barriers. Using more than a mile of moveable barriers – which can be used to quickly reconfigure the lanes to reverse travel direction – the plan called for a reduction of open lanes from four to three, with two being dedicated to whichever direction was experiencing peak volume. This provided an expanded work zone along with positive physical protection of the highway crews.[32]

Results

Once the new traffic control plan with moveable barriers was implemented, zero additional vehicle incursions into the work zone occurred for the remainder of the project. In addition, left-turn and head-on crashes – two particularly severe types of collisions – were greatly reduced because the barriers physically prevented mid-block turns. This marked a great improvement over the first phase of the project, when the work zone was delineated with traffic barrels and confused motorists made left turns through the work zone despite signage prohibiting such maneuvers. A project report commissioned by the Utah DOT and compiled by T.Y. Lin International, estimated that utilizing this innovative approach, the movable barriers prevented 20-25 left-turn crashes, saving approximately 1 million dollars (assuming none of the crashes was fatal) and reducing the crash-related congestion seen earlier.[32]

In addition to the safety benefits, the expanded and protected work zone allowed crews to operate significantly more efficiently and use larger, more effective machinery. This resulted in substantial economic benefits, as the contractor was able to condense the original three-phase plan into two phases, and complete the entire project seven months early.[32] The project evaluation report estimated that using movable barriers yielded a benefit/cost ratio of between 4:1 and 10:1, based on crash, travel time, and emission reductions, benefits to local businesses, and reduced vehicle operating costs.[32] In addition to these safety and economic achievements, this project marked the first use of movable barriers on a major U.S. arterial project, as opposed to on a freeway or bridge.[32]

Utilizing this innovative approach, the movable barriers prevented 20-25 left-turn crashes, saving approximately 1 million dollars.

Intersections

Intersections constitute a very small physical part of the road network, yet they are implicated in roughly 20 percent of all traffic fatalities and 40 percent of motor vehicle crashes.[33] *Not only must motorists negotiate a variety of potential conflict points with other vehicles, they need to watch for crossing pedestrians, changing signals, lane assignments, and street signs. Given intersection complexities, perhaps it is not surprising that many of the FHWA-recommended countermeasures deal directly with this topic. One that has traffic safety experts particularly excited – modern roundabouts – was relatively slow to get off the ground in the United States when compared with their*

implementation in many European countries. However, their proven ability to save lives and improve efficiency over more traditional intersection designs has won them much support across the country, and more and more Americans are seeing modern roundabouts constructed along the routes they travel everyday.

WISCONSIN AND COLORADO REALIZE SAFETY BENEFITS WITH ROUNDABOUT IMPLEMENTATION

Overview

Modern roundabouts offer a safer alternative to traditional, stop-controlled intersections.[6] They are designed specifically to improve efficiency by eliminating traffic signals, and increase safety by slowing speeds, directing all traffic in only one travel direction, and reducing the number of possible conflict points between vehicles. The Wisconsin Department of Transportation (WisDOT) and the Colorado Department of Transportation (CDOT) have made tremendous efforts to capitalize on these benefits by installing dozens of modern roundabouts throughout their jurisdictions and mounting strong public outreach campaigns to educate motorists on how to navigate them safely.

WisDOT has installed roughly 70 modern roundabouts statewide. Recognizing the importance of motorists understanding and accepting the rules and traffic patterns of these new intersections, an extensive public outreach campaign was conducted to highlight the safety achievements of roundabouts and teach road users how to navigate them properly. The campaign includes a web site, www.wisconsinroundabouts.gov, and a Wisconsin roundabouts DVD distributed to driver education instructors, trucking firms, public television stations, AARP and other associations, and elected officials. In addition, WisDOT created and disseminated a variety of printed materials, including four million fliers distributed with registration renewal letters, and 100,000 brochures. Thirty-four Wisconsin newspapers carried ads showing diagrams of how to negotiate a roundabout, and WisDOT updated the state's motorist handbook and design manual to reflect current information and best practices.[34]

Colorado also takes roundabout construction seriously, building the first roundabout freeway

Roundabouts have been shown to reduce fatalities by more than 90%, injuries by roughly 76%, and all crashes by 35%.

interchange in the country in 1995, just off I-70 in Vail Village. CDOT has kept the momentum up: statewide there are now around 140 roundabouts, more than 20 of which are on state highways and interstate ramps. Within 12 years, the town of Avon alone had 10, and shortly thereafter additional construction commenced on four new roundabouts for Edwards, CO.[35]

To keep the public informed, CDOT maintains a web site with information about active projects. News and press releases explain the safety benefits of roundabouts, and offer tips for Colorado's road users. Local jurisdictions have also joined in getting the word out: Fruita's police department published an informational brochure for motorists when its roundabouts were completed, and Jefferson County maintains a web site with an interactive game demonstrating traffic patterns and regulations.[35]

Results

Research has demonstrated the safety benefits of implementing roundabouts in place of traditional intersections. While there are 32 potential points of conflict between vehicles in traditional intersections,

there are only eight in a modern roundabout. Because all vehicles must yield to circulating traffic, and because the shape of the roadway forces drivers to slow down, roundabouts have been shown to reduce fatalities by more than 90 percent, injuries by roughly 76 percent, and all crashes by 35 percent.[5] Data from national research on roundabout safety has been supported through analysis in parts of Colorado. After roundabouts were installed on Avon Road, the police department recorded a 33 percent reduction in crashes, along with a decline in serious injuries when crashes did occur.[35] On the public outreach side, WisDOT's concerted efforts to build roundabouts and educate motorists were recognized with an Honorable Mention at the National Roadway Safety Awards.

SOUTH CAROLINA DOT IMPLEMENTS PROGRAMS TO IMPROVE SAFETY AT INTERSECTIONS

Overview

The South Carolina Department of Transportation (SC DOT) identified safety improvements to be deployed systematically at intersections across the state to reduce the number of fatalities and serious injuries. SCDOT identified more than 2,000 intersections for improvement in the South Carolina Intersection Safety Implementation Plan (ISIP), to help achieve their SHSP goals. The improvements are taking place over a three year period.

SCDOT implemented a major program to improve intersection safety at intersections across the state. The project involved improving intersections through signing, pavement markings and signal enhancements, commencing in 2010. Previously, in 2005, another program involved adding retro-reflective borders to traffic signal backplates to increase the visibility of traffic signals and reduce red light running in Columbia.

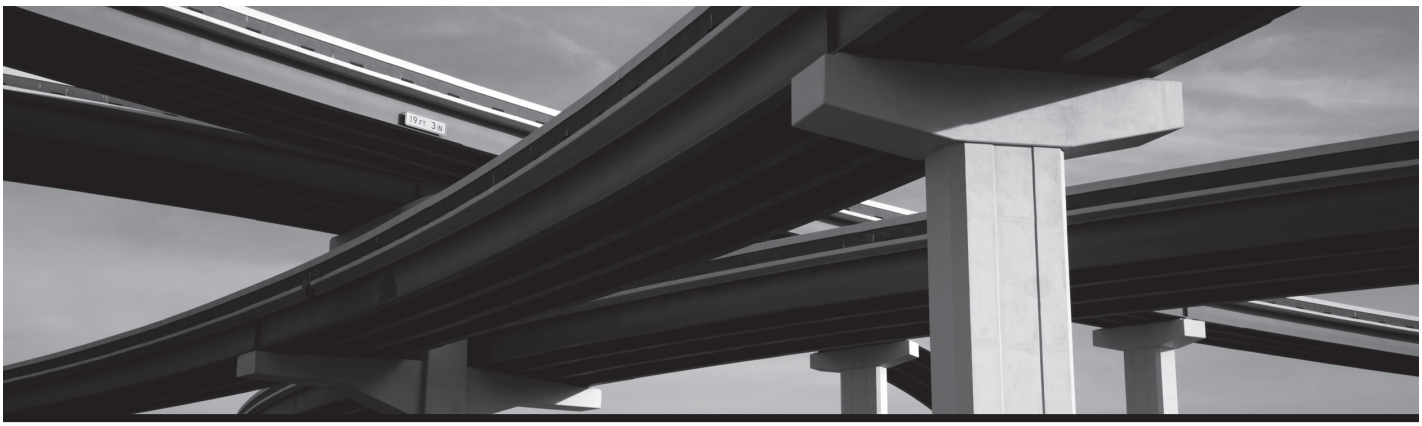
In response to the SHSP emphasis area goal of reducing fatal and serious injury crashes at intersections, those locations appearing within the ISIP were targeted to receive improvements in the form of updated signing, pavement markings, and signal enhancements. In order to address such a large number of locations, SCDOT established a streamlined installation process for making modifications. Using low-cost treatments, SCDOT followed FHWA's ISIP Process to develop thier systematic plan.

The improvements applied are listed below by treatment category.

All Intersections

**** Signing:***

- **Doubled up (left and right) signing**
- **Oversized signing with high-intensity fluorescent sheeting**
- **Advance street name signs on intersection warning signs**
- **Retro-reflective sign post panels**
- **Solar-powered, sign-mounted beacons**
- **Replacement of additional safety related signs (e.g., Do Not Enter, One Way, etc.) within 500 feet of the intersection**



Two-lane rural roads see fatality rates two-three times higher than the nation's safest roadways, our Interstates.

** Pavement Markings:*

- **Properly placed stop bars (4'-8' offset and perpendicular to the mainline)**
- **Dashed edge lines to delineate the mainline and turn bays and establish points of conflicting traffic**
- **Lane arrows and word messages in accordance with standard drawings, general notes and specifications**
- **Addition of crosswalks**

** Signalized Intersections:*

- **One signal head per lane**
- **Supplemental nearside sign heads**
- **Backplates with retro-reflective border**
- **12" LED signal indications**
- **Pedestrian treatments such as push button indicators and pedestrian countdown signals**

Results

An FHWA-led, multi-state Pooled Fund Study is currently evaluating the safety effects of SCDOT's low-cost systematic intersection improvements and the overall public reaction has been positive, based on feedback to SCDOT.

The retro-reflective borders on signal backplates have proven to be extremely effective in reducing crashes primarily resulting from red-light running, and quite inexpensive to install. The retro-reflective borders were installed at three intersections at a cost of $1,500 each. Red-light running is a serious traffic safety problem in America, so treatments that address this problem inexpensively are notable. The addition of retro-reflective borders on traffic signal backplates has been shown to reduce crashes by 15 percent on average, and at the three test locations in Columbia, showed reductions well in excess of that.

Roadway Reconfigurations and "Road Diets"

Overview

If your safety concern is related to conflicts between turning vehicles and those going straight, a roadway reconfiguration may be worth considering. Depending on a variety of factors, a new street design may make traffic flow more safely and efficiently and may also help to safely accommodate pedestrians and bicyclists.

One example of a roadway reconfiguration is a "road diet," which commonly involves converting an undivided four lane roadway into three lanes made up of two through lanes and a center, two-way left turn lane. This change has been shown to reduce crashes by 29 percent. Because this type of reconfiguration reduces the number of through lanes, an engineering analysis should be conducted to determine the impact on both congestion and safety. Road diets on streets with fewer than 15,000 daily vehicles and frequent left-turns had very good results in the areas of safety and operations. Well-designed roadway reconfigurations have multiple safety and operational benefits, such as:

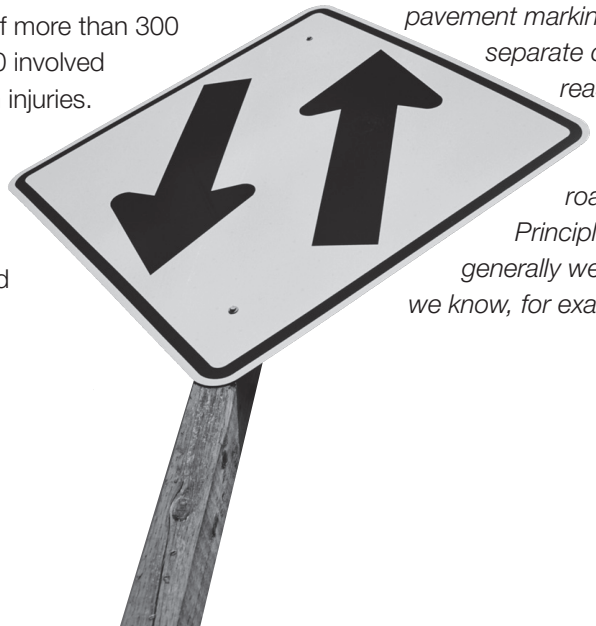
- **Reducing rear-end, intersection, and side-swipe crashes;**
- **Improving speed limit compliance and decreasing crash severity;**
- **Reducing the number of lanes that pedestrians may have to cross without a refuge;**
- **Improving safety for bicyclists; and**
- **Providing more space for on-street parking.**

Roadway reconfigurations improve safety at mid-block locations where drivers tend to increase speed. More than 80 percent of pedestrians hit by vehicles traveling at 40 mph or faster will die, while less than 10 percent will die when hit at 20 mph or less.

Roadway reconfigurations can be done at low cost if planned in conjunction with reconstruction or simple overlay projects, or if the project mostly consists of restriping. Driveway density, transit routes, the presence of trucks, the number and design of intersections along the corridor, and operational characteristics are some considerations to be evaluated before deciding to implement a new roadway design.

It is important to analyze and understand the effects of the proposed change, obtain input from stakeholders, and ensure the appropriate elements are included in the project. Improvements to intersection turn lanes, signing, pavement markings, traffic control devices, transit stops, and pedestrian and bicyclist facilities may be needed to support this concept. It should be noted that many roadway reconfigurations are compatible with roundabouts.

One example of a successful roadway reconfiguration is in University Place, Washington. A section of Bridgeport Way was the site of more than 300 crashes in a two year span: 10 involved pedestrians and 91 resulted in injuries. There were no sidewalks or bicycle lanes, lighting was sporadic, and speeding, multiple access points, and narrow gravel shoulders added further dysfunction.



Bridgeport Way is a significant regional arterial connecting Interstate 5 to State Route 16. Approximately 25,000 vehicles per day and a major transit route use the corridor. Before improvements, the 1.5 mile section that bisects University Place's main commercial area had five undivided traffic lanes (two in each direction and a shared center turn lane) with narrow gravel shoulders.

After obtaining a grant from the Washington State Transportation Improvement Board, this section of Bridgeport Way was reconstructed in three phases over two years. The new design maintained the four through travel lanes and replaced the center two-way left turn lane with a raised, landscaped median with lights. Planter strips along the corridor include streetlights that match the median lights, and bicycle lanes and sidewalks were installed on both sides of the road. Other improvements included mid-block pedestrian crossings with overhead signals and flared intersections to accommodate U-turns, which reduced crashes and improved access to businesses.

Results

On Bridgeport Way, the reconfiguration along the corridor resulted in lower speeds and fewer mid-block collisions. Crashes have been reduced by about 60 percent and average traffic speeds by about 13 percent. Despite greater pedestrian activity and exposure to vehicle traffic, pedestrian crashes did not increase.

Roadway Design Limitations

Many local roads were not built to serve today's high-volume, high-speed traffic. Their safety is limited by hazards such as sharp curves, poor signs and pavement markings, and lack of medians to separate oncoming traffic. For these reasons, two-lane rural roads see fatality rates two-three times higher than the nation's safest roadways, our Interstates.[12]

Principles of good road design are generally well-understood: we know, for example, that rumble strips

You'll learn how the AAA Foundation for Traffic Safety is working with numerous partners to map the nation's road network according to risk, safety standards, and potential for lifesaving improvements.

can reduce drift-off-road crashes by as much as 80 percent,[7] *and that other engineering treatments that make roadways forgiving of inevitable driver error and vehicle malfunction save lives.*

The problem, of course, is that transportation departments do not have unlimited resources to pursue all of the roadway improvement projects they would like. It is critically important, therefore, that investments be targeted to fixing trouble spots that have the gravest safety needs and that offer the greatest opportunity to save lives should they be upgraded. But how do we know where those are?

In the case study below, you'll learn how the AAA Foundation for Traffic Safety is working with numerous partners to map the nation's road network according to risk, safety standards, and potential for lifesaving improvements. Such an effort is intended to provide state agencies, motorists, and others with an easily-accessible reference for locating roadway segments where design may be outdated or crash countermeasures can be lacking, so that lives will be saved through infrastructure upgrades and other types of projects.

USRAP PIONEERS EFFORTS TO DOCUMENT RISKS

Overview

While many highway agencies do a commendable job of collecting and analyzing roadway data, there is currently no overarching, systematic assessment of the safety performance, risk level, and design features of the millions of miles of roadway making up the nation's highway network. When agencies do collect data, map crashes, and inventory their safety devices, resource constraints often dictate that this be done on a limited scale for a confined geographical area, with the results generally maintained for internal purposes rather than public use. It is difficult, therefore, for motorists to factor roadway safety considerations into their route selection, and for transportation officials to get a solid overview of the safety of the entire road network within their jurisdiction.

The AAA Foundation for Traffic Safety is trying to change that. In 2004, The Foundation, along with numerous safety partners, launched a pilot program to develop and test the feasibility of the U.S. Road Assessment Program (usRAP).[36] Modeled after similar undertakings in Europe and Australia, and coordinated with these by the International Road Assessment Program (iRAP), usRAP is designed to provide a systematic assessment of risk on the nation's roadways, and serves as an excellent example of cutting-edge approaches to documenting, publicizing, and addressing possible roadway design limitations.

usRAP consists of four protocols:

- **Risk mapping, in which a state's road network is mapped with a color code according to measures such as crash rate and density;**
- **Performance tracking, in which the safety performance of the network is monitored over time;**
- **Star ratings, similar to those for hotels and restaurants, which are assigned to roads according to their design features; and**
- **Safer roads investment plans that identify appropriate infrastructure improvements and estimate the benefit-cost ratio for each treatment.**[36]

usRAP risk maps consist of five colors denoting levels of risk. It is important to note that the roads deemed to pose higher levels of risk do not necessarily have infrastructure-related safety problems; some may be corridors in which speeding, impaired driving, or simply heavy traffic is common.[36] The star rating maps, therefore, help zero-in on the infrastructure component, as they assess the safety of the roadway based specifically on the presence or absence of engineering features known to be associated with crashes.

Ultimately, the information generated by usRAP is intended to help highway agencies identify road segments with the greatest safety needs and target limited resources in a cost-effective manner; build broader public support for and awareness of the need to invest in infrastructure safety upgrades; empower motorists to factor safety into route selections; help states meet legal obligations to report their most hazardous road locations; and build broader public support for increased investment in infrastructure upgrades.[36]

Results

Various phases of the usRAP pilot project have been completed, beginning with tests of the risk mapping and star rating protocols in Iowa and Michigan, and then expanding to additional tests of these and other maps and protocols in Florida, New Jersey, Illinois, Kentucky, New Mexico, and Utah.

In Illinois, for example, nearly 3,800 segments of rural state highway encompassing 11,000 miles and serving 21.5 billion vehicle miles of travel were analyzed for risk mapping. Five years of crash data were analyzed, yielding 8,637 fatal and serious injury crashes whose coordinates were determined for mapping purposes.[36]

The star rating cannot be used to predict crash rates for any specific period of time; however, researchers studied the relationship between star ratings and crash rates in Iowa and Washington in order to validate the protocol, and found a clear link between the two: crash rates decrease as star ratings increase.[36] The validation of this protocol is particularly promising for highway agencies that do not have the resources to collect solid crash and crash location data, as software developed by iRAP uses the star ratings and the documented roadway data underlying them to generate suggested countermeasures. As such, these highway agencies will still have access to specific recommendations regarding various cost-effective countermeasures appropriate for their needs.[36]

• SAFE DRIVE 112 DRIVE SAFE •

WE'VE MADE SR-112 SAFER

NOW IT'S YOUR TURN

The completion of roadwork on SR-112 represents the culmination of years of comprehensive safety research and renovation by the Utah Department of Transportation (UDOT). The roadwork satisfies the results of the AAA-sponsored United States Road Assessment Program (usRAP) study. However, the ultimate goal of the major renovations was to make SR-112 safer for you – the drivers and passengers who travel the roadway on a regular basis.

According to last year's Dan Jones Survey, 46 percent of those who travel on SR-112 felt at least somewhat unsafe. By combining our own research with that of the usRAP, UDOT identified and implemented five effective, low-cost roadway solutions: rumble strips, better signage, wider stripes, a new shoulder and general repaving. Each element of the new road plays a part in overall safety and ultimately helps reduce crashes and traffic fatalities.

Safe Drivers Make the Difference

We're very serious about reducing fatalities on all of Utah's roads, and SR-112 is merely one example. All the roadway improvements have been made to provide peace of mind for all drivers and passengers who use SR-112. We realize the importance of safe roadways and will continue to research effective safety measures, listen to those who travel Utah's roadways and upgrade roads in an effort to reduce crashes and traffic fatalities.

According to last year's survey, unsafe drivers are the second highest safety concern for those who travel SR-112. Even with the five roadway improvements we've made, there is only so much that UDOT can do to make your roadway safe. The greatest contributor to roadway safety is you – those who drive Utah's roads.

Driving distracted (using cell phones, texting, etc.), drowsy, aggressive, impaired and unbuckled are all major factors in driver and roadway safety. Your safety efforts and attention on the road can make a huge difference. By always buckling up, driving safely and avoiding distractions and impairments, you can contribute to the safety of SR-112 and all of Utah's roadways.

STATE ROAD 112 IMPROVEMENTS

Wider shoulders *give drivers room to safely correct.*

Repaving *provides a smoother and safer road.*

Rumble strips *ensure that drivers feel and hear when they are veering out of their lanes.*

Wider pavement stripes *make lane boundaries visible no matter the time of day.*

New Road Signs *are bright and more reflective than standard signs.*

In New Mexico, the state DOT is maintaining records of the trouble spots identified.[36] Then, engineers will give special attention during project planning to roadway stretches shown by the risk

In Utah, the first official usRAP member state, the DOT used the maps to help build public support for roadway safety projects in Tooele Valley.

maps to have high concentrations of crashes. In Illinois, supplementary risk maps focusing on alcohol and drug-related crashes may be used to assist law enforcement agencies looking to target their efforts.[36] And in Iowa, usRAP maps were used by the State Safety Engineer and district field staff to look for candidate locations for roadway safety audits or low-cost safety upgrades.[36]

In Utah, the first official usRAP member state, the DOT used the maps to help build public support for roadway safety projects in Tooele Valley. In addition to conducting a phone survey regarding area residents' feelings of safety on a state roadway, the Utah DOT created newspaper ads and press releases highlighting that the roadway improvement took into account the concerns expressed by citizens and was grounded in solid risk and crash data as shown by the usRAP maps.[36] (See ad on page 35)

The usRAP pilot projects demonstrated the program's achievements and potential, and even included a successful effort in Kane County, IL to create the first county-level strategic highway safety plan. Participating states have indicated their belief that usRAP maps and products will be useful for identifying priority areas of concern, targeting limited resources effectively, communicating project decisions to the public, and complying with Federal mandates. In addition, by offering "consumer-friendly" materials, usRAP presents technical roadway data in an accessible format for the public's use. With these successes, the AAA Foundation has transitioned beyond the pilot phase, and begun efforts to implement usRAP across the country. •

CHAPTER 3

Safety for Vulnerable Road Users

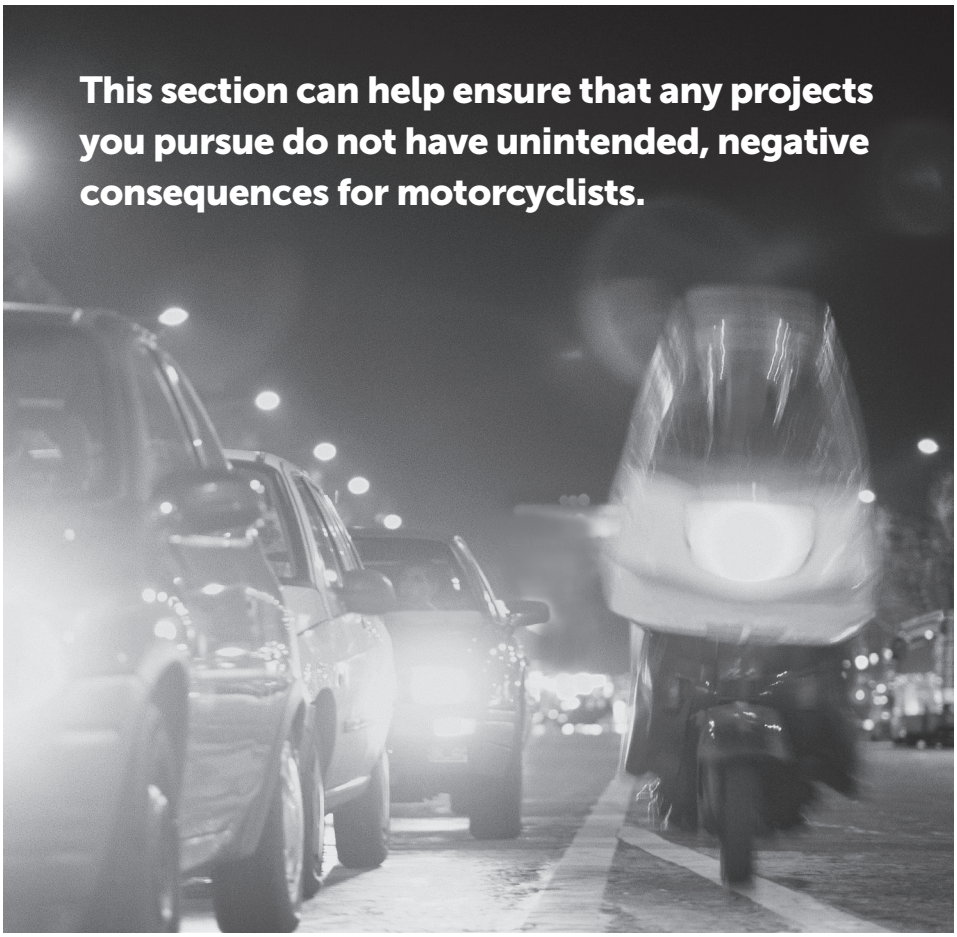
So far we've outlined a variety of considerations and proven strategies that you need to be aware of to improve roadway safety in your community. Describing trouble areas accurately, considering potential solutions, identifying sources of funding, and building partnerships are important in any effort to get safety concerns addressed.

Additional efforts may be required, however, when dealing with safety matters concerning vulnerable road users.

Before continuing, it's worth stressing that EVERYBODY is vulnerable on the road.

Crashes can happen even to well-rested, experienced motorists in safe cars on Interstate-quality highways. But not all road users are equally vulnerable. Some are particularly at risk due to age: young drivers with little experience demonstrate stronger tendencies toward dangerous behavior, such as speeding or not using seatbelts. Later in life, people may lose certain cognitive and physical abilities. When this happens gradually, it can be hard to determine when somebody is no longer capable of driving safely. Still, other road users are vulnerable because of exposure: pedestrians, bicyclists, and motorcyclists simply don't have the physical protection afforded to motorists. And while we've all heard the plea to, "Share the Road," it's not always clear how best to do that safely and efficiently.

In this chapter, we focus on some of the issues that must be taken into account when working on safety matters concerning these vulnerable groups. As you'll see, most of the treatments and guidelines that protect these vulnerable road users also provide benefits to the larger motoring public, resulting in a kind of "safety synergy" that reduces hazards for everybody. Pay particular attention to such examples, because the more you can demonstrate that a variety of different road users will benefit from a project, the more likely you will be to get widespread community support and buy-in.



Motorcyclists

In many ways, motorcycles represent the best that road transport has to offer. They are quick and maneuverable, but do not isolate the operator like a car. They are fuel-efficient, easy to park, and evoke a sense of freedom on the open road. Riders engage with their environment rather than sealing themselves off from it. In this connectivity lies the thrill of riding, but also the risk. Because of the particular dangers posed to motorcyclists, it is important to consider these road users when examining options to improve roadside safety.

Of the registered vehicles in the United States, only three percent are motorcycles, and their use represents just 0.6 percent of vehicle miles traveled in the country.[37] But in 2011,14 percent of those killed on America's roadways were motorcyclists.[37] This is a remarkable imbalance attributable to many things. As you'd expect, we'll focus here on how roadways affect motorcyclists differently from other users, leaving them especially vulnerable to injury and death. Consider some of the main reasons:

- **Motorcyclists are not afforded the protection of a passenger cabin; their bodies are more exposed and may come in direct contact with the roadway, roadside hazards, or other vehicles in the event of a crash.**
- **Motorcycles travel at highway speeds but can be much harder to see than other vehicles, because of their smaller profile. In fact, 38 percent of the fatal, two-vehicle crashes in 2011 that involved a motorcycle and another type of vehicle occurred when the other vehicle turned left into a motorcycle traveling straight or passing.[37]**
- **Motorcycles interact with the roadway in more complex ways than do other vehicles. Because motorcyclists need to keep their vehicles balanced on two wheels, pavement quality, traction, curve radii, and roadway debris become**

even more urgent safety concerns than they are for other users.

- **The countermeasures designed for passenger cars and trucks are not all effective for motorcycles.**

In this section, we'll examine some of the major roadway and roadside elements that are particularly hazardous to motorcyclists. If motorcycle safety is your primary concern, this section will give you important information on promising ideas and options for reducing injuries and fatalities among this vulnerable group. For readers who are concerned about road safety more broadly, or who are focused on cars and trucks, careful consideration of the information in this section can help ensure that any projects you pursue do not have unintended, negative consequences for motorcyclists.

Slippery, Uneven, or Compromised Road Surfaces

Road surface quality is important for all vehicles, but is of particular concern to motorcycles. Operating with only two wheels both creates the need to maintain balance and reduces the contact points between the rubber and pavement necessary to establish and maintain traction. A variety of small pavement defects that may be of little to no consequence for larger vehicles may therefore pose significant dangers to motorcycles, and might be overlooked if the needs of motorcyclists are not specifically and deliberately considered.

Some of the most common roadway characteristics or imperfections can spell disaster for motorcycles. For example, "tar snakes," those ubiquitous meandering strips of sealant used to repair surface cracks, pose little threat to cars and trucks but can be very slippery and hazardous for motorcycles when wet. In fact, the Ohio Department of Transportation (ODOT) has taken a proactive approach in promoting roadway safety for motorcycles and has adopted guidelines limiting crack seals to four inches or less.[38]

A similar problem can be seen with certain pavement markings, particularly those that motorcyclists may ride over while turning at intersections. Such lines and markings are often smoother than the surrounding asphalt, becoming even more slippery when wet. Blackout tape, which is used to temporarily cover pavement markings when roadwork or other activities necessitate a change in traffic patterns, can also become slick. Ohio and New Jersey have adopted some of the nation's tightest restrictions on the use of blackout tape because of this.[38] The TRB recommends treating or replacing any pavement markings with high-traction material, and including motorcycle traction tests in all standard evaluations of the effectiveness of such materials.[39]

BOX 3.1: MOTORCYCLES ACCOUNT FOR:

Source: National Highway Traffic Safety Administration

Uneven roadways also pose a challenge for motorcycle balance, particularly if, as in the case of many metal surfaces – like manhole covers or steel plates – they can also be slippery or hard to see.

Uneven roadways also pose a challenge for motorcycle balance, particularly if, as in the case of many metal surfaces – like manhole covers or steel plates – they can also be slippery or hard to see.[39] Think about roadways in your community. Are there potholes that may have been overlooked because they don't appear to pose a threat to cars? Are there manhole covers or steel plates that are not level with the road surface? Are there open bridge joints? Are there work zones with milled asphalt, or pavement drop-offs between travel lanes due to an ongoing re-surfacing project? All of these situations could pose a threat to motorcyclists, even though they would likely be safe for larger vehicles. Tapering pavement, closing lanes, or finding an appropriate detour may therefore be required to ensure safety for all.[39]

Another strategy that has been gaining support is providing adequate motorcycle-specific warning signs. ODOT, for example, changed its standards for work zones – which are prime locations for compromised road surfaces – to require "Grooved Pavement" signs ahead of any surface undergoing treatment.[38] A number of signs geared toward motorcyclists have been created to help call attention to areas of particular concern to two-wheeled vehicles.

Debris presents another road surface hazard to all motorists, though larger vehicles tend not to be threatened by some of the hazards that could cause a motorcycle to crash.[40] Motor oil, gravel, sand, tire treads, and even dirt can cause a motorcyclist to lose traction, balance, and control.[39] Debris removal efforts should therefore not be limited to major items like tree limbs or garbage, but should include a range of materials that impact the surface quality of the roadway.

Roadside Hazards and Barriers

The purpose of roadside and median barriers is to reduce the severity of crashes by preventing collisions with objects that pose an even *greater* danger than the barrier itself – such as trees, bridge supports, or on-coming traffic. For motorcyclists, however, the barrier itself may be a hazard.

Given the inherent lack of physical protection motorcyclists have when riding, any kind of object – including a barrier – will pose a danger if struck. But steps can be taken to mitigate the risk and severity of injury that motorcyclists face by incorporating "Motorcyclist Protective" design elements into barriers to create "motorcycle friendly" systems. Because the force of an impact is most devastating when concentrated in a small area, like the sharp edge of a support post, the key principle behind such a design is to provide a surface that yields a sliding – not a snagging – impact.[41] For example, with guardrails, one way to achieve this is to install a second longitudinal beam, beneath the primary one, that shields motorcyclists from the support posts. Alternatively, the posts themselves can be fitted with impact attenuators, which surround them.[41] Though such systems are gaining in popularity, particularly in Europe, and seem to offer promising

safety benefits, it is worth noting that robust data on the precise impact they have on crash mitigation is still forthcoming, and further research into the extent of their effectiveness is required.

Other options for improving barrier safety for motorcyclists do exist. Though I-shaped support posts are frequently used, replacing these with other shapes that have more rounded edges can offer safety benefits. Finally, setting the barrier back from the immediate road edge may provide crucial space for deceleration, so that by the time of impact the chances of the crash being survivable are better. It is important to note that none of these strategies diminishes safety for other types of vehicles. Indeed, as we've seen throughout the Guide, they play a role in a certain safety synergy that benefits all users.

Of course, barriers are often necessary in order to protect motorists from harsh roadside environments that cannot be sufficiently tamed. When this is the case, implementing "Motorcyclist Protective Systems" may go a long way toward protecting these road users.

In 2009, roughly 63% of motorcycle operators killed in single-vehicle crashes died on curved sections of roadway.

Curves

On curved sections of roadway, many of the safety concerns specific to motorcycles converge to present a uniquely hazardous situation, representing a "perfect storm" of sorts. Maintaining the path of travel can be challenging, particularly if the curve radius is tight or inconsistent. The danger of losing traction and falling is greater than usual, because of the increased traction demand between the tires and roadway when leaning and turning. Additionally, when a vehicle loses traction on a stretch of curve, centrifugal forces send the vehicle off the road. Because of the risk of run-off-the-road crashes occurring on curved stretches of road, these areas are a prime spot for roadside barrier installation which, as we've seen, can be hazardous to riders if such barriers are not "motorcycle friendly." The data highlight these dangers: in 2009, roughly 63 percent of motorcycle operators killed in single-vehicle crashes died on curved sections of roadway.[42]

This information can be of valuable use to communities interested in improving roadway safety for motorcycles. Given budget and resource constraints for projects related to debris removal, surface re-paving, and the like, it is helpful to know what troublespots should be prioritized. Roadway curves in your community – even those that may not seem particularly dangerous to four-wheeled vehicles – are likely good candidates for increased vigilance with

BOX 3.2: ADDITIONAL COMMUNITY CONCERNS: HELMETS AND ALCOHOL

There are additional community concerns that need to be addressed in order for this issue to be tackled holistically. Chief among them are speed, alcohol, and helmet usage. For communities concerned with reducing motorcycle crashes, fatalities, and injuries, efforts must be made to reduce speeding and alcohol-impaired operation, and to increase helmet use.

regards to maintenance, engineering assessments, and rehabilitation.

When possible, the curve radius should be consistent – and not too tight – throughout the turn, and advance warning signs should be provided. Given the increased risk motorcyclists face when leaning into a turn, efforts should be made to create clear zones whenever possible, and to promptly address compromises in surface quality that could cause a motorcycle to lose traction at a particularly vulnerable moment.

Given the increased risk of falling motorcyclists face when leaning into a turn, efforts should be made to create clear zones whenever possible, and to promptly address compromises in surface quality that could cause a motorcycle to lose traction at a particularly vulnerable moment.

Case Study

FLORIDA'S *MOTORCYCLE SAFETY COALITION* MAKES LIFESAVING STRIDES

Boasting plenty of sunny days, well over 1,000 miles of coastline, and some of the nation's most iconic tourist destinations, it is not surprising that Florida is a popular place for motorcyclists. From 1991 to 2008, Florida saw more than a tripling in the number of motorcycle registrations in the state, whereas nationally this figure doubled.[43] With this increase, however, came a sharp uptick in motorcycle crashes, injuries and fatalities. Between 1999 and 2009 the percentage of Florida traffic fatalities involving motorcycles rose from about five percent to roughly 18 percent.[43]

In response to this alarming trend, Florida formed a *Motorcycle Safety Coalition* to spearhead broad-based, comprehensive efforts targeted at each of the four "E" areas – Engineering, Education, Enforcement, and Emergency Medical Services. Chief among its tasks was the development and implementation of a Motorcycle Strategic Safety Plan (MSSP), a document developed over the course of nine months that supplements the state's SHSP. The MSSP sets out goals covering areas such as motorcycle crash data collection, personal protective equipment usage, rider education and training, and roadway engineering.[43]

Prior to the creation of the *Motorcycle Safety Coalition,* little public outreach and education was being conducted in Florida to address the rising fatality numbers. With the Coalition and MSSP in place, however, this changed quickly. For example, part of the MSSP targets rider impairment, with a comprehensive public awareness campaign effort including public service announcements, billboards, yard signs, media coverage, and high-profile events.

With Coalition partners well-aware of the crucial impact that infrastructure deficiencies have on motorcycles, roadway safety featured prominently in all of these efforts. In addition to conducting mapping and trend analysis of motorcycle crashes in high-fatality counties, the Coalition identified in the MSSP four strategies for addressing roadway engineering concerns, including better training and education for highway workers on the specific concerns motorcyclists have, and greater consideration of the unique characteristics of motorcycles when designing roadways.[43]

To promote awareness and understanding of the importance of such goals and strategies, a Public

Service Announcement (PSA) entitled "Making Roadways Safer for Motorcycles" was created that details how motorcycles interact differently with the roadway than cars do, and explains how things like steel plates, uneven pavement surfaces, and roadway markings can present special challenges to motorcycle operation. This PSA is available on a web site – www.ridesmartflorida.com – that was developed by the Coalition as another crucial tool for public outreach and stakeholder engagement. The site includes a page for roadway engineering strategies that highlights some key issue areas that highway engineers, transportation departments, policymakers, and others should consider. These include installing motorcycle-specific signage, correcting traffic signal sensors that cannot detect small vehicles such as motorcycles, and incorporating the motorcyclist perspective in roadway safety audits.

Other Coalition efforts address the broad spectrum of highway safety stakeholders, including law enforcement officers, who received a quick reference guide to state traffic laws pertaining to helmets, licensing, DUI, and other issues. The Coalition also conducted a statewide campaign targeted to motorist awareness of motorcycles – and has held or attended numerous press events, motorcycle rallies, charity rides, and other public gatherings.

The efforts of the *Motorcycle Safety Coalition* have been met with considerable success; for almost 10 years prior to its formation, motorcycle-related crashes, fatalities, and injuries had risen consistently. Just prior to its creation a dip of about two percent in fatalities was seen, but the years immediately following the Coalition's formation contributed significantly to a 30 percent reduction in fatalities and a 21 percent reduction in motorcyclists injured in Florida from 2008 to 2010.[44]

Partnership in coordinated motorcycle safety efforts in the state expanded from the Florida DOT (FDOT) and Department of Highway Safety and Motor Vehicles to include the Department of Health, Florida Highway Patrol, the Florida Motorcycle Dealership Association, the Motorcycle Safety Foundation, the Florida Rider Training Program, and numerous local councils, trauma centers, and law enforcement agencies. With federal government support, FDOT has been able to award an annual grant of $575,000 to assist with MSSP implementation, and in the year after the Coalition began, motorcycle-related fatalities fell from about 18 percent of all traffic fatalities to 14 percent, despite the share of licensed Florida drivers represented by motorcyclists remaining the same.[44]

Young Driver Safety

Young drivers experience disproportionate fatality rates on the roads, and represent a key demographic of concern for safety professionals. While road traffic crashes remain the leading cause of death for Americans until age 34, teenagers are most at risk. The crash rate per mile driven for 16-19 year-olds is quadruple that of adult drivers, but even this conceals just how at-risk the very newest drivers are: 16 year-olds have crash rates twice those of even 18-19 year-olds.[45] In 2007, youths 15-20 years old accounted for nine percent of the population in the United States, though 19 percent of road fatalities were attributed to crashes involving young drivers.[46] A variety of factors comes into play with this demographic, including

The crash rate per mile driven for 16-19 year-olds is quadruple that of adult drivers, but even this conceals just how at-risk the very newest drivers are: 16 year-olds have crash rates twice those of even 18-19 year-olds.

Between 1975 and 2009, the number of teenagers killed annually in traffic crashes dropped 60 percent (from 8,748 to 3,466).

inexperience, immaturity, peer pressure, and skewed assessments of risk. Here, we'll take a look at what can be done about it. Several programs, policies, and laws have set a foundation for substantial gains to be made in young driver safety, and there are a number of youth outreach and engagement opportunities that can make a big difference in your community.

Statistical Overview of Young Driver Safety Concerns

A familiar scene plays out in towns and cities across the United States. Americans love their mobility, and in a nation of automobile lovers, getting a driver's license signifies a new level of freedom for millions of teenagers every year. For many, it comes at a period already marked by transition: increasing independence and responsibility, thoughts of college or getting a job, and, eventually, a shift away from living with family. It's no wonder that getting a license is a thrill, but the data consistently remind us that our youth are at a greater risk during this phase and often pay a higher price for these new found freedoms.

Between 1999 and 2007, nearly 37 percent of all fatalities among persons aged 15-19 were related to traffic crashes, accounting for roughly 75 percent of all unintentional injury deaths suffered by this group.[1] While traffic fatalities decline as a percent of total deaths in subsequent age groups – attributed to 16.5 percent of deaths in persons aged 25-34 – they remain the leading killer of Americans between 3 and 34.[1] Males, in particular, account for these high numbers, with roughly two-in-three teenagers killed on the road being young men.[45]

The crash data also speak to another reality: while much emphasis has been placed on teenage behavior behind the wheel, the roadways teenagers are dying on cannot be ignored. Rural roadways, many of which lack the safety features of major interstates and the slower speeds of urban roads, are unforgiving terrain for drivers of all ages. However, for the relatively-inexperienced teenage demographic, such roads can be even more deadly. Data collected by the U.S. Department of Transportation (USDOT) indicate that around 64 percent of young driver deaths (ages 15-20) occur on rural roads. In addition to inexperience, teen drivers exhibit risky tendencies that may have particularly severe consequences on winding, narrow rural roads. According to the Centers for Disease Control and Prevention (CDC), compared with other age groups, teenagers have the lowest rate of seatbelt usage and are more likely to speed.[47] These tendencies make teen drivers a particularly compelling target of proven crash countermeasures, such as rumble strips and median barriers, on the nation's roadways.

While certain behaviors can be addressed through driver's education, public outreach, and legislation, some characteristics of young drivers will always remain. It will always take time to develop the kind of driving experience necessary for optimal safety, and the only way to get this experience is to drive. In addition, according to the NHTSA, studies have shown that areas of the brain crucial for making decisions and judgments do not fully develop until roughly age 25. In the same report, NHTSA notes that because driver's education programs cannot give teens first-hand experience in dangerous driving situations, there are strong limitations to what such courses can achieve by way of measurable crash reductions.[48] This makes it all the more crucial for roadways to be forgiving of young driver errors as they first gain experience behind the wheel.

Limits to Success, Options for Improvement: Countermeasures

There is little doubt that legislation, education, and enforcement play major roles in improving young driver safety. Such efforts set the stage for safety gains over time, but the problem is that death can occur in an instant. Roadway safety countermeasures provide that last line of defense for people who are in immediate danger. They are particularly important for young driver safety because there are underlying factors (many of which either cannot be addressed or can only be mitigated in the very long term) that make teenagers more vulnerable, and dangerous, on the road.

A good deal of cognitive development has simply not occurred by the time youth are eligible to drive. Compared with adults, teenagers process information more slowly, are less able to multitask, have a harder time focusing, have poorer decision-making abilities, and are highly susceptible to social pressures.[49]

Such cognitive limitations cannot be addressed behaviorally or legally; only time and experience will mitigate such factors. The best protection in the meantime is physical. Rumble strips can help keep distracted teens on the roadway, and barriers mitigate the crash severity risks for young drivers who have lost control of their vehicles. Additionally,

BOX 3.3: IMPORTANT TEEN DRIVING LAWS

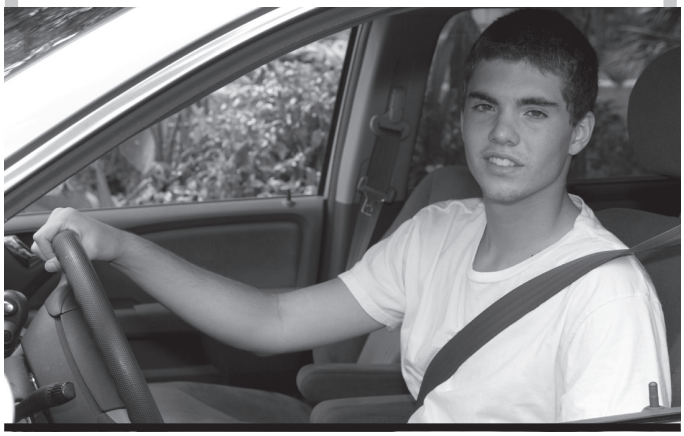
Graduated Driver Licensing is a system for controlling the risk factors that are present while a novice driver is first gaining experience.

This tiered approach, mandates strict limitations for brand new drivers, and then gradually allows for exposure to increasingly-risky circumstances. NHTSA recommends a three-stage approach, in which drivers first obtain a learner's permit, which allows them to operate vehicles only when under the supervision of a licensed adult who is at least 21 years old; followed by a provisional license, which allows unsupervised driving with restrictions on nighttime operation, number of passengers, use of electronic devices, etc.; and finally a full license.

According to the Insurance Institute for Highway Safety (IIHS), states that have adopted GDL systems have seen a 10-30 percent crash rate reduction among teen drivers. For communities concerned with teen driver safety, supporting strong GDL programs is crucial.

Additionally, all states and DC have zero-tolerance alcohol policies that stipulate immediate penalties for underage drivers found with any detectable amount of alcohol in their systems. These laws are particularly important because young drivers have a much higher crash risk after consuming alcohol than do older drivers, and are more likely to not wear a seatbelt after drinking. NHTSA credits these laws with reducing highway deaths involving drivers ages 18-20 by13 percent.

Sources: Insurance Institute for Highway Safety; National Highway Traffic Safety Administration



intersections designed with youth cognitive limitations in mind can help improve traffic flow and safety. As recommended by FHWA, for example, implementing turning lanes at stop-controlled intersections and yellow light intervals in-sync with operating speeds can reduce the level of decision-making required with regards to crossing traffic.[50]

The efficacy of implementing such physical interventions is suggested by the data. Teen crash rates in rural areas are more than double those in cities and suburbs.[46] This is not a surprise given the cognitive strain placed on drivers by such roads, which may be curvy, narrow, and poorly lit. For young drivers, whose brains may have the least capacity for handling this strain, these conditions are extremely hazardous. Additionally, young drivers have higher rates of single-vehicle fatal crashes than do older drivers.[45] Many of these involve drivers running off the road and potentially colliding with roadside hazards. According to the USDOT, roughly 70 percent of fatalities of drivers ages 14-19 occur in roadway departure crashes; for drivers of all ages this figure drops to 53 percent.

Single-vehicle crashes, in particular, are more often linked to risky driving behavior than are multi-vehicle collisions, and it may therefore be of little surprise that a study in Connecticut found that while males are more likely to cause all crashes, the gender discrepancy is most pronounced in single-vehicle cases.[49] Interestingly, 49 percent of drivers ages 16-19 who were in fatal crashes in 2009 were involved in single-vehicle crashes. The percentage is the same for drivers ages 20-24, and doesn't begin to decline relative to multi-vehicle crashes until age 25 – the age at which reasoning and decision-making areas of the brain reach maturity. The decline is steady in subsequent age groups, falling to 31 percent for drivers 70 and older.[45]

Rumble strips can help keep distracted teens on the roadway, and barriers mitigate the crash severity risks.

What Can You Do?

A CASE STUDY *PROJECT IGNITION:* GIBSON CITY-MELVIN-SIBLEY HIGH SCHOOL

Project Ignition, a teen driving safety competition between schools across the country, began as a friendly challenge to youth: find a creative way to blend service projects and learning in order to promote safer driving by your peers. Schools receive funding from State Farm to implement safety programs and campaigns, ultimately in competition to receive a major grant.

Gibson City-Melvin-Sibley High School (GCMS), in Gibson City, Illinois, won the competition in its second year and has had a safe teen driving program ever since. Their first campaign theme, in response to a horrific run-off-the-road crash involving twins – one of whom survived, one of whom did not – centered on reducing speeding and increasing seatbelt use. In each subsequent year, the students conduct surveys to identify the major road safety problems facing the community, and to select a theme for the competition. The group looks inward and outward, promoting road safety in the community and spreading its safe driving messages around the country. In addition to the State Farm grants, GCMS has received funding from the Illinois Department of Transportation to present to county and school groups around the

state, and conduct workshops with various safety organizations.

As the years have progressed, GCMS has seen remarkable success in some of its focus areas, and local police have even recorded a two-thirds drop in crashes involving drivers 16-18 years old. This has encouraged students to tackle more and more issues related to highway safety, including promoting anti-texting legislation, and creating instructional videos on how to avoid run-off-the-road and head-on crashes.

Recognizing the need for comprehensive approaches to road safety in the community, students have taken an active role in promoting engineering countermeasures, as well. Throughout the school year and summer break, students identify areas they believe to be trouble spots – a two-way stop they think should be four-way, for example – and notify the faculty advisor. The group then contacts the mayor to establish who has jurisdiction over the danger zone, and sends letters and makes phone calls to get items of concern on city council meeting agendas. In this way, youth are brought into the safety process itself, and are given an opportunity to explore, comment on, and positively address systemic problems. It is not difficult to imagine why such an approach is more rewarding for teens than simply telling them how statistically dangerous they are behind the wheel.

Of particular note is the high level of youth involvement at all stages, from identifying the trouble spots to advocating for engineering improvements in presentations to city officials. Students obtain crash data from the police, take photographs of hazards such as deep ditches or signage concealed by tree limbs, and pursue the appropriate agencies responsible for the segment of roadway in question. Sometimes students can even tackle the problem directly: each year, the group works to cut back cornstalks and tree limbs from about a dozen intersections in the area in order to improve visibility of signage and crossing traffic.

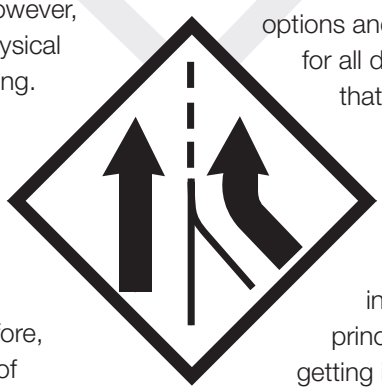
With ownership of the process and support from faculty and other leaders, these students have engaged their peers in crucial safety discussions, and made a difference stretching beyond their community.

As a rural community, the Gibson City area faces certain roadway issues not experienced everywhere. Students, for example, are working on projects and outreach related to farm equipment infrastructure needs, railroad crossing safety, and roadside ditches. Operational conditions are also of concern; in response to some crashes involving students losing control after hitting patches of loose gravel, the group made this a project focus point. Efforts in this area include teaching students how to steer through a skid, and advocating appropriate warning signs when pavement conditions are about to change.

Project Ignition has given youth an opportunity to improve road safety in their community while utilizing their natural talents and developing new skills. With ownership of the process and support from faculty and other leaders, these students have engaged their peers in crucial safety discussions, and made a difference stretching beyond their community.

Improving Older Driver Safety Through Road Design

Between 2002 and 2020, the number of Americans over 65 will increase more than 50 percent, while the overall population is only predicted to grow 16 percent.[50] By 2025, one-quarter of all licensed drivers will be over age 65. As people age, however, they may lose certain cognitive and physical abilities that are important for safe driving. Vision, depth-perception, reaction times, and the ability to process information and make decisions may all diminish. Fatal crash rates per mile traveled begin to increase at age 75, with a dramatic jump for persons over 80;[50] older drivers, therefore, must be considered in our discussion of vulnerable road users.



The Effects of Age: a Contrast Between Old and Young

This section and the previous one both explore the effects of age as they pertain to road safety. We've seen that young drivers – and especially teenagers – lack experience, are particularly susceptible to peer pressure, and exhibit the strongest tendencies towards risk-taking behavior. This stands in stark contrast with the experience, skills, and behavior patterns of older drivers, which makes our analysis of risk and vulnerabilities in these groups somewhat different. Luckily, as we've seen, there are many options and strategies for improving roadway safety for all demographics despite certain differences that may exist between them.

First and foremost, it is important to emphasize that high death rates of older drivers are predominantly due to increased fragility that makes surviving a crash more difficult; they are not principally caused by an elevated likelihood of getting into a crash.[50] Older drivers are experienced, and tend to take steps to mitigate – rather than exacerbate – the risks of driving. Seatbelt usage is higher among older vehicle occupants, and many older drivers limit their driving to times of favorable weather and lighting conditions.[50] It is important to keep these facts in mind in order to understand where the real risks lie with regards to this demographic.

BOX 3.4: *"SENIOR ZONES"* IN FLORIDA

When driving near schools, motorists know to expect that the surrounding roadways will likely be designated as school zones, and feature reduced speeds, crossing guards, school buses, crosswalks and other things designed to keep kids safe. In an effort to improve safety for another vulnerable group, officials with the Hillsborough County Public Works Traffic Services Division in Tampa, FL decided to capitalize on motorists' familiarity with this idea by implementing *"Senior Zones."*

In addition to signs and markings that alert passing motorists to the presence of retirement and assisted-living facilities in the area, the *Senior Zones* feature design elements that specifically address challenges faced by older drivers. Street signs are situated overhead with large lettering for easier, more consistent visibility; retroreflective pavement markers facilitate nighttime driving; and lanes divide well in advance of intersections to reduce last-minute confusion.

Two pilot *Senior Zones* were created and achieved notable success in improving safety. Crashes were reduced by 47 percent and 37 percent, respectively, over a two-year period, and average speeds in these areas decreased up to 18 percent after they were formally designated as *Senior Zones*. Moreover, the success of these zones prompted support for establishing additional sites, and the county continues to assist interested stakeholders by reviewing eligibility criteria and working to find grants and financial partners to create more *Senior Zone* designations.

Source: Hillsborough County Public Works Traffic Services Division

In this section, we'll examine why this is an issue of critical concern to communities across the country, and take a look at some specific countermeasures and guidelines that address the challenges faced by aging drivers. What sets these countermeasures apart is simply that the standards for their design and use were set with the needs of older drivers especially in mind.

Older Drivers and Your Community: Challenges and Opportunities

The reality in many parts of the United States is that having access to a car is critical for independence. Demographic data show that most Americans live in low-density suburban and rural areas where public transportation is a less viable alternative, and where stores and needed services are often not within walking distance.[51] Moreover, the notion that older Americans leave their homes and retire in droves to senior-friendly communities in warm climates is simply not supported by data; instead, Americans tend to "age in place," often in the very communities in which they need their cars.[51]

All of this leads to a risk, as people age, of isolation. When it is time to hang up the keys, this becomes even more likely. Mobility, and the independence that comes with it, can be very important for healthy aging. To be sure, there are people who simply cannot or should not operate motor vehicles. But for many, the issue remains a large gray area, and easy answers are hard to come by.

Given projections that the population of older drivers will grow, and will continue to rely to a large extent on private transportation (driving), community support must include efforts to improve safety through road design. There are a number of strategies and treatments for designing roads with the needs of older drivers in mind, and examining your trouble areas through this lens has the potential to yield tremendous safety benefits for all.

Analyzing Trouble Areas with Older Driver Concerns in Mind

As people age, they may experience a decline in a variety of physical and cognitive functions that are important for driving. The strategies and treatments discussed below enhance the road environment and

By evaluating your community's roadways with the needs of older drivers in mind, you are improving safety for all road users.

make it safer by addressing some of the major challenges older drivers face.

Signage Location and Visibility:

Driving is a visually demanding task, and a decline in visual acuity – especially peripheral vision – commonly accompanies the aging process. This can have both direct effects – impacting, for example, a driver's ability to interpret something he or she is looking at – and indirect effects, as in the case of a driver having to take his or her eyes off the road more frequently to compensate for reduced peripheral vision.

The size, placement, and height of road signs, along with the font and size of their lettering, can make a big difference in their visibility. Overhead, centrally-mounted signs are preferable at intersections to the smaller signs often seen attached to trees or posts on the side of the road.[52] For older drivers focused on upcoming traffic signals and crossing vehicles, having large signs located in a central field of view allows them to keep their eyes on the road and reduces reliance on peripheral vision. If signs are hard to see in your community, crashes may occur due to confusion and distraction as drivers attempt to figure out where they are.

Safe Intersection Negotiation:

Judging distances and speeds is crucial on the roadway, particularly when turning across traffic. As people age, the ability to make these calculations – along with the decisions that are based on them, such as whether it is safe to turn – may diminish. Older drivers may therefore experience particular difficulty at intersections. In fact, according to FHWA, 40 percent of crashes involving drivers over age 65 occur at intersections; this is roughly twice the rate seen among experienced younger drivers.[53]

BOX 3.5: CLEARVIEW FONT

For more than 50 years, motorists in the United States have been familiar with a set of fonts commonly referred to as Highway Gothic. In the early 1990s, research commenced with the goal of creating crisper, more legible signs, leading to the introduction of a new font: Clearview.

One of Highway Gothic's chief flaws is that the interior spaces within letters – such as the central circle in an "O" – are too small. This can lead to a phenomenon called halation, which older drivers are particularly susceptible to, whereby light reflecting off the white lettering appears as an undefined blob around the small, dark interior spaces. Clearview carves out these inner spaces to yield crisper lettering, and uses capital and lowercase letters to help drivers recognize word shape.

Without increasing the size of the lettering or the signs themselves, Clearview has been shown to improve word recognition among older drivers by 16 percent. For an older person driving 45 mph, this translates to an extra 1.2 seconds of time to read and interpret a given sign. As a result, dozens of states have begun to implement Clearview on their roadways.

Source: Federal Highway Administration

BOX 3.6: RETROREFLECTIVITY

Light is reflected to some degree off of most surfaces; retroreflective materials, however, are specifically engineered to direct that light straight back to its source. This concentration of light is particularly beneficial to older drivers with diminished vision who are operating a vehicle at night or in inclement weather. Retroreflective sheeting is used on street signs for brilliant visibility when illuminated by a car's headlights. Moreover, adding retroreflective material to devices like cones, barrels, or raised pavement markers can help notify drivers of hard-to-see obstacles, such as curbs, bridge supports, or lane shifts.

Source: Federal Highway Administration

BOX 3.7: TURNING PATH MARKINGS

A more fundamental problem than judging when to turn may actually be gauging how to turn. Lane markings guide us down highways, but oftentimes intersections are completely unmarked in the center, beyond the stop lines and crosswalks. For older drivers struggling with spatial awareness, keeping on an appropriate path throughout a turn can be a challenge. Pavement markings can be used to guide vehicles through the intersection, ensuring that drivers who stay in the path will ultimately turn into the appropriate lane of the destination roadway. This can help prevent unintentional drifting, sideswipes, and other dangerous maneuvers.

Source: Federal Highway Administration

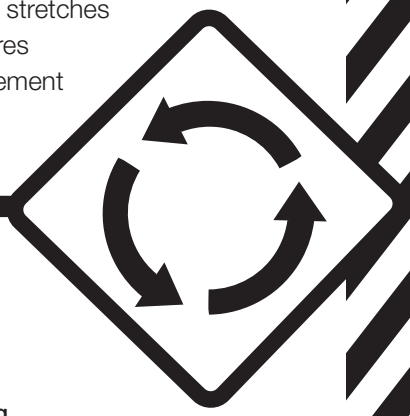
Protected turn phasing, signalized with green arrows, takes the judgment call out of the equation for those turning at intersections by bringing conflicting traffic to a stop.[52] This is different from a green ball, which allows for turns but does not stop oncoming vehicles in order to provide a guaranteed window for them. On a green ball, it is up to the driver to determine when a safe gap exists through which they may travel. It may be beneficial to consider protected turn phasing at intersections in your community in order to provide older drivers with a safer opportunity to turn across travel lanes.

Roundabouts also offer safety benefits for older drivers. FHWA has found them to reduce intersection fatalities by as much as 90 percent and other intersection crashes by 75 percent by reducing the number of potential conflict points and reducing the speed of vehicles in the intersection. This reduction in speed is what leads to fewer fatal crashes. See Box 3.8 for additional information on the safety benefits of roundabouts.

Concise and Clear Information:

Driving is an enormously complex task: thousands of pieces of information are constantly being received and processed in the brain, and drivers must separate the trivial from the urgent. Once information is gathered and assessed cognitively, drivers must also exert a physical response in order to control the vehicle appropriately. We often don't appreciate just how quickly, and seemingly effortlessly, we pull off these complex tasks every time we get behind the wheel. But for persons with a diminished capacity for processing information or physically reacting to it, driving becomes much more difficult.

Even experienced younger drivers can be confused or overwhelmed by the road environment. For drivers with reduced abilities to process information, receiving direct, concise, clear input from the road environment is even more crucial. Think about your least favorite stretches of road. Chances are at least one features myriad confusing signs, signals, or pavement markings that fail to give complete and



BOX 3.8: ROUNDABOUT SAFETY FOR OLDER DRIVERS

We've already seen how implementing roundabouts can improve intersection safety tremendously, but did you know that they may be particularly beneficial for older drivers? The slower speeds in a roundabout allow drivers more time to approach and negotiate the circle. Keeping in mind that fragility poses the greatest threat to older drivers, slower traffic also increases survivability in the event that a crash does occur. Additionally, all vehicles move in the same direction and exclusively make right turns; decision-making is thereby limited only to judging when it is safe to enter the roundabout. While it is true that drivers must learn the rules and become familiarized with this type of intersection, proper education campaigns can be very valuable for building comfort and understanding of this lifesaving design.

Source: Federal Highway Administration

BOX 3.9:
SAMPLE MESSAGE BOARD

Phase One

LANE ENDS
1500 FEET
SLOW DOWN

Phase Two

MERGE
LEFT
AHEAD

FHWA recommends that any changeable board should have no more than two message phases, with each phase having a maximum of three lines of text and eight characters per line. Nothing beyond the issue of concern, the distance to the area in question, and the necessary driver action should be displayed. This is particularly important for older drivers, who may get confused or have a harder time remembering previous messages. If you see confusing or distracting messages while driving, contact the local police or the agency with jurisdiction over the road and voice your concern.

Source: Federal Highway Administration

accurate instructions to motorists. Information clutter on roadways is real: the fact that a driver may be in a tractor crossing zone is important, but a sign to this effect is a distraction if his lane is also ending in 500 feet. Similarly, placing a temporary message board ahead of a work zone is crucial for informing motorists about lane shifts and speed reductions, but if it also cycles to wish happy holidays and implore safe driving, the urgent message is lost.

As you consider the roadways in your community, pay particular attention to whether the most important information about a given segment's traffic patterns, operating conditions, or potential hazards is being presented to road users "undiluted." This will positively impact everybody's safety, but will particularly benefit those motorists who might be more easily overwhelmed or confused by information overload.

Why Senior Safety is Crucial (and will continue to be)

The nation's driving population is aging, and as many states experience a rapid growth in retirees, it will fall

BOX 3.10: ADVANCE SIGNAGE

If your trouble spot involves some kind of unexpected change or condition in the roadway – such as loose gravel, standing water, or a new work zone – installing warning signs on the approach is one of the quickest ways to assist motorists. For older drivers in particular, who may not be able to react quickly at the moment of urgency, advance notification may help them adjust speed, merge into the appropriate lane, or focus attention early enough to avoid a collision.

Advance signage is also beneficial prior to intersections, as junctions present a great deal of information to process all at once: Are there pedestrians crossing? Is there oncoming or turning traffic? What type of traffic control is used? These are crucial safety matters that may be compromised if a driver is also trying to determine whether they are at the cross street they need to turn on to. FHWA recommends repeated and redundant signage to help older drivers approaching intersections. With the upcoming street and lane assignments named mid-block, drivers can focus exclusively on navigating the intersection itself when they arrive.

Source: Federal Highway Administration

Delaware has the fastest-aging population in the United States.

to communities and local leaders to develop appropriate strategies for ensuring the safety, mobility, and independence of this demographic. In cities, towns, and counties across the country, older residents will continue to drive in order to live healthy, social, and happy lives.

By evaluating your community's roadways with the needs of older drivers in mind, you are improving safety for all road users. You are also in a position to make a valuable contribution to ongoing efforts to address a demographic shift toward an older population, and to find transportation solutions that will support it. By understanding where the true risks with this demographic lie – and indeed by recognizing that older drivers cause less harm to others than do drivers in their twenties – public support can be sought for increased investment in roadway safety strategies that help everybody navigate the road network with greater ease and comfort.

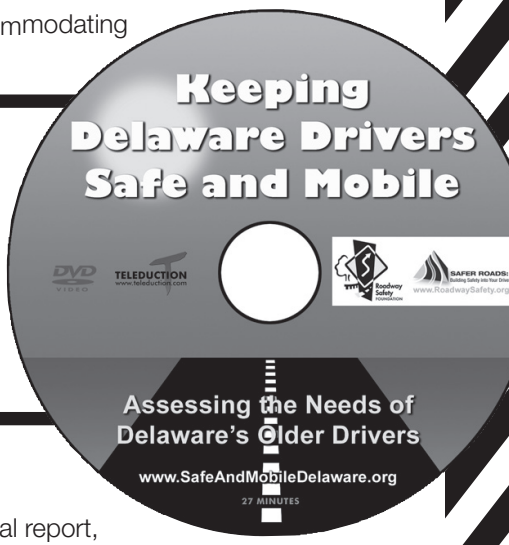
Case Study

SAFE AND MOBILE DELAWARE CAMPAIGN

Delaware has the fastest-aging population in the United States.[54] Mirroring national trends, many of the state's older residents live in suburban and rural communities and are dependent on private automobiles for their daily routines.[54] According to the Delaware Department of Transportation (DelDOT), such transportation is used for roughly 90 percent of the trips made by this demographic.[54] With significant continued growth in the senior population predicted, finding ways to keep older residents safe on the roads is of the utmost importance.

Toward this end, two research centers at the University of Delaware in Newark – the Institute for Public Administration and the Delaware Center for Transportation – undertook a project to study the needs of Delaware's older drivers and make recommendations for better accommodating them on the state's roadways. Following publication of the final report, the University of Delaware was offered technical assistance by the Roadway Safety Foundation for a public information campaign designed to promote the research findings and educate residents about the importance of roadway safety programs and policies that support older drivers.

Central to the campaign is a half-hour documentary featuring interviews with seniors, state officials, and AAA, AARP, and other association representatives discussing the challenges older drivers face and the strategies available for addressing them.



Central to the campaign is a half-hour documentary featuring interviews with seniors, state officials, and AAA, AARP, and other association representatives discussing the challenges older drivers face and the strategies available for addressing them. The documentary also details the importance of safety and mobility for healthy aging, and provides footage of roadway locations in Delaware that have been upgraded to assist older road users.

Think about roadways in your community. When not in a vehicle, do you feel safe on them?

The film originally aired on WHYY TV12, the public broadcasting station covering Delaware and parts of Pennsylvania and New Jersey. The station reaches roughly three million homes and attracts one million viewers each week. The documentary is also available online. In addition, the Roadway Safety Foundation and University of Delaware provide DVDs free of charge, and have distributed them at trade shows, in mailings, and in an outreach campaign to the Delaware state legislature, which received the film along with a letter detailing the importance of safety investments. Other campaign efforts include radio and TV public service announcements and a launch event in Wilmington featuring speakers from AAA, AARP, and the state government.

The research and campaign efforts have been key to longer-term engagement and cooperation between project staff and state agencies. For example, Delaware's Department of Motor Vehicles (DMV) launched a *Senior Driver Task Force,* and DelDOT has taken a pro-active approach toward making the state's roadways safer for seniors. Among the projects DelDOT has undertaken are initiatives to provide pedestrian countdowns and adjust signal timing. On average, it has been able to re-time approximately 50 signals per year to sync with slower walking speeds (3.5 ft./sec.). DelDOT has also adopted a policy of installing countdown signals any time old signals are being replaced or modification projects are being performed.[55]

Other DelDOT efforts include adopting Clearview font, which is used on major guide signs to improve readability for all motorists, and particularly for seniors. Eight-inch signal heads have been replaced with 12-inch ones, and protected-only turn phasing has been implemented at a number of locations.[55] Additionally, DelDOT considers many recommendations on a case-by-case basis, including adding auxiliary left-turn lanes and providing pedestrian refuge islands. A Roundabout Committee developed guidelines for site selection and project design in the state, and maintains a web site to educate the public on safe navigation of this type of intersection.[55]

The *Safe and Mobile Delaware* campaign serves as an excellent example of the success that can be achieved when community groups, local and statewide institutions, national, and government agencies work together. Combining scientific research, a successful public relations and communications effort, support for older drivers at the local level through senior and civic centers, and collaboration with DelDOT and other agencies, the campaign helped educate the public about these critical issues and motivate on-the-ground improvements to Delaware's road network. These crucial investments will only increase in importance in the coming years as the state's senior population continues to grow.

Pedestrians and Bicyclists

Non-motorized Road Users and Vulnerability

Pedestrians and bicyclists are vulnerable for two principal reasons. First, they lack the physical protection afforded by a vehicle, making them extremely susceptible to injury in the event of a crash. Second, it is not always clear how best to integrate them with the roadway as a whole. In many suburban and rural

areas, building sidewalks for pedestrians may not be practical. In urban locations, bicyclists are often the odd ones out, as they may be prohibited from using the sidewalk and yet feel unsafe pedaling down crowded streets. Because this Guide's focus is on traffic safety engineering and roadway design, we will focus on the latter of these two.

Roughly every two hours a pedestrian is killed in the United States; 4,432 died in 2011. That same year, 677 cyclists were killed. The injury numbers are significantly higher, with 69,000 and 48,000 pedestrians and cyclists hurt in crashes in 2011 respectively. For both groups, fatalities were mainly in urban areas – roughly 70 percent each – and at non-intersection locations (NHTSA).[56,57]

Countermeasures and Your Community

Think about roadways in your community. When not in a vehicle, do you feel safe on them? If the trouble areas you are concerned about involve narrow, curvy streets; limited visibility; lack of a shoulder or roadside clearzone; or high speeds, they may present hazards to nonmotorized road users as well as the vehicular traffic we've discussed throughout this Guide. Fortunately, as we've seen in other cases, many of the enhancements that benefit pedestrians and bikes contribute to safer roadways for all users.

There are several engineering treatments that specifically address pedestrian and cyclist safety; we will focus on two of them here. The first, raised medians, confronts the issue of crossing safety; the second, walkways, aims to keep nonmotorized users safe while traveling along the roadway. When these features are lacking, pedestrians and bicyclists could be at increased risk on the road.

Roughly every two hours a pedestrian is killed in the United States; 4,432 died in 2011. That same year, 677 cyclists were killed.

Raised Medians

How many times have you stood on a curb, waiting to cross the street, and felt like you'd never get a break in both directions of traffic at the same time? Judging the speed and distance of two different directions of traffic can be difficult, as is assessing when two safe gaps in traffic exist simultaneously. Raised medians can alleviate this. By creating refuge areas between the opposing travel lanes, raised medians allow pedestrians to cross one direction of traffic at a time, thereby reducing the complexity of the judgments that are required for safe passage. According to FHWA, such crossing islands have been shown to reduce pedestrian crashes by 46 percent at marked crosswalks, and by 39 percent at unmarked crosswalks.[52] They may be particularly effective at mid-block locations, as vehicles tend to travel faster on these stretches than at junctions.[52] If your community has streets busy with both pedestrian and vehicular traffic, such crossing islands may be a worthwhile investment for improved safety.

Walkways

Because most pedestrian and cyclist fatalities occur at non-intersection locations, building appropriate infrastructure for these users along the roadway can have a huge impact on safety.[52] The term "walkways" is deliberately vague, because the actual design that is implemented will depend on the area in question. Sidewalks

are often appropriate in urban locations, while wide shoulders may be more feasible in rural areas, and shared use paths may work in suburban communities. Regardless of what form the "walkway" takes, the underlying idea is separation, whether by space or physical barrier. According to FHWA, having sidewalks on both sides of the roadway has been shown to reduce "walking along road" pedestrian crashes by 88 percent.[52] A 71 percent reduction in these crashes has been demonstrated with paved and widened shoulders.[52] In short, where resources and space permit – and demand justifies – these paths for nonmotorized users may be extremely beneficial in your community.

Bridging the Motor-Foot Divide (Almost)

There is a certain tension between motorized and nonmotorized road users. It may not be present in all communities at all times, and allegiances may be inconsistent. How many drivers, for example, declare that they, "can't stand bicyclists," then get on a bike and complain that passing cars don't give them enough space? Motorists accuse bicyclists of flouting traffic laws; bicyclists counter that motorists don't respect their status as vehicles. Such discord, and corresponding bad behavior on the road, has resulted in pleas to respect all users' rights and "share the road."

This puts community leaders, elected officials, concerned citizens, and transportation professionals in a tough position. How do you weigh the needs of different kinds of road users? What is the appropriate balance between efficiency and safety?

BOX 3.11: IMPROVED DRIVER COMPLIANCE AT CROSSWALKS

Signs, signals, and pavement markings all play a critical role in managing and regulating traffic flow, but major safety concerns arise when road users don't comply with the directions provided.

In St. Petersburg, Florida, for example, the pedestrian crash rate once stood at 68.9 per 100,000 population, compared to the national figure of 23.4. With roughly 100 uncontrolled crosswalks in the city and a review concluding that motorist yielding compliance rates were less than two percent overall, the city recognized that significant improvements needed to be made.

Toward this end, devices known as Rectangular Rapid Flashing Beacons were installed at 19 crosswalks where over 98 percent of motorists failed to yield. These LED Rectangular Rapid Flashing Beacons are placed immediately beneath pedestrian crossing signs and feature quick, irregular flashing patterns designed to grab the attention of approaching motorists. Results of the installation were dramatic, with compliance rates reaching 94 percent at some crosswalks and averaging about 82 percent system-wide. Drivers also yielded farther in advance of the crosswalks, providing a safer zone for pedestrians and reducing the likelihood of rear-end crashes.

Another type of beacon, known as the Pedestrian Hybrid Beacon, has also been very effective in improving motorist compliance and pedestrian safety. These beacons consist of special synchronized traffic signals and pedestrian countdown timers that are installed at crosswalks not otherwise controlled by a traditional stoplight (at a mid-block location, for example). In addition to improving safety, these beacons are also designed to improve efficiency, as they sit dormant until a pedestrian activates them.

Sources: City of St. Petersburg, FL; Center for Education and Research in Safety; Federal Highway Administration

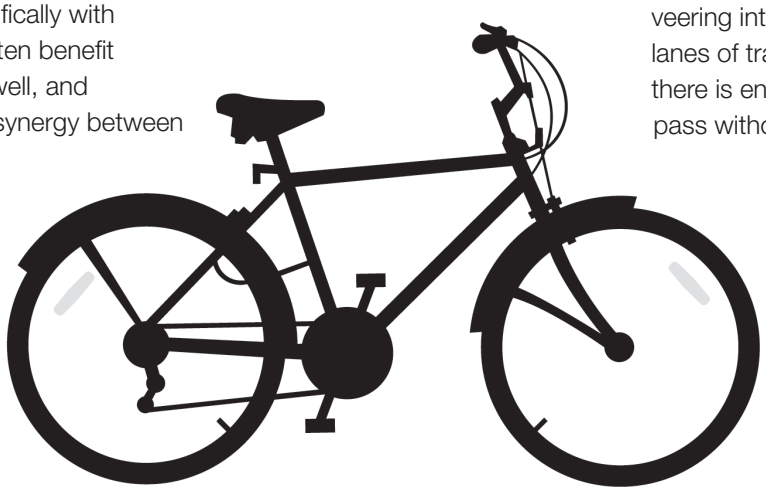
Absent a designated bike lane, cyclists tend to ride dangerously close to the edge of the roadway, risking hitting roadside objects, ditches, curbs, or other hazards.

If you are trying to get a project implemented in your community, you will almost certainly face some tough questions from people whose job it is to manage scarce resources and balance priorities. Because of this, you will want to be able to demonstrate that your proposal will benefit a diverse array of interests, some of which may even initially seem to be in direct conflict. The more users served, the easier it is to justify project costs, set priorities, and satisfy the electorate. This adds up to a greater potential for success in getting your concerns addressed.

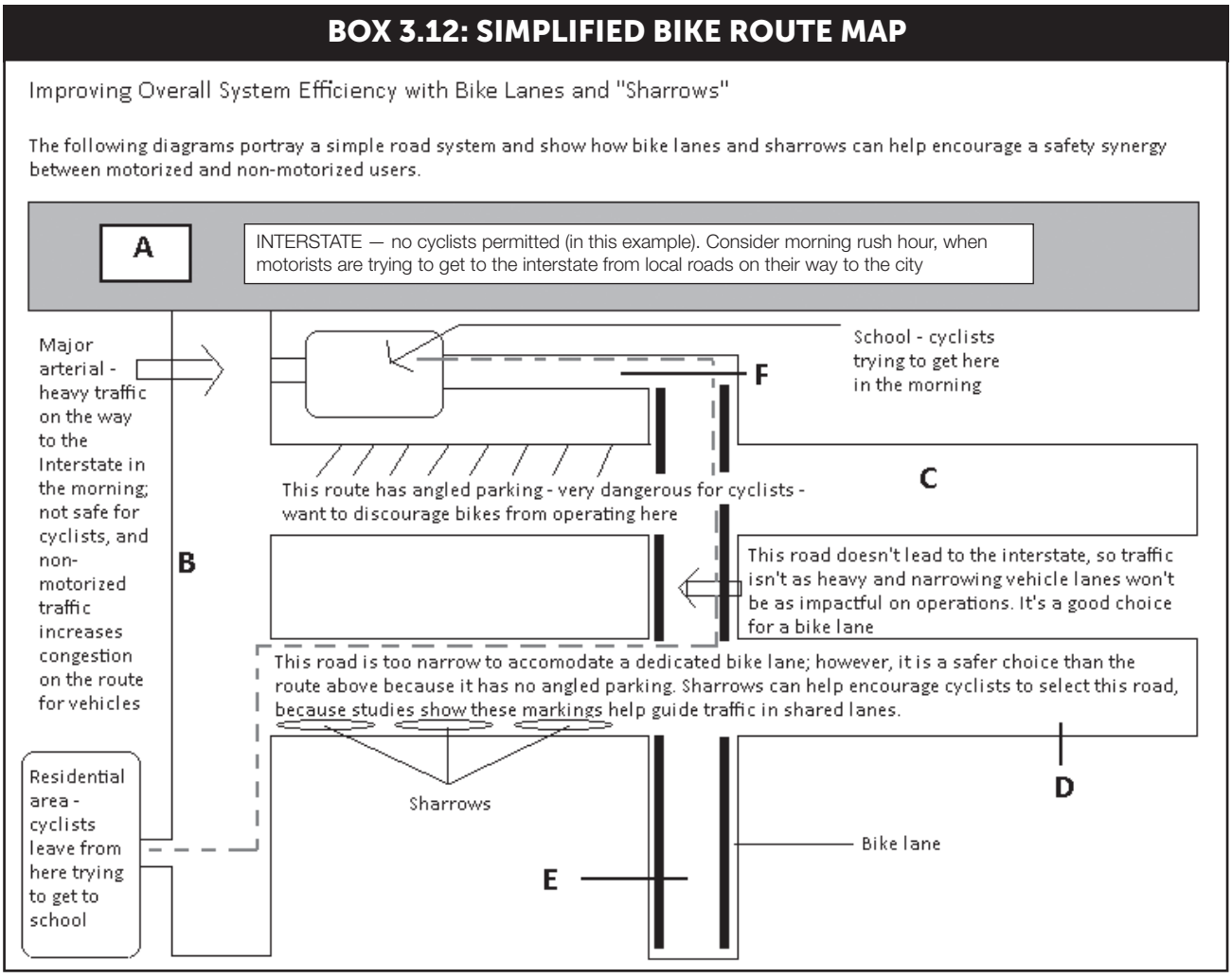
Safety and mobility for both motorized and nonmotorized road users need not be difficult to achieve. As we've seen throughout, safety countermeasures designed specifically with one group in mind often benefit other road users as well, and can create a kind of synergy between seemingly-divergent needs. Take roundabouts, for example. Inherent in the design of a modern roundabout is a wedge-shaped median that slows vehicles by deflecting them at an angle on approach. This same median also provides pedestrians with a space between opposing lanes of traffic, thereby allowing them to cross only one direction at a time. The same things that make roundabouts safer for motorists – slower speeds, exclusively right turns, a singular travel direction – also improve safety for nonmotorized users.

Safety and mobility for both motorized and nonmotorized road users need not be difficult to achieve.

Intersection locations are not the only places that one finds this synergy. Pedestrians and bicyclists in the roadway can be a source of stress for motorists, particularly when passing them requires veering into adjacent or opposing lanes of traffic. Even when there is enough space to pass without such encroachment,



BOX 3.12: SIMPLIFIED BIKE ROUTE MAP



cautious – or nervous – motorists may not accurately perceive this. Walkways or bike lanes can therefore help channel nonmotorized users into a designated part of the roadway that clearly defines the space available to everybody.

Consider the findings of a study by the Center for Transportation Research at the University of Texas at Austin. Researchers found that, absent a designated bike lane, cyclists tend to ride dangerously close to the edge of the roadway, risking hitting roadside objects, ditches, curbs, or other hazards.[58] In addition, they found that nine out of 10 passing motorists would encroach on an adjacent travel lane (even if there was enough space to pass without doing so) and that the average encroachment was a full three to four feet.[58] This puts motorists at significant risk for a head-on or sideswipe crash.

By striping the pavement to delineate space for each type of road user, motorists and cyclists alike demonstrate increased comfort levels as expressed through the positioning of their vehicles. Bike lanes bring cyclists safely away from the edge of the road, and only five of 10 motorists encroach on adjacent lanes when passing, with a 33 percent reduction in the extent of the intrusion.[58] Safety is thereby improved with a reduced risk of head-on or sideswipe crashes.

Studies show certain reductions in operational performance for motor vehicles when travel lanes are narrowed to accommodate a bike lane, but it is worth remembering a few key points:

BOX 3.13: EXPLANATION OF BIKE ROUTE MAP

The diagram on the previous page shows a very simplified road system, in which roads A, B, C, D, E, and F serve a residential development, a school, an Interstate highway, and a larger suburban community. In this example, the dotted gray line shows the route that community leaders want bicyclists to take from the residential area to the school during morning rush hour. Here's why:

- Road A: Road A is an Interstate highway. In this example, legally, no cyclists are permitted to operate on this road. It cannot be included in the bike route. However, Road A is an important factor in our scenario: commuters are trying to get to Road A on their way to work.
- Road B: This is the major arterial serving the Interstate. Bikes are permitted on this road, but it is not ideal for their use. Motor vehicle congestion is heavy because of commuter traffic, and the presence of bikes adds to this slowdown while also posing an elevated hazard to the cyclists. It is necessary for bikes to use Road B when first leaving the residential development, and this is both legal and appropriate. The goal, however, is to get them off of Road B as soon as possible.
- Road C: For bikes to use Road C poses two problems. First, it keeps them on the heavily-congested and relatively-risky Road B a block longer; second, Road C has angled on-street parking, which is particularly hazardous for bicyclists. Use of Road C should be discouraged.
- Road D: This is a better option for cyclists wishing to travel East in the morning, but it is too narrow to accommodate a dedicated bike lane. Studies show that sharrows (see photo) can help regulate traffic in shared lanes, so putting these markings along Road D may improve safety and encourage cyclists to choose this route.
- Road E: Road E is ideal for a bike lane – it doesn't connect to the Interstate, so morning traffic is lighter than on Road B. Additionally, it is wide enough to accommodate a slight reduction in lane width for the purpose of adding a bike lane, and it runs a similar North-South route that allows travelers to get from the residential development to the school, via Road F.

While this is obviously a very simple example, you can see here how safety and efficiency may be able to be improved for both motorists and cyclists through targeted use of bike lanes, sharrows, and other infrastructure modifications. The needs of commuters have been met by drawing cyclists off of Road B as soon as possible, and cyclists have been provided a safe, efficient route to their destination.

www.pedbikeimages.org / Lyubov Zuyeva

- **Cyclists are allowed to – and will – operate on most types of roads.**
- **When there is a heavy presence of cyclists, especially in urban environments, bike lanes improve operation and comfort for all road users, when compared with other options.**
- **By reducing the tendency for motorists to encroach when passing a cyclist, bike lanes allow all traffic to operate freely, thereby mitigating the kinds of back-ups encountered when long lines of traffic get stuck behind bicyclists.**

However, this should not be taken to mean that bike lanes are appropriate on all roadways. Roads that are already narrow and unable to accommodate a bike lane without eliminating general purpose lanes that serve as popular truck or commuter routes, or that have certain arrangements for on-street parking – such as head-in angled spaces[59] – may simply be inappropriate for such retrofitting, and may increase tension between motorists and bicyclists. In cases like this, incorporating bike lanes on alternate routes may help create safer and more convenient networks for bicyclists.

Widening paved shoulders to four feet on rural, two-lane roads has been shown to reduce all crashes by 29 percent.

Even on roadways that cannot accommodate a dedicated bike lane, there is evidence that simply putting in shared lane markings – or "sharrows" – can improve safety. These markings serve as reminders of the need to share the road, and are generally placed far enough from the curb to encourage cyclists to ride outside the reach of a parked car's open door. According to a FHWA report summarizing experiments in three cities, sharrows tended to help regulate traffic in the shared lane, giving cyclists more space to operate, reducing the number of "close calls" between cycles and motor vehicles, and reducing the percentage of motorists who perceived a need to change lanes when passing a bicyclist.[60] As with bike lanes, communities can use sharrows to help improve overall system efficiency by encouraging cyclists to ride on the routes most suitable for safe, efficient operation.

This kind of safety synergy can also be found in locations where bike lanes or sidewalks are deemed infeasible or impractical, such as in many rural areas. For example, the *2012 AASHTO Guide for the Development of Bicycle Facilities* recommends widening paved shoulders to at least four feet for pedestrian and cyclist use if sidewalks or bike lanes are not provided. As mentioned above, this greatly reduces pedestrian crashes; it also, however, benefits motorists. In fact, widening paved shoulders to four feet on rural, two-lane roads has been shown to reduce all crashes by 29 percent.[52] An even better option would be to widen the shoulder enough to install bicycle-friendly rumble strips and provide at least a four-foot-wide operating space for nonmotorized users beyond the grooves. Where this proves possible, truly everybody wins, as the rumble strip may prevent a distracted or drowsy driver from running off the road and striking a pedestrian or cyclist on the way.

It is important to keep in mind, of course, that with the sheer diversity and size of our road network there will always be locations where this kind of synergy is not achievable. Rumble strips, for example, can negatively impact cyclists, and it's clear that widening every shoulder to provide space for nonmotorized users outside the grooves is simply not possible. And difficult as it may be to widen shoulders in rural areas, widening urban streets is an even tougher – if not impossible – undertaking. As noted above, installing bike lanes often comes at the expense of motor vehicle lane width. It's therefore important to remember that tough decisions may need to be made to balance user needs, and it is crucial to tackle

Federal funding can be used by state and local governments to put in sidewalks, crosswalks, and other infrastructure upgrades.

safety system-wide to optimize performance and reduce unintended negative consequences of a given project or countermeasure.

To the extent that you can demonstrate that your concern touches a broad range of stakeholders – and can be practically addressed without causing undue burden for certain road users – you may have a greater chance of success in seeing your project through to completion. For officials balancing needs and resources, satisfying as many groups' bottom lines as possible is the goal. Below, we'll take a look at how a community has achieved significant safety gains for all by undertaking projects designed to improve infrastructure for pedestrians and cyclists.

Case Study

INFRASTRUCTURE UPGRADES IN LITTLE ROCK SERVE AREA SCHOOL CHILDREN

Forest Park Elementary School in Little Rock, AR serves as one example of the kind of success that can be achieved when a local community voices its concerns, secures funding, coalesces around solutions, and sees projects through to completion.[61] Located in the middle of a residential neighborhood, but lacking any sidewalks to or from school grounds, Forest Park Elementary experienced major growth in its student body, which nearly doubled in just a few years. This expansion placed enormous strain on surrounding roadways, leading to numerous traffic crashes and, ultimately, a student being hit by a vehicle.[61]

While the city added a traffic light and crossing guard to improve safety at the location where the student was hit, the school PTA worked with local stakeholders and partners to secure federal funding and create a broad, comprehensive program to address the underlying infrastructure deficiencies and reduce traffic in the immediate vicinity by encouraging students to walk or bike to school. The project, "Stride with Pride on Neighborhood Streets," received more than $315,000, along with over $10,000 in funds for public awareness campaigns, pedestrian education, and other efforts to encourage students to walk to school and to do so safely.[61]

All of the upgrades were made during one summer, and were completed by the first day of school the following autumn. These included the installation of thousands of square feet of new sidewalks; over 1,500 linear feet of curb and gutter; two solar-powered speeding signs; painted crosswalks; "Safe Routes to School Zone" signs; "Yield to Pedestrian" signs; raised pavement markers; and other street improvements.[61]

Area residents even worked together to raise private funds to do additional improvements. The PTA contributed funds and leveraged the successes already achieved by the roadwork to build support for the additional project, which consisted of filling a six-foot deep drainage ditch that had been a pedestrian hazard on an unimproved block near the school, and adding additional linear feet of sidewalk. The city even discounted the cost of this additional work.

This case highlights how local support for community-driven programs, coupled with successful efforts to secure outside sources of funding, can have an enduring impact. The efforts of the Forest Park Elementary PTA, the city of Little Rock, area residents, and others involved demonstrate the success that can be achieved when communities rally behind projects and unite to promote roadway safety. •

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CHAPTER 4
Getting it Done

Working with your community's traffic engineers or other road professionals is the critical first step to ensuring that needed roadway improvements are completed. These individuals can help you identify roadway problems and potential solutions. The next step is to broaden the base of support for addressing the roadway safety issues you have identified. The more people who share your vision and voice their commitment, the more likely it is that your issue will receive the attention it deserves.

This chapter answers the following questions:

- What makes an effective coalition?
- How do you build your coalition?
- Where can you get funding?
- How do you evaluate results and benefits?

What Makes an Effective Coalition?

Regardless of your specific mission or purpose, there are key characteristics that will increase your likelihood of meeting your goals:

- A wide range of community leaders should be at the table—from local officials, businesses, political leaders, and community groups to "moms and dads" who are concerned about their children's safety.
- Everyone should share a common sense of purpose, and a vision of zero deaths and zero injuries at the trouble spot and in the larger community.
- A strong relationship with the local press should be cultivated.
- The coalition must establish and maintain visibility within the community.
- Efforts must be ongoing and consistent to keep up the momentum.
- Regular self-evaluation keeps a good coalition together and moving towards common goals.
- A coalition volunteer should take on administrative duties to schedule meetings, set agendas, and keep the group on track; in larger groups, a management team may be needed.

How Do You Build Your Coalition?

Reaching Local Stakeholders

As you move through the labyrinth of government agencies concerned with roadway safety, don't forget to contact other stakeholders and organizations that may have a hand in keeping your roads safe. These might include:

- Political leaders
- Local law enforcement
- Utility/public works providers (water, sanitation, gas, telephone, electric, etc.)
- Tourism Advisory Councils and/or related groups
- AAA and other auto clubs
- Auto insurance companies
- Safety advocacy groups
- Local planning and zoning commissions
- Metropolitan Planning Organizations
- Local Chambers of Commerce and/or business/ trade advocates

A Word on the Media

Print, broadcast, online, and social media are resources right at your fingertips and can easily bolster support for addressing your roadway problems.

The media can be used to:

- Introduce a roadway problem.
- Highlight governmental activity or inactivity on an issue.
- Build support for a particular project.

Use the media to support and applaud your collaborative efforts. For example, citizens can:

- Write press releases and letters to the editor (see sample to the right).
- Arrange for local television and radio coverage of safety initiatives.
- Contribute to relevant blogs, web chats, comment boards, social media pages, and other online content/discussions.
- Consider paid advertising or local Public Service Announcements (PSAs).
- Call in to radio talk shows.

As you'll see in the case studies below, the media can serve as a powerful tool for generating awareness of your efforts and providing you with a platform for expressing your concerns.

Box 4.1

Roadway Safety FOUNDATION

Contact: [spokesperson]
Office: [phone number]
Cell: [phone number]
[e-mail address]

FOR IMMEDIATE RELEASE
[date of release]

STUDY CREDITS INCREASE IN SAFETY PROJECTS FOR REDUCTION IN FATALITIES

(Washington, DC) - A new report released June 29 credits major federal funding increases for roadway safety engineering projects for the dramatic reduction in highway fatalities between 2006 and 2009.

The study, *Highway Safety Improvement Program (HSIP) Obligations and Fatalities on U.S. Highways: Final Report*, prepared for the American Traffic Safety Services Association by Science Applications International Corporation (SAIC), examines engineering funding increases provided under the 2005-2009 federal-aid highway law.

With sharp safety project funding increases beginning in 2006, the report analyzes the extent to which the new HSIP program can be credited with the reduction in fatalities that started around the same time, following a 10-year period with little change. For years that figure fluctuated slightly, but remained around 42,000. By 2009, following annual reductions since 2006, the number of deaths had fallen to 33,808.

As fatalities decline, a variety of non-engineering factors have been commonly hypothesized as responsible, such as the temporary reduction in driving that occurred with the economic downturn and fuel price spikes of 2008. SAIC found that none of the commonly cited reasons sufficiently explains the sharp decrease in deaths seen since the HSIP program was created. Rather, the report found that the HSIP program spending changes correlated with the sharp decrease in traffic fatalities. Further, the report estimates that the United States realizes an annual savings of $42.7 million for every $1 million increase of HSIP funds spent.

"This report makes it crystal clear that modern engineering enhancements are making our drivers and passengers much safer and these investments are going to continue to save thousands of families from heartbreak," said Greg Cohen, Executive Director of the Roadway Safety Foundation. "It is critical that we prioritize systemic safety improvements on our nation's roads and bridges in the years ahead to continue this trend. We can't forget that road crashes are the #1 killer of children and young adults aged 3-34."

The full report is available online, at www.atssa.com.

RSF is the only national organization solely dedicated to reducing deaths by improving the physical characteristics of America's roadways - design and engineering, operating conditions, removal of roadside hazards, and the effective use of safety features. RSF works to attain its goals by building awareness through media campaigns and outreach activities, developing educational materials and forming roadway safety partnerships between the private and public sectors. For additional information on RSF please visit www.roadwaysafety.org.

Coalitions in Action

The following are examples of successful coalition-based efforts that address roadway problems and hazards.

TAZEWELL COUNTY TEEN INITIATIVE

Tazewell County, a jurisdiction in central Illinois with a population of about 130,000, experienced a frightening period marked by a surge in teen road deaths. Within 16 months, 15 teenagers were killed on county roadways, an enormous increase over the previous four years, during which Tazewell averaged less than one teen traffic death annually.[62] According to the Illinois State Police, speed and alcohol were the most common causes, and in at least five of the crashes seatbelts were not used. Seven of the nine incidents were single-vehicle run-off-the-road crashes accounting for 12 of the 15 deaths.[62]

The initial response to the problem was largely limited to law enforcement, and included ramped-up seatbelt checks and crackdowns on underage drinking.

However, this proved insufficient – two months after the campaign began, two teens were killed in a run-off-the-road crash, followed by seven more throughout the subsequent six months.[62]

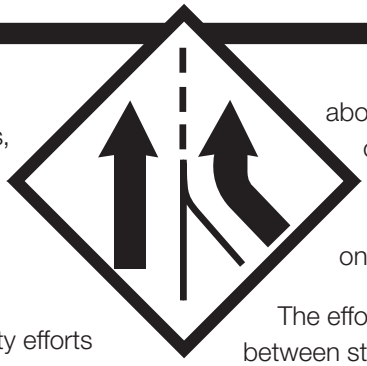
Recognizing the need for a comprehensive community response, the Illinois State Police, Illinois Department of Transportation (IDOT), Tazewell County Sheriff, and other stakeholders convened to develop a strategy. Breaking into committees representing each of highway safety's four "E" areas – Engineering,

BOX 4.2: DON'T BE DISCOURAGED!

Don't be discouraged if your initial efforts to reach the media don't pan out. Be persistent (but not pushy) in drumming up interest for your story, and keep in mind that timing is very important: just because another story may have trumped yours today doesn't mean your contacts won't be interested in giving you coverage in the future. And remember: in this day and age, there are lots and lots of outlets you can turn to. You may even wish to consider starting with your community association listserv or a local newsletter. Don't give up! With social networking you can always be your own media, and maintaining a presence on Facebook, Twitter, YouTube, or other sites can give you valuable exposure and boost your audience.

Education, Enforcement, and Emergency Response – working groups were asked to develop strategies for improving young driver safety within their specialty, and appoint a contact person for the committee.[62] The *Tazewell County Teen Initiative* was thus launched, garnering statewide and even national attention for its efforts and serving as an outstanding model for the kind of coalition-building discussed in this chapter.

One of the particularly impressive aspects of the Initiative is the diversity of projects undertaken. Some focused on getting the safety message out; others provided experiential, hands-on education, allowing youth to use crash simulators, receive professional driving lessons, and, with a donated golf cart and goggles, get a sense of impaired driving while in a safe environment.[62] Enforcement continued to play a major role, and included increased use of speed trailers.



Recognizing that thorough highway safety efforts must include consideration of roadway design, the Initiative secured roughly $1 million in funding from IDOT for physical upgrades and engineering enhancements of area roads.[62] IDOT mapped out the crash locations where teenagers were killed in order to identify roadway defects, prioritize enforcement efforts, and determine what countermeasures would be appropriate. Roadway Safety Audits were also performed, along with an analysis of fatal, injury, and property damage crashes.[62]

A variety of improvements have been made in Tazewell County based on the analysis conducted, with close coordination between IDOT, county engineers, and others a hallmark of the efforts. Because at least four of the vehicles involved in run-off-the-road crashes ultimately collided with a tree, various roadside hazards were removed to create safer clear-zones.[62] Signage was upgraded to conform to current retroreflectivity standards, and pavement markings and striping were improved.[62] The county also lowered speed limits along stretches of roads with high crash rates, and improved at least three dangerous intersections. One intersection, plagued by sight distance issues, was completely re-designed with the grade cut back to improve visibility.[62] The county engineer also went to driver's ed classes to teach students about distinguishing between different classes of roadways, understanding the safety features encountered – or not – on them, and adapting behavior based on the physical qualities of the roads.

The efforts are ongoing, with collaboration between stakeholders a highly-valued aspect of the campaign. One very active committee, a Tazewell student group, identifies trouble spots where young people are noticing roadway dangers, and provides this information to the police. State troopers use such student input to plan patrols and conduct spot checks. The Initiative won an Honorable Mention for Program Planning, Development, and Evaluation in the 2007 National Roadway Safety Awards, and the State Police and other stakeholders are frequently asked to present on their success, often to engineering groups.

To build on Tazewell's efforts, the Ford Motor Company provided funding for a statewide off-shoot

By bringing teens themselves into the process, the Initiative provided a means for youth to make a positive contribution to safety, and understand their responsibilities on the road.

of the program, in which students at all Illinois high schools were invited to create traffic safety programs based on specific road issues in their communities. This program won an award for Operational Improvements in the 2009 National Roadway Safety Awards, and Illinois saw a 40 percent reduction in teen deaths statewide.[63]

The coalition built through the *Tazewell County Teen Initiative* serves as an impressive model for anybody seeking to generate community support for safety improvements. By dividing into working groups according to areas of expertise, participants were able to develop effective strategies representing various components of highway safety. Central coordination of these efforts provided a unified platform and a vehicle for evaluation and collaboration. By bringing teens themselves into the process, the Initiative provided a means for youth to make a positive contribution to safety, and understand their responsibilities on the road. Such broad-based coalitions are more likely to enjoy community support and buy-in, which can be very important for securing funding and resources for large projects, such as roadway upgrades. By bringing all four "E" areas together, Tazewell got this program on the radar screens of IDOT, Ford, State Farm, and others, whose investments helped the county reap the most important benefit of all: lives saved.

THE SANDY JOHNSON FOUNDATION

The Sandy Johnson Foundation (SJF) is an Ohio-based non-profit organization founded in 2002 in response to the deaths of two women, Sandy Johnson and her mother, at a dangerous intersection. While investigating the crash, Sandy's husband learned that the intersection, once ranked the eighth-most dangerous in Ohio, had not been adequately upgraded or enhanced despite having been the site of numerous crashes and fatalities and the subject of multiple studies over the previous 13 years. Moreover, he found that hundreds of such sites existed in the state. In response, he established SJF to help improve roadway safety in Ohio and across the country.[64]

The creation of SJF and its efforts to date serve as an excellent example of a concerned citizen taking concrete action, building an organization, working with the media, and enlisting the support of other safety partners to effect positive changes. The story also serves as a realistic example of the kinds of obstacles and hurdles you may encounter as you begin your own roadway safety efforts, and is illustrative both of the power of collaboration, and the persistence coalitions often must demonstrate to achieve success.

After learning of the multitude of crashes that had occurred at the intersection where Sandy was killed, her husband began to investigate, re-tracing Sandy's drive and interviewing residents in the area as well as victims of crashes at the site. Since all 11 intersections leading to the site of the fatal crash were either four-way stops or were controlled by fully-functioning traffic signals, Sandy's husband concluded that

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An ODOT safety report eerily foreshadowed the crash 14 months later that killed Sandy Johnson and her mother, Jacqueline Ebert-Routch.

way to the nearby fruit farm, a southbound Chevrolet Blazer plowed into the driver's side. Johnson's car spun and hit a northbound Infiniti SUV waiting to turn west from Rt. 310 onto Morse Road.

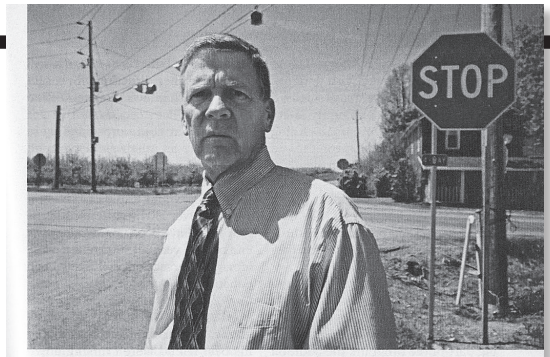
Committee approved funding for the light five days after Johnson and her mother died.

"I think it was coincidence more than anything else," Cunningham said of the timing.

The $70,000 signal will reduce

The Sandy Johnson Foundation termed this phenomenon "driver-conditioning," which it defines as the process by which motorists become conditioned to respond to traffic patterns, road conditions, and other aspects of their surroundings that remain consistent over time, leaving them vulnerable to err when sudden changes occur with little or no warning.

drivers were becoming conditioned to the roadway environment.[65] With the crash location resembling simply more of the same – it was controlled by a flashing red light and drivers were unable to see that cross traffic had a flashing yellow – conditioned motorists were reacting to this final intersection as they perceived it to be: a four-way stop.[65] It wasn't, and visual obstructions and 55-mph speed limits only served to compound the problem.



When Dean Johnson's wife became a victim of this deadly intersection, he says, "My world collapsed."

of safe crosswalks for pedestrians. The simple truth is that you can buy the safest car available, drive carefully, and still be in danger because the road itself is working against you.

"We've done a great deal over the past couple of decades to improve driver and vehicle safety," says Diane Steed, former head of NHTSA and now executive director of the Roadway Safety Foundation (RSF). "But our roads are not safe enough, and it's time to bring this to the floor."

But fixing problems gets expensive quickly. And in times of tight budgets, states and localities are often left without enough to do the job.

Meanwhile road use is soaring. In 2000, Americans traveled 2.7 trillion miles, up 20 percent since 1993. And experts are becoming concerned about who's behind the wheel. Bella Dinh-Zarr, national director of traffic safety policy for AAA, points out that by 2020 there will be more than 40 million licensed drivers over the age of 65. "Crash rates for this group continue to climb because existing road hazards and aging don't mix well."

Dangerous Crossings. *Reader's Digest* wondered how often roadway designs and defects might contribute to serious accidents, so we analyzed NHTSA fatal crash data from 1998 to 2001, removing accidents linked to driver error or impairment. The result: 24,067 people were killed. One-third of them were at intersections, where confusing lanes, blind spots and inadequate signs can cause havoc.

"Left-turning vehicles are involved

79

July 2003 Issue of *Reader's Digest*

SJF termed this phenomenon "driver-conditioning," which it defines as the process by which motorists become conditioned to respond to traffic patterns, road conditions, and other aspects of their surroundings that remain consistent over time, leaving them vulnerable to err when sudden changes occur with little or no warning.[65]

Interviews with other crash victims added support for this theory, and their input helped solidify SJF's approach to improving highway safety. Returning to the location after the crash, Sandy's husband witnessed a near-collision in which a convertible entered the intersection from the same approach Sandy had and was almost struck by crossing traffic. On scene, he asked the driver why she'd entered the intersection, and she responded that she'd perceived it to be a four-way stop. A few weeks later, Sandy's husband met another person involved in a crash at the same site. Driving on the cross street, this person hit a car whose driver had pulled out believing the junction to be a four-way stop.

In the weeks following Sandy's crash, *The Columbus Dispatch* took a special interest in the story, covering the founding of SJF, interviewing Sandy's husband several times, writing a piece on the intersection's crash history, and publishing an editorial in support of promptly making it a four-way stop.[66] Through interviews with area residents, the *Dispatch* publicized what SJF had been finding in its investigation: drivers unfamiliar with the intersection consistently misperceived the traffic pattern, and support existed from locals for changes to be made.[67] In addition, others came to SJF in the wake of the *Dispatch* coverage with their personal or family stories of involvement in crashes at the same site, thereby further emboldening SJF's efforts.

Empowered by media publicity, the testimonials of numerous victims of crashes at the site, and the support of local residents familiar with the troubled intersection, SJF met with the Ohio Department of Transportation (ODOT) roughly two months following Sandy's crash and strongly suggested that the intersection be converted to a four-way stop. The following day, ODOT agreed to make the recommended changes, and just 10 days after the initial request

was made the conversion was completed. This brought to an end 13 years of studies and virtually eliminated crashes and fatalities at the location, with a notable exception occurring some time later due to a drunk driver.

With safety improved at the intersection that killed Sandy Johnson, the Foundation bearing her name teamed up with county engineers, transportation officials, law enforcement, local and national politicians, and others to accelerate efforts to upgrade and enhance other trouble spots. To combat the effects of driver-conditioning, SJF's Highway Safety Initiative calls for adequate notification and education features that both grab motorists' attention – such as rumble strips across the roadway – and provide clear, concise instructions for avoiding a hazard.[65]

For example, SJF worked with county engineers and police departments in Ohio to put up signage at intersections that might be mistaken for four-way stops or that had visibility problems. An example of such a sign is pictured below (Box 4.3): It educates drivers about a problem at the site and the proper precautions motorists need to take in order to avoid a potential crash. These signs have helped to significantly reduce crashes at this and other intersections in the county where they have been installed.

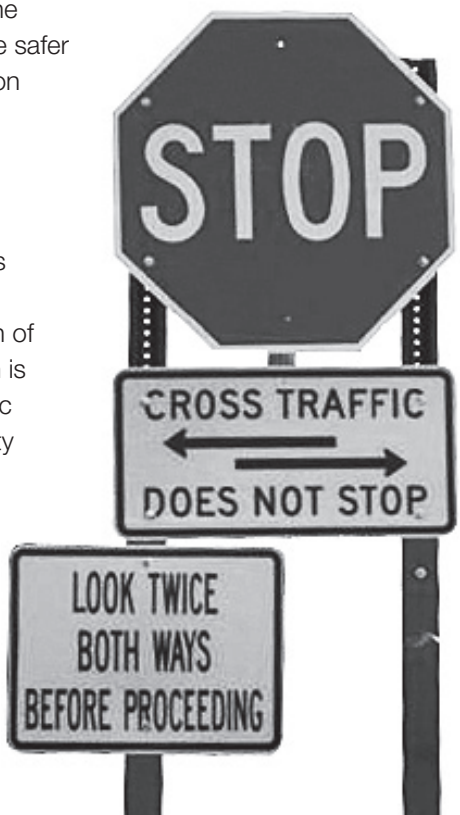
SJF's continued mission to identify and map trouble spots and hazardous roadway locations, notify the public so motorists may choose safer routes, and encourage legislation and policies that streamline the process by which highway departments can implement sensible countermeasures, has provided excellent opportunities for coalition building and media outreach. Even the composition of the Foundation's board – which is made up of an attorney, a public relations specialist, and a county engineer – is reflective of the broad-based support for such efforts.

SJF teamed up with politicians to get legislation written and signed into law requiring that states identify their most hazardous road locations and detail what is required to fix them. It works with crash victims and others familiar with hazardous sites to identify why drivers frequently make mistakes at specific locations, and has presented these findings to county engineers and ODOT officials. To raise the profile of these efforts, SJF submits letters to the editor of various publications, and has commended *The Columbus Dispatch* for its attention to dangerous roadways. SJF has received national coverage as well, including a lengthy profile in *Reader's Digest.*[68] Moving forward, the Foundation is planning a national driver-conditioning awareness day, an effort that will call upon the support of its partners and that is intended to build an even broader coalition network.

SJF will be the first to admit, however, that it has faced numerous challenges along the way, and it is worth noting that you may face obstacles, as well. It is important to keep in mind that every agency and organization with which you initiate a dialogue will have its own internal procedures, policies, and resource constraints. There will always be debates as to the most appropriate solutions for a given problem, the priority level it should be accorded, and the flexibility that an agency has to respond to concerns. Even well-meaning staff that you contact may simply not be in a position to act on your concerns.

A coalition with strong public support armed with crash data and good ideas is a powerful force, but as you work certain channels you may simply find that some lead to dead-ends. This is to be expected, but it can be demoralizing. Keep at it, get the facts you need, build media support and public interest, and you too may be able to help solve a problem that's been lingering for years in a matter of months.

BOX 4.3:
NON-TRADITIONAL SIGNAGE



Source: Logan County (OH) Engineer's Office

THE RSF *RECOGNIZE, REACT, RECOVER* RUN-OFF-ROAD CAMPAIGN IN SOUTH CAROLINA

South Carolina is home to a large network of rural and secondary roads, and over 25,000 miles of it falls under the responsibility of the state's Department of Transportation (SCDOT), which operates the fourth-largest state-run highway system in the country.[69] Unfortunately, many of these roads were not built to current design and safety standards and are characterized by the same problematic features seen on secondary roads nationwide, such as narrow lanes, hairpin turns, and myriad roadside hazards.

In addition to budgeting $5 million to install almost 3,000 miles of rumble strips, SCDOT approached the Roadway Safety Foundation for technical assistance to develop a public information and education campaign in support of the roadway projects.[69] The resulting program, entitled *Recognize, React, Recover: Using rumble strips to prevent run-off-the-road crashes,* gathered numerous partners into a robust coalition that, in addition to RSF and SCDOT, included the AAA Foundation for Traffic Safety, Michelin North America, SC Highway Patrol, Families of Highway Fatalities, the SC Criminal Justice Academy, the SC Fire Academy, Lexington County EMS, several paving and traffic safety services companies, leading driving experts, and FHWA.

Using Rumblestrips to prevent run-off-the-road crashes

The purpose of the campaign was twofold: to educate the public about the safety benefits of rumble strips, and to work toward a strategy listed in South Carolina's Strategic Highway Safety Plan for reducing crashes by educating motorists about proper vehicle handling and recovery techniques in the event of a roadway departure.

Motorists driving on such roadways are particularly at risk for roadway departure crashes: one occurs every 30 minutes in South Carolina, accounting for roughly half of the state's highway fatalities. In fact, a study issued by a national research group found that South Carolina had the nation's highest traffic fatality rate on secondary roads. With FHWA designating South Carolina as a focus state for roadway departure (RD) safety efforts, SCDOT set a goal of reducing RD crashes, fatalities, and injuries by at least five percent over a three-year period.[69,70]

The purpose of the campaign was twofold: to educate the public about the safety benefits of rumble strips, and to work toward a strategy listed in South Carolina's SHSP for reducing crashes by educating motorists about proper vehicle handling and recovery techniques in the event of a roadway departure. At the time, rumble strips were used sparingly on two-lane roads in the state, and 60 percent of Interstate mileage in South Carolina lacked the devices on the left and right shoulders.[69] To capitalize on the proven safety benefits of rumble strips, and expand on roadside safety successes already achieved (a study found a

22 percent reduction in run-off-road crashes and a 12.5 percent decline in fatalities along 1,000 miles of roadway to which SCDOT had added two-foot paved shoulders) an initiative was launched to install rumble strips when resurfacing any roadway meeting certain eligibility criteria. The state's design standards also were revised to require rumble strips on all Interstate shoulders.[69]

The centerpiece of the campaign is a six-module DVD that explores the issue of roadway departure crashes nationally and in South Carolina. The film explains what rumble strips are and how they work, and provides real-life stories of crash victims. In addition, segments filmed at Michelin's test track feature professional drivers who offer tips on safely handling tire blowouts, hydroplaning, and other causes of RD crashes. These drivers also take audiences through the steps of reacting appropriately for a safe recovery in the event of a roadway departure. More than 6,000 DVDs have been distributed, along with thousands of brochures that correspond with the film and serve as complementary or standalone handouts.

The campaign coalition also made effective use of the media to share its message. Radio and television PSAs were developed promoting the safety benefits of rumble strips and paved shoulders, and through a three-month, $25,000 ad buy with the South Carolina Broadcasters Association they aired more than 5,500 times at a value of over $292,000. Press coverage of the campaign's efforts was also strong, with articles appearing in the *Charlestown Post and Courier,* the *Anderson Independent Mail,* the *Orangeburg Times and Democrat,* and numerous online news sites. In addition, at least 16 TV stories in three states covered the campaign, resulting in a media value of $30,000.[71]

Pre- and post-campaign polling indicates that the *Recognize, React, Recover* message reached the intended audience, and with coalition partners continuing to distribute the DVD and brochure, more and more people are being engaged. Polling found that one in five South Carolinians was familiar with the rumble strip campaign, and one in 10 knew the *Recognize, React, Recover* slogan. Support for rumble strip installation increased from 51 percent before the campaign to 57 percent after, and those who were aware of the campaign were significantly more likely to strongly support the use of rumble strips on South Carolina roads.[71]

Most importantly, motor vehicle crashes and fatalities in South Carolina have declined, with reductions in RD crashes mirroring the overall statewide trend. According to federal data, South Carolina RD crashes declined 2.3 percent from 2008 to 2009, with a 2.9 percent reduction in overall crashes. Particular progress seems to have been made on the most common types of RD crashes: run-off-road to the right crashes fell 6.3 percent, and run-off-road to the left crashes dropped 3.9 percent in this time.[72]

The materials created by the *Recognize, React, Recover* coalition continue to be distributed free of charge to driving schools, non-profits, government agencies, and the general public. By creating valuable instructional tools, raising public awareness, and promoting lifesaving engineering treatments, this campaign highlights the virtues of having a well-conceived public information component of broader safety efforts and initiatives.

Sources of Funding

Getting financial support for safety projects is often difficult, so it's important to know where to look for potential sources of funding. This section will start with the "big picture" to show you the federal and state

programs that may be used to finance roadway safety projects. Next, we'll look at how much of this money goes to each state and who generally controls the use of these funds. Finally, we'll describe your opportunities as a citizen to influence the priorities and funding decisions in your region by participating in the metropolitan planning process.

One of the best ways to make your project a funding priority is to develop relationships with staff and decision makers in your local Metropolitan Planning Organization.

The Big Picture

In the summer of 2012, a bipartisan federal transportation law was passed by Congress and signed by President Obama. The new law, "Moving Ahead for Progress in the 21st Century" (MAP-21), funds America's major roads, bridges, and mass transit systems for fiscal years 2013 and 2014.

The major federal highway programs authorized by Congress under the Provisions of "MAP-21" include: National Highway Performance Program, Surface Transportation Program, Highway Safety Improvement Program, Railway-Highway Crossings Program, Congestion Mitigation & Air Quality Improvement and Metropolitan Planning.

Each of the programs can be used for safety investments (with some restrictions); however, the Highway Safety Improvement Program (HSIP) is dedicated specifically to safety investments in all public roads. Unlike many highway programs that require states to provide at least $2 for every $8 of federal-aid, HSIP investments only require states to spend $1 for every $9 of federal-aid.

MAP-21 provides $2.4 billion per year to the states for HSIP projects. An annual set-aside of $220 million is dedicated to railroad-highway crossings. Some funds are also set-aside for planning and research and the "Transportation Alternatives" program, which can be used for bicycle paths, and other alternatives to traditional highway projects.

States may transfer up to 50 percent of the funds in each major program to other programs, so the amount actually spent on HSIP by the end of 2013 may be more or less than what was envisioned by Congress. This transferability provision is in place so that each state has the flexibility to prioritize the programs most critical to the needs in that state.

From 2005 to 2009 the total federal investment in engineering safety programs jumped due to the creation of the HSIP program in 2006. That increase in funding has been found to have a high correlation with the roughly 25 percent drop in highway fatalities between 2006 and 2009. MAP-21 nearly doubles down again on safety funding for fiscal years 2013 and 2014. With wise investment in safety projects, fatalities and injuries are expected to continue to decline.

Under MAP-21, states are required to regularly update Strategic Highway Safety Plans (SHSPs) that guide investment priorities. The law requires that county transportation officials,state representatives of non-motorized users, and other major Federal, state, tribal, and local safety stakeholders participate in the strategic planning process. *The key is to get involved with the agencies and planning organizations that weigh in on SHSPs and demonstrate the importance of advancing roadway safety in your community.*

Unlike the previous highway bill, MAP-21 does not have a special program for high risk rural roads (HRRR), which are generally considered the most dangerous roads and typically have the highest fatality rates. However, MAP-21 does require states to measure fatality rates on HRRRs and requires them to spend more money on them if the fatality rates increase over two years.

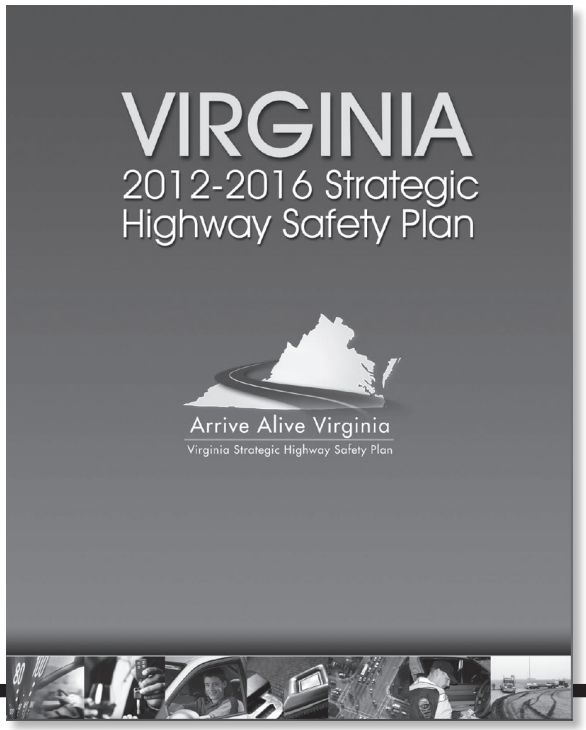
MAP-21 also requires states to incorporate strategies for older drivers in their SHSP if older driver and pedestrian fatalities and serious injuries increase over two years.

MAP-21 established safety progress as a key performance goal for the country. The law requires the US Department of Transportation to set performance measures and states to set specific achievement targets. For safety, the key performance metrics are reductions in the number and rate of fatalities and injuries.

Who Decides How Funds Are Used?

Who makes the decisions about which funds will be used for safety and which safety projects will be advanced? There are no easy answers. Each state has its own laws and institutional arrangements. State DOTs are responsible for the construction and maintenance of state highways and take the lead in roadway safety activities such as elimination of roadside hazards. The Governors' Highway Safety Representatives in every state are responsible for administering NHTSA highway safety grants, preparing an annual plan, and implementing programs to carry out the plan at the state and local levels. Under MAP-21, state DOTs and Governors' Highway Safety Represenatives are required to coordinate their planning efforts so that engineering solutions and behavioral safety programs work hand-in-hand. In metropolitan areas with populations above 50,000, Metropolitan Planning Organizations (MPOs) play a key role in selecting projects for funding.

In metropolitan areas, one of the best ways to make your project a funding priority is to develop relationships with staff and decision makers in your local MPO. Be sure to include the state DOT representative serving on the MPO. They can help provide access to state funds and technical expertise to get a project done. DOTs are experts in statewide planning, engineering, and roadway safety. Use the information from your safety checklist completed in Chapter 1 to inform MPO members about the need for your project. This kind of information will help to convince them of its merit. Now let's find out how MPOs work and how you can participate in the planning process.



They key is to get involved with the agencies and planning organizations that weigh in on Strategic Highway Safety Plans and demonstrate the importance of advancing roadway safety in your community.

Metropolitan Planning Organizations (MPOs) So What are MPOs, Anyway?

MPOs are the forum in which local elected officials, in cooperation with the representatives of the state departments of transportation and transit operators, determine the best mix of transportation investments to meet metropolitan needs. Created by Congress in 1970, MPOs are charged with transportation planning for specifically designated areas. They usually encompass metropolitan areas but may include more than one area or even cross state boundaries.

Where Do You Find MPOs?

Any urbanized area above 50,000 in population has an MPO. There are approximately 385 MPOs across the country. Some MPOs are stand-alone organizations, while others are housed within larger organizations such as a Metropolitan Council of Governments. To find the MPO in your area, visit the Association of Metropolitan Planning Organizations' website at www.ampo.org.

What Do MPOs Do?

The planning process requires MPOs to create a long-range transportation plan (LRTP) covering at least 20 years, and a four-year Transportation Improvement Program (TIP) that details the projects and investments to be prioritized in the short-term. A "3-C" approach is said to be taken in developing these plans, in reference to federal requirements that the process be "continuing, cooperative, and comprehensive." In addition, updates to both the LRTP and the TIP are to occur at least every four years, and include a review of current activities. Such updates may provide an opportunity for consideration of additional projects.

Where Does Roadway Safety Fit In?

MPOs are required to "increase the safety and security of the transportation system for motorized and non-motorized users." Community leaders and concerned citizens have the opportunity to work with MPO leaders and staff to place greater emphasis on safety. MAP-21 also gives MPOs and local governments more authority to make investment decisions that involve funding from the Transportation Alternatives program.

When and How Do You Contact an MPO?

In keeping with the principles of the 3-C approach, MAP-21 requires that *each metropolitan planning organization provide citizens, affected public agencies, representatives of public transportation*

Timing is critical, so contact your Metropolitan Planning Organization and find out the status of the long-range plan and the Transportation Improvement Program. Hearings are often scheduled to deal with proposed additions to the plans. Ask for a schedule of future hearings and opportunities to comment on the plans. Find out the requirements for presenting your views or suggestions for additional projects.

employees, freight shippers, providers of freight transportation services, private providers of transportation, representatives of users of public transportation, representatives of users of pedestrian walkways and bicycle transportation facilities, representatives of the disabled, and other interested parties with a reasonable opportunity to comment on the transportation plan.

This means you are entitled to participate in the planning process for both the TIP and LRTP and in any public outreach activities organized by the MPO to get citizen input. How can you make your views known?

- **Attend and speak at your local MPO's public meetings.**
- **Write letters to your MPO.**
- **Arrange one-on-one meetings with key MPO members and staff.**

Timing is critical, so contact your MPO and find out the status of the long-range plan and the TIP. Hearings are often scheduled to deal with proposed additions to the plans. Ask for a schedule of future hearings and opportunities to comment on the plans. Find out the requirements for presenting your views or suggestions for additional projects.

If you choose to speak at a hearing, work with coalition partners and community supporters to prepare your remarks. Ask them to attend TIP or LRTP hearings where additional projects will be considered. If possible, include letters of endorsement from your public works director, city or county engineer, elected officials, and residents of the area where the safety improvement is needed. This lets MPO leaders know that your project has community support.

Even if you don't have a specific project in mind, MPOs are important institutions to contact. They are constantly dealing with projects that affect the future of your community. For example, your local government may propose the development of a new road that would connect your community with the neighboring city, and it will supposedly take the pressure off some of the local roads. As a community leader, you might have both positive and negative concerns about the new road. Getting plugged in to the MPOs' planning process is one of the best ways to learn about the merits and potential impacts of a proposed project. It's also an effective way to express your views.

For more information on how to work with your local MPO, see Chapter 5.

What if You Don't Live in an Urbanized Area?

If you live in an area with a population of less than 50,000, your state DOT is responsible for planning and selecting highway improvements in your area. State DOTs work with local elected officials and Rural Planning Organizations (where they exist) in developing plans for these areas, so it's important to contact your local officials, rural planning officials, as well as representatives of the state DOT. Let them know about your safety concerns and any safety initiatives you would like considered as part of the planning process.

States prepare a Statewide Transportation Improvement Program (STIP) which lists all the highway improvements endorsed in your state. The STIP includes not only projects for areas with populations of less than 50,000, but also projects approved by MPOs for inclusion in their TIPs. Work with your state DOT to get your safety concerns addressed when the STIP is developed.

Your coalition can get the ball rolling by conducting as much of the evaluation as possible and relying on professionals to fill in the gaps, provide technical assistance, and share data.

Evaluating Results and Benefits

Why Should You Evaluate Your Roadway Safety Improvement?

The purpose of evaluation is to determine the effectiveness of a specific action, countermeasure, or multi-component program or project. A proper evaluation should tell you if what you did worked and how effective it was. There are two basic types of evaluations: administrative or effectiveness.

The administrative evaluation helps you determine how well the components, processes, or resources of a project performed. For example, were the planned and actual costs of the project what you expected? Was the project completed in the time planned? Were all the identified roadside hazards addressed properly?

The effectiveness evaluation determines the bottom-line results. Did the number and severity of crashes on a hazardous section of road decrease? Were fewer pedestrians injured or killed? Were there fewer serious crashes at a roundabout that replaced a traditional intersection?

What are the Benefits of Evaluating Your Project?

An evaluation tells you how well the implemented solutions worked. It also helps you figure out what approaches might be tried in the future. An evaluation also helps build visibility and support for a project or program and documents successes and shortcomings so that future safety efforts are easier to advance.

The importance of communicating the results of an evaluation to decision makers and the community is critical. During the course of a project, several interim evaluations should be performed to develop additional support and to generate midcourse adjustments.

Who Performs Evaluations?

Your state and local highway departments and state highway safety offices should be aware of the requirements for a proper evaluation and have experience in conducting them. However, your coalition can get the ball rolling by conducting as much of the evaluation as possible and relying on professionals to fill in the gaps, provide technical assistance, and share data. •

CHAPTER 5

Getting Help: Resources to Assist in Your Efforts

Through a concrete, thorough research and evaluation process, you:

- Have now identified and clarified your roadway trouble areas or hazardous operating conditions.
- Know how the experts move forward with roadway initiatives.
- Have a more comprehensive understanding of proven countermeasures.
- Understand and appreciate the importance of collaboration in making your roadways safer.

In this chapter, we'll identify resources that are available to you as you put this knowledge to work in your community. From federal agencies to non-profits, from national research centers to local organizations, there is a wealth of information, expertise, and data that you can call upon to assist in your efforts. While certainly not exhaustive, the list on the following page is a good place to start as you look for this support.

First, we'll go over some of the kinds of data you may find helpful as you seek to demonstrate your safety concerns, and discuss what highway engineers and other officials will be looking for as they analyze the location in question. This will give you a better sense of the scientific, concrete information that generally needs to be documented and reviewed when transportation agencies consider projects. We'll also discuss where you can find and access this information, and present a list of organizations, agencies, and other groups that can offer additional resources and assistance.

Finding Data

Where do you find the types of information and data you need?

Data, Information, and Sources

Several types of data are used to identify and evaluate a potential highway safety hazard or trouble area. The type of data available in your community will depend on the record keeping practices of local and state agencies. Ideally, at least three years of data should be examined. Key data include:

- **Crash records**
- **Complaint files**
- **Maintenance records**

Other types of data may also be available from state and local agencies, including:

- **Enforcement records (traffic citation files)**
- **Roadway photologs or videologs**
- **Construction prints**
- **Traffic control device inventories**

Where Can You Find This Information?

Data is kept at the federal, state, and local levels by a variety of agencies.

Federal data

At the federal level, the National Highway Traffic Safety Administration (NHTSA) maintains a national data system on fatal crashes, the Fatality Analysis Reporting System (FARS). This database aggregates fatal crash reports collected from each state, and documents every traffic related death nationwide that occurs on a public roadway. FARS is the most comprehensive national source for such crash data. In addition to offering summary tables, charts, and trends, it can be queried online and will produce raw data for analysis. FARS also breaks down fatal crash statistics by state and can be queried to find out local summary crash information for counties and cities. FARS cannot compile fatal crash data for specific roads, road segments, or intersections, nor can multiple years of data be analyzed at once. Due to the scope and complexity of the database, it takes several months to compile, code, and finalize a year's data; therefore, information for a given year is not available until around October of the following year.

In 2009, NHTSA began a multi-year effort to standardize the data definitions and coding of FARS and the National Automotive Sampling System General Estimates System (NASS GES). NASS GES serves as a vital source of information regarding non-fatal injury and property damage crashes, and is the basis for NHTSA's annual Traffic Safety Facts publication. The database is composed of a nationally-representative sample of police-reported crashes, and is used to identify traffic safety trends, including the prevalence of various types of crashes and the severity of outcomes when they occur. To explore these resources or visit their online tutorials, go to:

- **FARS: Search "FARS" at www.nhtsa.gov**
- **NASS GES: http://www.nhtsa.gov/NASS**

BOX 5.1: DATA TOOLS AVAILABLE TO TRAFFIC SAFETY PROFESSIONALS

While your coalition may not use these tools, it is useful to know what information is available to the professionals who are developing effective, targeted, and prioritized safety strategies.

MMUCC (Model Minimum Uniform Crash Criteria) and its companion, MIRE (Model Inventory of Roadway Elements) are data sets that together contain hundreds of information elements deemed crucial for improving highway safety. Part of the FARS/NASS GES standardization process involves ensuring alignment with the MMUCC guidelines.

MMUCC involves 107 data elements, including 75 to be collected at the scene of a crash and others to be derived from collected and external data. Elements include vehicle maneuvers prior to the crash, roadway alignment, extent of damage, driver age, etc. MMUCC is the de-facto standard used by nearly all states when developing crash information for crash reporting; its adoption has allowed for greater compatibility of state data and ease and accuracy of comparative safety analysis of jurisdictions across the country. Such thorough, uniform data is also vital for determining what conditions pose particular hazards and what countermeasures are effective in enhancing safety. The program is funded by NHTSA and managed by NHTSA and the Governors Highway Safety Association. For more information visit http://www.mmucc.us/.

MIRE is a newer data set and is intended as a companion to MMUCC. MIRE includes 202 data elements dealing with roadway segments, alignment, and junctions. Examples include traffic control devices, number of travel lanes, curve and grade details, traffic volumes, and roadway classification. By collecting this information, transportation agencies can better understand and catalog their road networks, identify trouble spots and areas in need of improvement, and target investments. For more on MIRE, go to http://safety.fhwa.dot.gov/tools/data_tools/mirereport/.

Sources: National Highway Traffic Safety Administration; Governors Highway Safety Association; Federal Highway Administration

U.S. Department of Transportation Federal Highway Administration Manual on Uniform Traffic Control Devices

The Manual on Uniform Traffic Control Devices (MUTCD) sets minimum standards and provides guidance for the messages, location, size, shapes and colors of all traffic control devices. Information on the MUTCD can be found at http://mutcd.fhwa.dot.gov/.

State data

All states maintain a database of crash reports collected from various police agencies in the state. It typically includes information on fatal injury and property damage crashes occurring in the state. The department that maintains each state's crash database varies, but typically includes the state police or highway patrol, state Department of Transportation, or public safety agency. One easy way to determine where to go for this information is to contact your state's highway safety office. The address and phone number of each state's highway safety office are listed on the Governors Highway Safety Association (GHSA) website, and can be found at http://www.ghsa.org/html/links/shsos.html.

Most states maintain a reasonably good database on fatal crash reports collected from the various police agencies in the state. Some also include injury and other types of crash data to varying degrees of completeness.

Local data

The availability of local crash data can vary from good to nonexistent, depending on the locality. Many localities may not maintain easily accessible records. Begin your search by talking to the local police agencies in your area. Some police agencies also keep traffic citation records and other enforcement information in their jurisdiction.

Other Highway Records

Complaint files, maintenance records, roadway video/photologs, highway construction information, and traffic control device records are typically kept in your local county, municipality, and state highway or public works departments. Again, start your search with your local police agency and state highway safety office.

Organizations & Resources

Below is a list of organizations you may find to be helpful in your efforts, along with the URL for each group's website. Phone numbers and e-mail addresses are not provided due to the frequency with which they can change; please visit the website listed to obtain the most up-to-date contact information for any group with which you wish to be in touch.

Federal Resources

Federal Highway Administration (FHWA) Resource Center

The Federal Highway Administration Resource Center (RC) provides support and advice to the FHWA division offices, state and local DOTs, metropolitan planning organizations, and other partners and customers. The RC has offices in Atlanta, GA; Baltimore, MD; Lakewood, CO; Matteson, IL; and San Francisco, CA, which serve as central locations for technical and program specialists who provide process, program, and technical assistance. The RC home page is http://www.fhwa.dot.gov/resourcecenter/index.cfm, and contact information for the safety and design experts can be found at http://www.fhwa.dot.gov/resourcecenter/teams/safety/index.cfm.

Federal Highway Administration Headquarters and Division Offices

The Office of Safety at FHWA Headquarters in Washington, DC, provides information on crash countermeasures, intersection safety, pedestrian

The Office of Safety at FHWA Headquarters in Washington, DC, provides information on crash countermeasures, intersection safety, pedestrian and bicycle concerns, road safety audits, and safety management systems to community leaders.

and bicycle concerns, road safety audits, and safety management systems to community leaders. The Office maintains a website, http://safety.fhwa.dot.gov/, which provides information on engineering strategies, databases, and other topics of interest in the transportation and safety fields. Many publications are also available through FHWA and its Reports Center. Visit www.fhwa.dot.gov/resources/pubstats/ for links and contact information.

FHWA's Division Offices support and provide technical assistance to state and local highway safety agencies. Division Offices are located in all 50 states, D.C. and Puerto Rico. You can find contact information for your Division Office through FHWA's listing of all of its Field Offices: www.fhwa.dot.gov/about/field.cfm.

Federal Motor Carrier Safety Administration (FMCSA)

FMCSA is tasked with reducing fatalities and injuries related to commercial motor vehicles in the United States. Among other things, the Agency sets standards for commercial driver licensing, enforces safety regulations, assists states with roadside inspections, and collects relevant safety data. Headquartered in Washington, DC, FMCSA also maintains a Service Center with four locations (Glen Burnie, MD; Matteson, IL; Atlanta, GA; Lakewood, CO) and Field Offices. If your safety concern involves buses or large trucks, FMCSA may be able to provide valuable assistance. Contact information for headquarters can be found at www.fmcsa.dot.gov/about/contact/hq/hq.htm; Field Office listings are available at www.fmcsa.dot.gov/about/contact/offices/displayfieldroster.aspx.

The American Association of State Highway and Transportation Officials provides leadership, technical services, information, and advice on national transportation policy issues to state DOTs, U.S. DOT, and Congress. It also sponsors forums to facilitate communication among transportation-related interests.

National Highway Traffic Safety Administration (NHTSA) Headquarters and Regional Offices
NHTSA is headquartered in Washington, DC, and has 10 regional offices that work on the Agency's mission to save lives, prevent injuries, and reduce traffic-related health care and other economic costs. Each regional office provides numerous services to the states and other public and private sector customers. They review legislation, administer the Agency's grant programs, assist in coalition building, and deliver training and technical assistance. To find contact information for NHTSA headquarters, or for assistance in locating the appropriate office for your inquiry, visit www.nhtsa.gov/Contact. Information and contact numbers for each regional office are available at www.nhtsa.gov/nhtsa/whatis/regions.

National Transportation Safety Board (NTSB)
The NTSB is an independent federal agency responsible for investigating accidents in all modes of transportation, determining the probable cause, and making recommendations to prevent future occurrences. Those accidents often include collapses of highway bridge/tunnel structures, mass casualties on motorcoaches and school buses, collisions at highway/rail grade crossings, and selected accidents that involve new safety issues/technologies. The Board's independent and objective investigations often help restore public confidence in our transportation systems. For additional information, please visit www.ntsb.gov.

State Resources

American Association of Motor Vehicle Administrators (AAMVA)
The American Association of Motor Vehicle Administrators (AAMVA) represents agencies throughout North America dedicated to ensuring drivers are safe on the roads. AAMVA's members include motor vehicle administrators, law enforcement professionals, and industry partners who work together to promote road safety. AAMVA develops model programs in motor vehicle administration, law enforcement and highway safety, serves as an information clearinghouse in these areas, and acts as the international spokesman for its members' interests. For additional information, please visit www.aamva.org.

American Association of State Highway and Transportation Officials (AASHTO)
AASHTO is committed to a safe transportation system that ensures mobility, enhances economic prosperity, and sustains the environment. It is an advocate for multimodal and intermodal transportation, representing state DOTs. AASHTO provides leadership, technical services, information, and advice on national

While AAA's services to the public are well known, regional offices also have departments of public affairs and/or government relations. These contacts can be valuable public relations/communications advocates as you move forward with your roadway safety initiative.

transportation policy issues to state DOTs, U.S. DOT, and Congress. It also sponsors forums to facilitate communication among transportation-related interests. Visit AASHTO's website at www.transportation.org.

Commercial Vehicle Safety Alliance (CVSA)
CVSA is an international not-for-profit organization whose membership includes transportation agencies, law enforcement, public works departments, and industry representatives from across North America. CVSA provides leadership on matters of enforcement, roadside inspections, educational outreach and safety awareness, and other issues pertaining to commercial motor vehicles. If your safety concern involves large trucks and buses, visit www.cvsa.org to see how CVSA may be able to assist.

Governors Highway Safety Association (GHSA)
This nonprofit organization represents the highway safety programs of states and territories that focus on the "human factors" of highway safety. It emphasizes occupant protection, impaired driving, speed enforcement, and motor carrier, school bus, pedestrian, and bicycle safety. GHSA's mission is to provide leadership in the development of national policy to ensure effective highway safety programs. Visit GHSA online at www.ghsa.org.

Local Resources

Local Technical Assistance Program (LTAP) Centers
The LTAP centers form a nationwide network that provides state-of-the-art technical assistance to local and tribal governments. The centers are located in all states and Puerto Rico, and seven Tribal Technical Assistance Program (TTAP) centers serve American Indian/Alaska Native communities.

The centers are generally housed at colleges, universities, or state Departments of Transportation. Community leaders can access LTAP training courses, publications, video and print libraries, and technologies by contacting their state's LTAP centers. For a list of LTAP and TTAP centers, visit the website of the LTAP Clearinghouse at www.ltap.org/centers/.

LTAP and TTAP centers provide the most direct, hands-on method that FHWA and its partners have for moving innovative transportation technologies out of the lab, off the shelf, and into the hands of the people who maintain local, rural, and tribal roads. Training is at the heart of all LTAP/TTAP centers. Many offer courses on winter maintenance, work zone traffic control, and pedestrian safety, as well as workshops on the maintenance of gravel roads.

National Association of County Engineers (NACE)
NACE has four primary objectives:

- Advance county engineering and management by providing a forum for the exchange of ideas and information.
- Foster and stimulate the growth of state organizations of county engineers and road officials.
- Improve relations and cooperation among county engineers and other agencies.
- Monitor national legislation affecting county transportation/public works departments and provide input to Congress through the National Association of Counties.

Membership in NACE is open to county engineers, engineers serving in that capacity at the county level, or non-engineers with similar responsibilities as well as members whose counties have similar goals. Visit www.countyengineers.org for contact information.

Trade and Nonprofit Service Associations

AAA

While AAA's services to the public are well known, regional offices also have departments of public affairs and/or government relations. These contacts can be valuable public relations/communications advocates as you move forward with your roadway safety initiative. Contact your local AAA club for more information; if you are unsure which club covers your area, visit www.aaa.com and enter your zipcode.

AAA Foundation for Traffic Safety

For over 60 years, the AAA Foundation has been dedicated to "Saving Lives through Research and Education." The Foundation funds major research projects, both in-house and through partner organizations and universities, and uses this research to develop focused, high-impact educational materials for drivers, pedestrians, bicyclists, and other road users. Topics covered by AAA Foundation research include distracted, drowsy, and impaired driving; driver's education; teen and older driver safety; and traffic safety culture. Educational products produced by the Foundation include dozens of DVDs, brochures, websites, and computer programs targeted to parents, teens, older drivers, driving schools, and the general public. Visit www.aaafoundation.org for links to research reports, product listings and order forms, and contact information. For more on the U.S. Road Assessment Program (Chapter 2 case study) visit www.usrap.us.

AARP

AARP is a nonprofit membership organization that promotes the needs of older Americans. Because of the importance of safety and mobility for the health and quality of life of older persons, promoting safe roadways and addressing the needs of older drivers is one of AARP's major undertakings. In addition, AARP Driver Safety is the nation's first and largest driver safety course designed especially for drivers age 50 and older. Since its launch in 1979, the program has helped over 14 million drivers stay educated and independent through classroom and online courses. The course provides information about rules of the road, defensive driving techniques, and techniques to help address common age-related changes in vision, hearing and reaction time. Learn more or sign up for a course by visiting www.aarp.org/drive.

Metropolitan Planning Organizations (MPOs) are key organizations that develop transportation plans for metropolitan areas and select projects for funding and implementation. The Association of Metropolitan Planning Organizations is the national organization representing all MPOs.

American Highway Users Alliance (Highway Users)

Founded in 1932, the American Highway Users Alliance is the parent organization of the Roadway Safety Foundation. The Highway Users is a nonprofit 501 (c)(6) advocacy organization serving as the united voice of the transportation community promoting safe, uncongested highways and enhanced freedom of mobility. Members of the Highway Users represent millions of motorists and thousands of businesses who pay the taxes that fund our national network of

highways and bridges. The Highway Users advocates for public policies that preserve opportunities for all people to live, work, shop, and travel unencumbered. The Highway Users does not represent any single industry or special interest view. Instead, it strives to present a united position that serves to benefit the broad interests of the motoring public. For additional information please visit www.highways.org.

American Traffic Safety Services Association (ATSSA)
ATSSA, an international trade association, is located in Fredericksburg, Va. Since 1969, ATSSA has represented companies and individuals in the traffic control and roadway safety industry. Over 1,600 ATSSA members provide the majority of features, services and devices used to make our nation's roadways safer. These include pavement markings, road signs, work zone traffic control devices, guardrail, and other roadside safety features. ATSSA state chapters address industry issues of local concern, and chapters develop close relationships with highway agencies in their areas through workshops and seminars. Contact information and more can be found at www.atssa.com.

Association of Metropolitan Planning Organizations (AMPO)
MPOs are key organizations that develop transportation plans for metropolitan areas and select projects for funding and implementation. AMPO is the national organization representing all MPOs. It offers its members technical assistance and training, conferences and workshops, frequent print and electronic communications, research, and a forum for transportation policy development and coalition building. For more information, see Chapter 4 or visit www.ampo.org.

Institute of Transportation Engineers (ITE)
ITE is an international educational and scientific association of more than 17,000 transportation professionals spanning more than 100 countries who are responsible for meeting mobility and safety needs. ITE facilitates the application of technology and scientific principles to research, planning, functional design, implementation, operation, policy development and management for any mode of ground transportation. Through its products and services ITE promotes professional development of its members, supports and encourages education, stimulates research, develops public awareness programs and serves as a conduit for the exchange of professional information. Visit www.ite.org for more.

Insurance Institute for Highway Safety (IIHS)
The Insurance Institute for Highway Safety is an independent, nonprofit, scientific and educational organization dedicated to reducing the losses — deaths, injuries, and property damage — from crashes on the nation's highways. Institute research focuses on three main areas: human factors, or preventing crashes by changing driver behavior; vehicle factors, or reducing deaths and injuries by improving vehicle design; and environmental factors, or changing roadway design, signs and signals to reduce crashes. For additional information visit www.iihs.org.

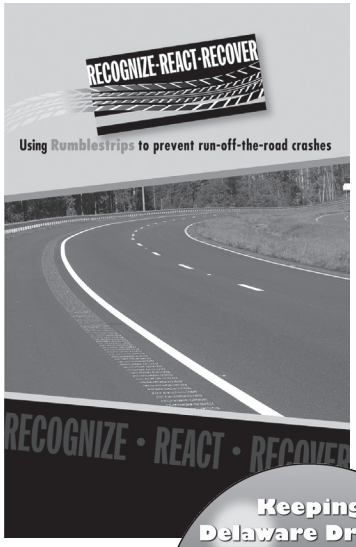
ITS America (ITSA)
ITS America is a national organization established to coordinate the development and deployment of intelligent transportation systems (ITS) in the United States.

The National Highway Work Zone Safety Information Clearinghouse, a cooperative venture between the Federal Highway Administration and the American Road & Transportation Builders Association, is the first centralized, comprehensive information resource that can assist those interested in reducing crashes associated with highway work zones.

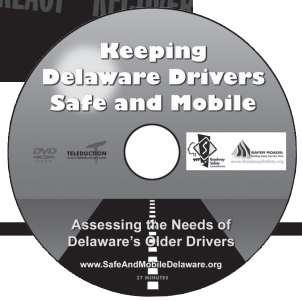
BOX 5.2: RSF EDUCATIONAL PRODUCTS AND MATERIALS

RUMBLE ON THE RESERVATION **DVD & BROCHURE:** These materials promote rumble strips as a cost-effective crash countermeasure that American Indian communities can incorporate into roadway safety projects on tribal lands. Both products present crash statistics and detailed information about the dangers of rural roads. They make the case for implementing rumble strips on tribal lands because of their ability, at low cost, to reduce roadway departure crashes, the most frequent type of crash seen on rural highways.

RECOGNIZE, REACT, RECOVER **DVD & BROCHURE:** These products focus on using rumble strips to prevent run-off-the-road crashes. Through six modules, audiences are introduced to the causes and consequences of run-off-the-road (ROR) crashes, hear real-life stories of ROR crash victims, and learn about the lifesaving — and cost-effective — benefits of implementing rumble strips as a crash countermeasure. In addition, professional drivers offer valuable tips on how to react appropriately in the event of a roadway departure, making this a valuable resource for novice and experienced drivers alike.



KEEPING DELAWARE DRIVERS SAFE AND MOBILE **DVD:** This 30-minute documentary introduces many of the challenges older drivers face on the road, and provides an overview of the countermeasures and engineering strategies available to make the roads safer for all by focusing on the needs of this demographic.



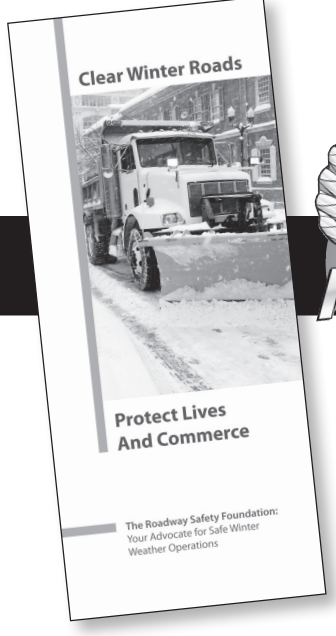
The ITS mission is to foster public/private partnerships that will increase the safety and efficiency of surface transportation through the accelerated development and deployment of advanced transportation systems. The organization serves as a clearinghouse for intelligent transportation systems-related information, and can be reached at www.itsa.org.

Make Roads Safe

Make Roads Safe is a global road safety campaign established with the aim of securing political commitment for road traffic injury prevention around the world. The campaign aims to raise public awareness of the scale of the road injury problem and to present this as a key issue for sustainable development. During their Decade of Action, which was approved by the United Nations, they will continue to campaign to make sure that politicians, institutions like the World Bank, vehicle manufacturers and transport planners put road safety first. The Make Roads Safe campaign is coordinated by the FIA Foundation. For additional information visit www.makeroadssafe.org.

National Highway Work Zone Safety Information Clearinghouse

The Clearinghouse, a cooperative venture between the Federal Highway Administration and the American Road & Transportation Builders Association (ARTBA), is the first centralized, comprehensive information resource that can assist those interested in reducing crashes associated with highway work zones. Located at Texas A&M University, users will find the



CLEAR WINTER ROADS: This brochure provides important information on the safety and economic benefits of timely, thorough winter weather roadway maintenance. It compares the costs of up-front investments in sufficient snow and ice removal programs with the much higher long-term costs of failing to properly treat and maintain roads in inclement weather. It is an especially useful resource for jurisdictions examining their strategies and funding for winter maintenance.

***MEDIAN MAN* PUBLIC SERVICE ANNOUNCEMENTS:** These award-winning radio PSAs feature *Median Man,* a fictional cartoon character made of high-tension cable guardrail who alerts motorists to the lifesaving benefits of this type of median barrier system. Aired in Michigan through a partnership with the Michigan Association of Broadcasters, these PSAs raise awareness of the importance and cost-effectiveness of the state's hundreds of miles of cable barriers, which reduce cross-median crashes by around 90 percent. Both PSAs are available for download at www.roadwaysafety.org.

***SAFETY SOLUTIONS FOR OLDER DRIVERS* DVD:** In this package of two videos, experts from leading safety organizations across the United States are partnering to make sure communities are more livable and driver friendly for our aging population. The two videos, the first a brief introduction to the topic, and the second a more in-depth piece, present trusted engineering solutions for older drivers including, but not limited to, such countermeasures as roundabouts, dedicated left turn lanes and brighter signage. The videos highlight how states like Delaware and Florida have implemented such practices and the success stories that were able to become a reality for so many seniors.

most comprehensive and up-to-date information on work-zone-related:

- Laws
- Products
- Public education and outreach
- Regulations
- Research reports
- Specifications
- Statistics
- Training courses

Visit www.workzonesafety.org for contact information and access to the Clearinghouse's various resources.

National Organizations for Youth Safety (NOYS) NOYS, based in the Washington, DC area, is a national coalition of roughly 70 youth and youth-serving organizations that is dedicated to promoting safe, healthy decisions and behaviors among the country's young people. Because motor vehicle crashes are the leading cause of death for teens and young adults, NOYS originated as a group dedicated to improving highway traffic safety. While it has expanded to include other aspects of health and well-being, road safety continues to be a major focus area of the coalition. NOYS is dedicated to getting young people involved in safety efforts, recognizing that teens often have more credibility with their peers than adults do, and fostering leadership skills and youth appreciation for safety

concerns. To learn more and to find out what NOYS and its members are working on in your community, visit www.noys.org.

National Safety Council (NSC)
Since its founding in 1913, the NSC has served as the premier source of safety and health information in the United States. It started in the workplace, particularly in factories, warehouses, and construction sites, making businesses aware of the ways to prevent unintentional injuries on the job. Subsequently, it expanded its efforts to include highway, community, and recreation safety. To find information about a local council near you, visit www.nsc.org.

Operation Lifesaver, Inc. (OLI)
Operation Lifesaver, Inc. (OLI) is a national non-profit organization dedicated to reducing crashes, fatalities, and injuries at highway-rail grade crossings. With a person or vehicle hit by a train in the United States every three hours, OLI is dedicated to improving safety at these crossings and bringing to an end these preventable tragedies. OLI maintains a national office in Alexandria, Virginia, and relies on a network of volunteer speakers and instructors in all 50 states who offer rail safety education programs. These efforts are managed by coordinators in every U.S. state, and the training sessions and educational materials offered by OLI may be of great interest to local leaders and community officials concerned with highway-rail crossings and other railroad safety concerns. For more information about OLI, or to locate your area's coordinator, visit www.oli.org.

Roadway Safety Foundation (RSF)
RSF is one of the few national organizations solely dedicated to reducing highway deaths and injuries by improving the physical characteristics of America's roadways. This encompasses design and engineering, operating conditions, removal of roadside hazards, and the effective use of safety features. RSF attains its goals by building awareness through media campaigns and outreach activities, developing educational materials, and forming roadway safety partnerships between the private and public sectors.

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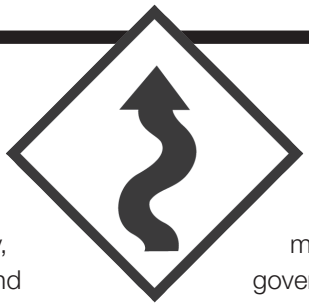


RSF members include a diverse network of public and private sector partners. Industries represented include insurance, salt, trucking, automakers, and safety equipment manufacturers. Public sector members include safety leaders at all levels of government. RSF's website, www.roadwaysafety.org, includes:

- **Information on each of the Public Information and Education technical assistance grant programs RSF manages;**
- **Press releases and newsletters dealing with the latest safety and transportation news from Washington, DC;**
- **A list of all RSF safety and education materials, including links to electronic versions where available and contact information for ordering hard copies.**

The Salt Institute (SI)
SI is a nonprofit association dedicated to the study and use of salt or sodium chloride in our daily lives. Its members include salt producers, highway and maintenance engineers, journalists, elected government policy makers, and regulators. Of particular interest to local leaders concerned with roadway safety, SI sponsors field studies and laboratory investigations on the impacts of various uses of salt, including the contributions of de-icing to winter road crash reduction. Visit www.saltinstitute.org for more.

The Sandy Johnson Foundation

The Sandy Johnson Foundation is an Ohio-based non-profit organization dedicated to saving lives by identifying hazardous roadway locations and determining quick, affordable solutions for the dangers posed. In addition to offering the public a list of perilous intersections and roadways, the Sandy Johnson Foundation advocates for common-sense engineering treatments based on the principles of the Foundation's Highway Safety Initiative. Visit www.sandyjohnsonfoundation.org/ for more; also see Chapter 4 for a case study that explores the Foundation's efforts in depth.

Other Research Programs

Transportation Research Board (TRB)

TRB is part of the National Research Council, and its mission is to promote innovation and progress in transportation by stimulating and conducting research, facilitating the dissemination of information, and encouraging the implementation of research results.

TRB has outstanding technical committees and task forces that address all modes and aspects of transportation. It publishes and disseminates reports and peer-reviewed research papers. TRB administers research programs and conducts special studies on policy issues requested by Congress and government agencies. It operates a computerized file of transportation research information and hosts an annual meeting that typically attracts more than 10,000 transportation professionals. You can explore the main TRB web page at www.trb.org.

Two TRB programs that local decision makers might find useful are the National Cooperative Research Program and the online information service known as the TRID Database. Both are described below.

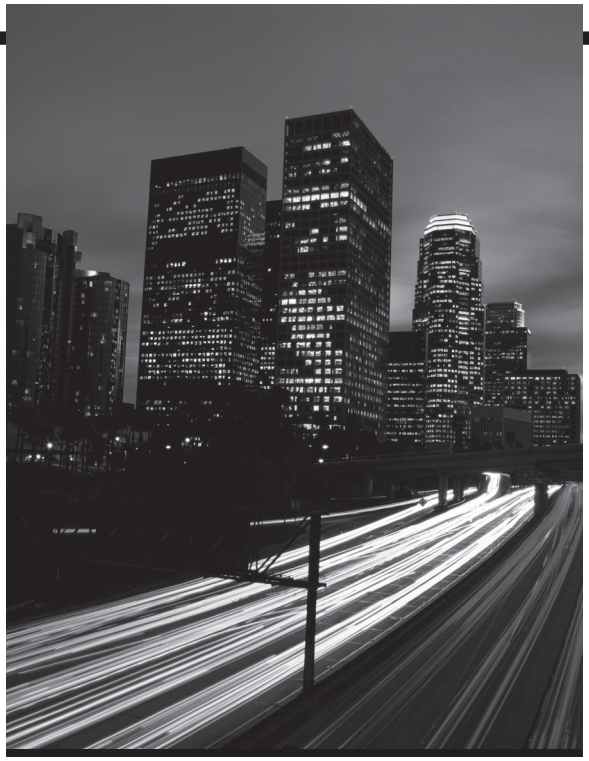
The National Cooperative Highway Research Program

The National Cooperative Highway Research Program (NCHRP) conducts research in acute problem areas that affect highway planning, design, construction, operation, and roadway maintenance nationwide. Research findings are published in the *NCHRP Reports* and the *Synthesis of Highway Practice* reports. The reporting format is designed specifically for transportation administrators and practicing engineers. In addition, to promote awareness and use of the research findings, the NCHRP produces *Research Results Digests* and *Legal Research Digests.* Visit www.trb.org/NCHRP/Public/NCHRP.aspx to learn more about the program, and to find links to reports, documents, and the Bookstore.

TRID Database

TRB also coordinates the *TRID Database,* the world's largest and most comprehensive source of information on published transportation research. TRID was created in 2011 by integrating TRB's Transportation

This Guide has taken you through the process of identifying trouble areas, weighing possible solutions, working with the right people, securing funding, and calling upon appropriate additional resources. Now, however, it's time for the real work to begin: making the roadways safer where you live and travel.



Research Information Services (TRIS) and the Organisation for Economic Cooperation and Development's (OECD) International Transport Research Documentation (IRTD) databases, a merge that brought together over 900,000 records of published transportation research worldwide. TRID not only provides access to the bibliographic records and abstracts, it also includes links to the full text of public domain documents or document suppliers. To access TRID and begin your document search, visit http://trid.trb.org/. •

Conclusion

Congratulations! As your community's newest roadway safety advocate, you are now in a position to play a valuable role in the effort to improve safety for all road users. This Guide has taken you through the process of identifying trouble areas, weighing possible solutions, working with the right people, securing funding, and calling upon appropriate additional resources. Now, however, it's time for the real work to begin: making the roadways safer where you live and travel.

We hope this Guide has helped you to become a more confident, knowledgeable stakeholder in the safety process, and that it has given you a greater appreciation for the role that the roadway environment itself plays in the overall highway safety equation. The Roadway Safety Foundation continues to promote this issue nationally, and we encourage you to check our website (www.roadwaysafety.org) frequently for our latest news and materials, including updates to the electronic version of this Guide.

One final note: while our focus here has been on engineering and infrastructure, this doesn't undermine the reality that each of us – whether motorist, pedestrian, motorcyclist, bicyclist, or passenger – has a responsibility to ourselves and each other when using our nation's roadways. Please remember to always buckle up, avoid distractions behind the wheel, obey posted speed limits, never drive drowsy or impaired, and be courteous and cautious at all times. With safe road users operating safe vehicles on safe roadways, we truly can continue to make dramatic gains in safety for all. •

Appendix

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The *Roadway Safety Guide* was produced by the Roadway Safety Foundation (RSF), a 501(c)(3) nonprofit educational and charitable organization chartered in 1995 by the American Highway Users Alliance. Governed by an advisory committee, RSF builds awareness through media campaigns and outreach activities, develops educational materials, such as this *Roadway Safety Guide,* and forms roadway safety partnerships between the private and public sectors. RSF's programs are funded by grants, sponsorships, membership contributions, and donations from others who share the Foundation's lifesaving mission.

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