CHAPTER 17
Keeping Vehicles on the Roadway and Minimizing the Consequences of Leaving the Road

KEY TOPICS

- clear zones
- data analysis tools
- design improvements
- hazard elimination
- pavement markings
- rumble strips
- signing

GOALS

- Reduce the number of and severity of consequences from run-off-the-road crashes.
- Consider upgrading roadside hardware and strengthen existing highway safety programs.
- Improve pavement markings.
- Enhance winter maintenance programs.

BACKGROUND

A highway system where drivers rarely leave the road; but when they do, the vehicle and roadside work together to protect vehicle occupants and pedestrians from serious harm.

National Cooperative Highway Research Program (NCHRP), *Strategies for Improving Roadside Safety*

We propose adopting this NCHRP vision statement—of a "forgiving environment" that reduces the consequences of leaving the road—and extending it to all the state's roadways, regardless of jurisdiction or type.

There are many reasons why drivers and their vehicles involuntarily leave the roadway, including driver fatigue or inattention; excessive speed; driving under the influence of drugs or alcohol; collision avoidance; adverse environmental conditions such as rain, snow, and ice; vehicle component failure; and poor visibility. Appropriate solutions vary from state to state and from county to county, depending on a range of elements.

NATIONWIDE

National Facts

Nationally, over 14,000 fatalities and nearly one million injuries result from roadside crashes. The annual societal cost of these roadside crashes is estimated at $30 billion, more than three times the amount spent to maintain and operate roads each year (according to NCHRP, *Strategies for Improving Roadside Safety*).

The Federal Highway Administration (FHWA) has determined nationally that "single-vehicle, run-off-the-road" was a major contributing factor to 37% of motor vehicle crash fatalities.

IOWA

Iowa Facts

In Iowa, crashes from vehicles leaving the road result in nearly 150 fatalities and 5,000 injuries annually. These crashes represent a societal cost to Iowa's citizens of $30 million each year. About 25%–30% of Iowa's total run-off-the-road crashes occur at rural highway curves (2000 Iowa Department of Transportation [Iowa DOT] curve data).

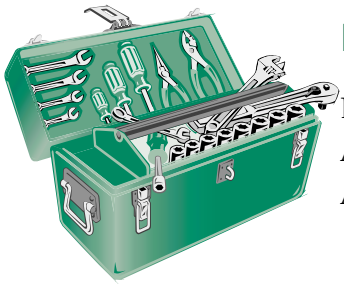
Iowa Conditions

Each state has unique mix of topography, waterways, and soils that determined how roadways were first developed. Iowa conditions warrant review as we enter a new century of changing vehicles, drivers, and population influences:

- The Iowa prairie topography offers many long expanses of straight and flat roadways where driver workload is minimal. Drivers in Iowa may miss minor roadway changes and run off the road because of inattention from monotony or because they miss changes in roadway topography such as curves.
- Raised pavement markers are prevalent in states south of Iowa, but their use in Iowa is limited because of durability related to snow plowing. Iowa is studying a variety of products that may be more resilient under Iowa road conditions, and the improved safety benefit may be worth the extra maintenance in limited locations (e.g., horizontal curves) with highest risk of run-off-the-road crashes.

- Iowa has harsh winter driving conditions, and with snow, fog, and ice—mitigated by plowing and chemical applications—it is often difficult to maintain highly visible lane markings. Simple improvements such as increased lane marking visibility would be of particular benefit in adverse weather and for older drivers who find it very difficult to locate lane and edge lines. (See Chapters 8, Sustaining Safe Mobility in Older Drivers, and 20, Accommodating Older Drivers.) Improvements could include increasing the width of lane markings from four inches to six or eight inches; using special products with increased day, night, and wet visibility; or simply painting lane and edge lines more often.
- Paved shoulders are used in most states along all their highways, but Iowa has usually only built paved shoulders along interstate highways. Iowa's four-lane expressways, primary, and secondary roads usually have granular shoulders. This and other Iowa highway design conditions are under review as we enter a new century of changing vehicles, drivers, and population influences.

Because of these various conditions, highway safety practitioners are challenged to take a comprehensive approach to reducing injuries and fatalities in run-off-the-road crashes in Iowa.



POTENTIAL STRATEGIES

For related strategies, refer to Chapters 23, Implementing Road Safety Audits, 20, Accommodating Older Drivers, and 18, Reducing Head-On and Across-Median Crashes.

Legislation, Policy, and Enforcement

- Improve timeliness and accuracy of crash reports.
- Provide 6–10 foot wide paved shoulders on Super 2 highways, expressways, and freeways.
- Add rumble strips to paved shoulders. Include bicycles in design considerations.
- Identify high-crash highway curves.
- Identify frequently hit trees, utility poles, and other obstructions.
- Evaluate locations of high run-off-the-road crash history or where the potential for such a pattern exists. Develop programs to address roadside safety in these locations and provide assistance to local governments in improving roadside safety, both urban and rural, emphasizing safe and forgivable roadside environments.

- Develop and implement an ongoing inventory and maintenance system for existing roadside safety features and conducting in-service performance studies of selected barrier systems. Study insufficient right-of-way alternatives with utilities and property owners.
- Study and recommend improvements in ice and snow management near bridges, along raised medians, and Jersey barriers.
- Explore alternative use of existing Iowa DOT funding sources for guardrail upgrades (e.g., National Highway System [NHS] Roadways/3R Program).
- Manage roadway vegetation on residential, urban, and rural roadways by maintaining clear zones and improving sight distance at intersections (e.g., in relation to crops, weeds, and shrubbery).
- Enhance knowledge of the relationships between safety, roadside features, and traffic.
- Promote the development of improved safety hardware systems and barriers, and consider alternatives to eliminate the use of barriers whenever possible.
- Implement a program to fund cost share relocation of utility poles in selected corridors.
- Integrate development, maintenance, and safety upgrade programs.
- Upgrade roadside safety devices as part of reconstruction and rehabilitation projects on all roadway systems.
- Evaluate the effectiveness of safety device upgrade programs on a continuing basis. Include formal review of roadside safety needs in development of all projects.

Education and Public Awareness

- Increase public awareness of highway features and design improvements (see Chapter 1, Increasing Driver Safety Awareness).
- Develop a resource for local officials and others to use in answering basic highway safety questions (see Successes and Strategies Implemented section in this chapter).
- Continue to use and support the Local Technical Assistance Program (LTAP) library and other cooperative efforts with the Center for Transportation Research and Education (CTRE) at Iowa State University (see Successes and Strategies Implemented section in this chapter).
- Expand the Traffic Engineering Assistance Program (TEAP) for local governments.

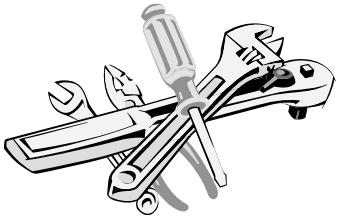
Design and Technology

- Enhance pavement markings:
  - Provide more frequent painting.
  - Increase use of more durable material.
  - Use raised pavement markers in selected locations.
- Construct more and wider paved shoulders on rural highways.
- Consider the needs of Iowa's aging population in all signing and marking.
- Install high-reflectivity warning signs, more chevrons, and raised markings on selected horizontal curves (e.g., centerline and sidelines).
- Explore alternative use of existing Iowa DOT funding sources for guardrail upgrades (e.g., NHS Roadways/3R Program).
- Increase use of shoulder rumble strips.
- Consider using centerline rumble strips or edge strips wherever helpful and appropriate.
- Increase use of delineation posts.
- Use advance pavement markings warning for selected curves.
- Improve clear zones on selected roadways.
- Increase use of delineation (e.g., use reflective material on objects such as utility poles that cannot be moved because of limited right of way or other issues).
- Implement a program to fund cost-share relocation of utility poles in selected corridors.
- Illuminate roadway sections when warranted.
- Investigate geometric characteristics of high-occurrence road segments. Implement and/or test geometric and/or signing mitigation measures at these sites.
- Investigate geometric characteristics of high-crash occurrence road segments and implement or test mitigation measures at these sites.
- Seek ways to link crash data, highway feature inventories, and traffic information to better understand the causes of roadside crashes (see Successes and Strategies Implemented section in this chapter).

Other Initiatives

- Develop methods for locating new plantings where they can contribute to highway aesthetics and environmental quality without diminishing safety.
- Study the effectiveness of Iowa's completed traffic safety improvement projects (see Successes and Strategies Implemented section in this chapter for information on the *Effectiveness of Roadway Safety Improvements* report).

SUCCESSES AND STRATEGIES IMPLEMENTED



- Improved crash data and analysis tools are available or under development. The following tools assist safety professionals in tracking changing conditions, analyzing the causes of crashes, selecting effective treatments to resolve roadside safety problems, and allocating highway safety funds effectively:
  - o Access-ALAS (Accident Location and Analysis System)
  - o Intersection Magic Collision
  - o GIS-ALAS (under development 2001)

  (See Chapter 25, Improving Information and Decision Support Systems.)
- The Iowa DOT sponsored a study of traffic safety improvement projects. The *Effectiveness of Roadway Safety Improvements* study (conducted by CTRE) of 94 traffic safety projects concluded that there was a mean crash reduction rate of 23% on these hazard elimination and safety improvement fund projects.
- The *Traffic and Safety Informational Series* is sponsored by the Iowa DOT Office of Traffic and Safety. The goal of this project was to make available clear, concise, and consistent answers to 25 traffic and safety questions, commonly asked by local officials and the public. The information may be altered, distributed, and used as seen fit by area officials and/or transportation professionals. It is available in print, on disk, and on the web.
- The Iowa DOT Office of Traffic and Safety is developing the "TAS" manual for highway safety practitioners and engineers at the state and local levels (to be available in print and on the Office of Traffic and Safety web site in 2002).
- The Iowa DOT Office of Traffic and Safety sponsors the annual Traffic and Safety Forum each fall to help city, county, state, and consulting highway safety engineers stay up-to-date on recent developments in highway safety technology and practice.

- The LTAP library has over 1,100 publications, 500 videos, 16 slide presentations, and several interactive CD-ROM training programs for free loan to Iowa transportation agencies. The library catalog is searchable on the web, and requests for library materials may also be submitted online.
- High-crash horizontal curves have been identified, and funding has been provided to improve signing.
- Locations of high cross-median crashes have been identified.
- The Iowa DOT has completed a study of paved shoulder needs on rural freeways, expressways, and Super 2 highway corridors in Iowa. The Iowa DOT has implemented a two-foot paved shoulder policy.

NOTE

The potential strategies in this chapter do not represent specific recommendations of the Iowa Safety Management System (Iowa SMS) Coordination Committee or any agency, group, or individual represented in Iowa SMS. The strategies represent a range of alternatives for legislators, department or agency directors, local governments, and citizen groups to consider when they elect to address a specific highway safety concern.

This toolbox is a living document that will continue to provide information, direction, and ideas for highway safety decision makers. Any strategies selected for implementation by Iowa SMS or any other entity will require further development through identifying potential partners, entities impacted, potential funding, steps for implementation, evaluation, and other pertinent tasks.

RESOURCES

Information in this chapter is drawn from many individuals and sources. Known sources are listed here. **Contributors:** Tom Welch (primary), Steve Gent, Becky Hiatt, Dave Little, Andy Loonan, Tom McDonald, John Nervig, Jaime Reyes, Randy Schlei, and Don Tebben.

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