PREFACE

The *Roadside Design Guide* is developed and maintained by the AASHTO Subcommittee on Design, Technical Committee for Roadside Safety. The guide presents a synthesis of current information and operating practices related to roadside safety and is written in dual units—metric and U.S. Customary units. The 2006 edition of the guide supersedes the 1996 AASHTO publication of the same name and includes an update to Chapter 6, "Median Barriers," which replaces Chapter 6 of the 2002 edition.

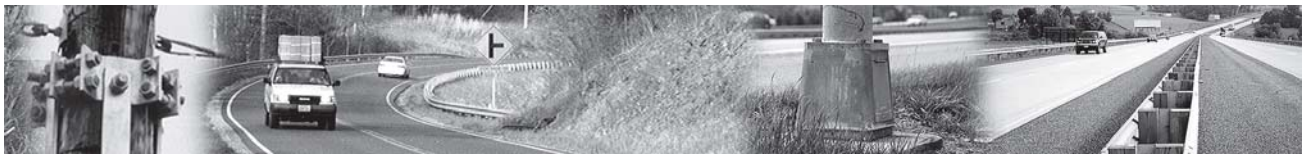
In this guide, the roadside is defined as that area beyond the traveled way (driving lanes) and the shoulder (if any) of the roadway itself. Consequently, roadside delineation, shoulder surface treatments, and similar on-roadway safety features are not extensively discussed. While it is a readily accepted fact that safety can best be served by keeping motorists on the road, the focus of the guide is on safety treatments that minimize the likelihood of serious injuries when a driver runs off the road.

A second noteworthy point is that this document is a guide. It is not a standard, nor is it a design policy. It is intended for use as a resource document from which individual highway agencies can develop standards and policies. While much of the material in the guide can be considered universal in its application, there are several recommendations that are subjective in nature and may need modification to fit local conditions. However, it is important that significant deviations from the guide be based on operational experience and objective analysis.

To be consistent with AASHTO's *A Policy on Geometric Design of Highways and Streets,* design speed is as the basic speed parameter to be used in this guide. However, since the design speed is often selected based on the most restrictive physical features found on a specific project, there may be a significant percentage of a project length where that speed will be exceeded by a reasonable and prudent driver. Conversely, there will be other instances where roadway conditions will prevent most motorists from driving as fast as the design speed. Because roadside safety design is intended to minimize the consequences of a motorist leaving the roadway inadvertently, the designer should consider the speed at which encroachments are most likely to occur when selecting an appropriate roadside design standard or feature.

Design values are presented in this document in both metric and U.S. Customary units. The relationship between the metric and U.S. Customary values is neither an exact (soft) conversion nor a completely rationalized (hard) conversion. The metric values are those that would have been used had the guide been presented exclusively in metric units; the U.S. Customary values are those that would have been used if the guide had been presented exclusively in U.S. Customary units. Therefore, the user is advised to work entirely in one system and not to attempt to convert directly between the two.

The reader is cautioned that roadside safety is a rapidly changing field of study, and changes in policy, criteria, and technology are certain to occur after this document is published. Efforts should be made to incorporate the appropriate current design elements into the project development. Comments from users of this guide on suggested changes or modifications resulting from further developmental work or hands-on experience are appreciated. All such comments should be addressed to the American Association of State Highway and Transportation Officials, Engineering Program, 444 North Capitol Street NW, Suite 249, Washington, DC 20001.



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An Introduction to Roadside Safety

1.0 HISTORY OF ROADSIDE SAFETY

Roadside safety design, as one component of total highway design, is a relatively recent concept. Most of the highway design components were established in the late 1940s and the 1950s. These components included horizontal alignment, vertical alignment, hydraulic design, and sight distance to name some of the most common highway design elements. These elements have been revised and refined over the years through experience and research. However, the highway design components themselves have remained about the same for several decades.

Roadside safety design did not become a much discussed aspect of highway design until the late 1960s, and it was the decade of the 1970s before this type of design was regularly incorporated into highway projects. Because most highways are designed for twenty- to thirty-year projected traffic volumes, many roadway projects placed in service before the 1970s are only now becoming candidates for major reconstruction. This reconstruction offers an opportunity to incorporate cost-effective roadside safety concepts and design features. The purpose of this Guide is to present the concepts of roadside safety to the designer in such a way that the most practical, appropriate, and beneficial roadside design can be accomplished for each project.

1.1 THE BENEFITS OF ROADSIDE SAFETY

Roadside design might be defined as the design of the area between the outside shoulder edge and the right-of-way limits. Some have referred to this aspect of highway design as off-pavement design. A question commonly asked revolves around whether spending resources off the pavement is really beneficial given the limited nature of infrastructure funds. Perhaps, some statistics bring the potential of crash reduction and roadside safety into focus.

The United States suffers approximately 40,000 traffic fatalities each year. The actual number has fluctuated around this level since the mid-1960s. At the same time, the number of vehicle kilometers [miles] traveled each year has increased approximately two and one-half times since the mid-1960s. Therefore, the traffic fatality rate per one billion vehicle kilometers [miles] given in Figure 1.1 has fallen by more than half since the mid-1960s.

This significant reduction is due to several factors. Motor vehicles are much safer than they were in the past. Protected passenger compartments, padded interiors, and occupant restraints are some features that have added to passenger safety during impact situations. Roadways have been made safer through design improvements such as increased superelevation, intersection geometry, and the addition of grade separations. Drivers are more educated about safe vehicle operation as evidenced by the increased use of occupant restraints and a decrease in driving under the influence of alcohol or drugs. All these contributing factors have reduced the motor vehicle fatality rate.

How significant is the involvement of the roadside environment in highway crashes? Unfortunately, roadside crashes account for far too great a portion of the total fatal highway crashes. About thirty percent, or almost one in every three fatalities, are the result of a single vehicle run-off-the-road crash. These figures mean that the roadside environment comes into play in a very significant percentage of fatal and serious-injury crashes.

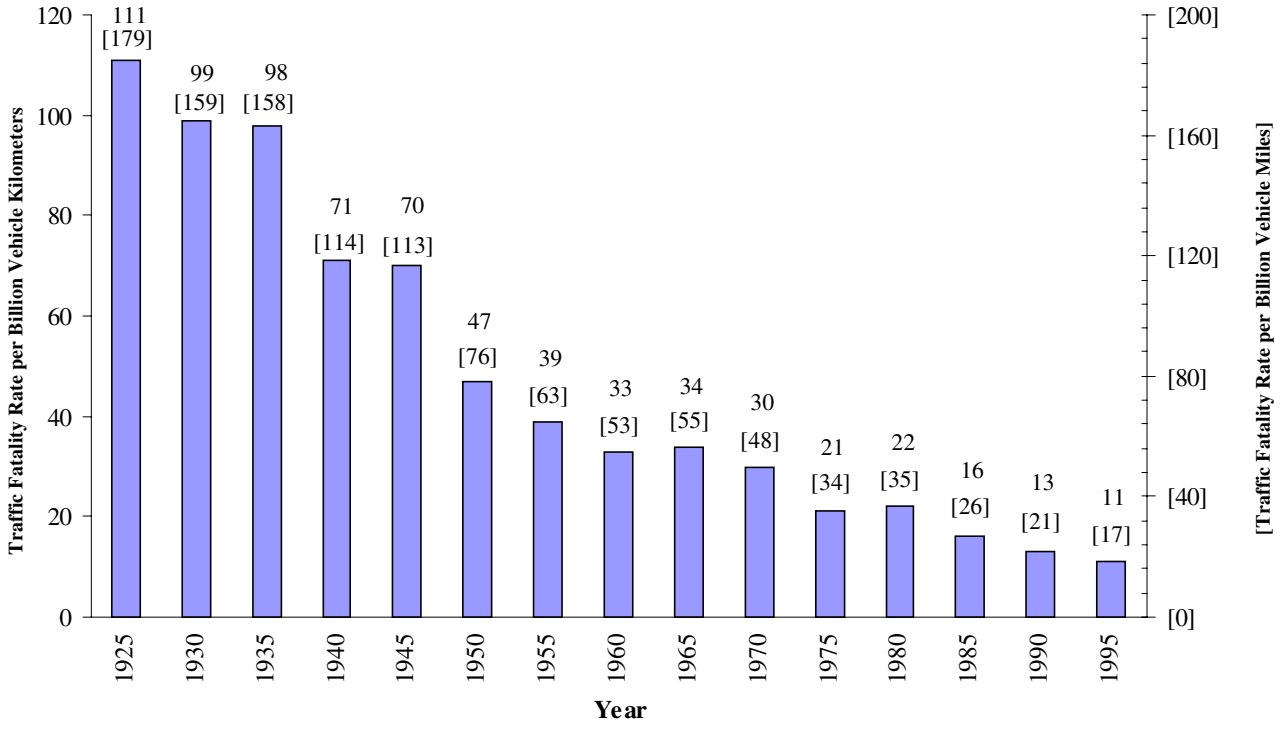

FIGURE 1.1 Traffic fatality rate per billion vehicle kilometers [miles] by year

1.2 THE FORGIVING ROADSIDE CONCEPT

There are many reasons why a vehicle will leave the pavement and encroach on the roadside, including:

- driver fatigue or inattention
- excessive speed
- driving under the influence of drugs or alcohol
- crash avoidance
- roadway conditions such as ice, snow, or rain
- vehicle component failure
- poor visibility

Regardless of the reason for a vehicle leaving the roadway, a roadside environment free of fixed objects with stable, flattened slopes enhances the opportunity for reducing crash severity. The forgiving roadside concept allows for errant vehicles leaving the roadway and supports a roadside design where the serious consequences of such an incident are reduced.

Through decades of experience and research, the application of the forgiving roadside concept has been refined to the point where roadside design is an integral part of transportation design criteria. Design options for reducing roadside obstacles, in order of preference, are as follows:

1. Remove the obstacle.
2. Redesign the obstacle so it can be safely traversed.
3. Relocate the obstacle to a point where it is less likely to be struck.
4. Reduce impact severity by using an appropriate breakaway device.
5. Shield the obstacle with a longitudinal traffic barrier designed for redirection or use a crash cushion.
6. Delineate the obstacle if the above alternatives are not appropriate.

One on-roadway safety feature that is becoming more prevalent nationwide on facilities experiencing a significant number of run-off-the-road crashes is the use of transverse milled shoulder rumble strips to supplement pavement edge lines. These indentations in the roadway shoulders alert motorists through noise and vibration that their