

## 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.





## Table of Contents

<b>PREFACE</b> .....	vii
<b>LIST OF FIGURES</b> .....	xvii
<b>LIST OF TABLES</b> .....	xxii
<b>CHAPTER 1: AN INTRODUCTION TO ROADSIDE SAFETY</b>	
1.0    HISTORY OF ROADSIDE SAFETY .....	1-1
1.1    THE BENEFITS OF ROADSIDE SAFETY .....	1-1
1.2    THE FORGIVING ROADSIDE CONCEPT .....	1-2
1.3    THE CONTENT AND FORMAT .....	1-3
1.4    CRASH TESTING ROADSIDE SAFETY FEATURES AND APPURTENANCES .....	1-3
1.5    THE APPLICATION OF THIS GUIDE .....	1-4
<b>CHAPTER 2: ROADSIDE SAFETY AND ECONOMICS</b>	
2.0    OVERVIEW .....	2-1
2.1    BENEFIT/COST ANALYSIS .....	2-1
2.1.1    Encroachments .....	2-2
2.1.2    Roadside Geometry .....	2-2
2.1.3    Crash Costs .....	2-2
2.2    BENEFIT/COST ANALYSIS PROGRAMS .....	2-2
<b>CHAPTER 3: ROADSIDE TOPOGRAPHY AND DRAINAGE FEATURES</b>	
3.0    OVERVIEW .....	3-1
3.1    THE CLEAR ROADSIDE CONCEPT .....	3-1
3.2    ROADSIDE GEOMETRY .....	3-2
3.2.1    Foreslopes .....	3-2
3.2.2    Backslopes .....	3-8
3.2.3    Transverse Slopes .....	3-8
3.2.4    Drainage Channels .....	3-10
3.3    APPLICATION OF THE CLEAR-ZONE CONCEPT .....	3-11
3.3.1    Recoverable Foreslopes .....	3-13
3.3.2    Non-Recoverable Foreslopes .....	3-13
3.3.3    Critical Foreslopes .....	3-13
3.3.4    Examples of Clear-Zone Application on Variable Slopes .....	3-13
3.3.5    Clear-Zone Applications for Drainage Channels and Backslopes .....	3-13
3.4    DRAINAGE FEATURES .....	3-14

3.4.1	Curbs .....	3-14
3.4.2	Cross-Drainage Structures .....	3-15
3.4.2.1	Traversable Designs .....	3-15
3.4.2.2	Extension of Structure .....	3-17
3.4.2.3	Shielding .....	3-17
3.4.3	Parallel Drainage Features .....	3-17
3.4.3.1	Eliminate the Structure .....	3-17
3.4.3.2	Traversable Designs .....	3-18
3.4.3.3	Relocate the Structure .....	3-19
3.4.3.4	Shielding .....	3-19
3.4.4	Drop Inlets .....	3-19

**CHAPTER 4: SIGN, SIGNAL, AND LUMINAIRE SUPPORTS, UTILITY POLES, TREES, AND SIMILAR ROADSIDE FEATURES**

4.0	OVERVIEW .....	4-1
4.1	ACCEPTANCE CRITERIA FOR BREAKAWAY SUPPORTS .....	4-2
4.2	DESIGN AND LOCATION CRITERIA FOR BREAKAWAY AND NON-BREAKAWAY SUPPORTS .....	4-2
4.3	SIGN SUPPORTS .....	4-3
4.3.1	Overhead Signs .....	4-4
4.3.2	Large Roadside Signs .....	4-4
4.3.3	Small Roadside Signs .....	4-8
4.4	MULTIPLE POST SUPPORTS FOR SIGNS .....	4-10
4.5	BREAKAWAY LUMINAIRE SUPPORTS .....	4-10
4.6	SUPPORTS FOR TRAFFIC SIGNALS AND MISCELLANEOUS TRAFFIC SERVICE DEVICES .....	4-13
4.6.1	Traffic Signals .....	4-13
4.6.2	Motorist-Aid Callboxes .....	4-13
4.6.3	Railroad Crossing Warning Devices .....	4-13
4.6.4	Fire Hydrants .....	4-14
4.6.5	Mailbox Supports .....	4-14
4.7	UTILITY POLES .....	4-14
4.8	TREES .....	4-15

**CHAPTER 5: ROADSIDE BARRIERS**

5.0	OVERVIEW .....	5-1
5.1	PERFORMANCE REQUIREMENTS .....	5-1
5.1.1	Current Crash Test Criteria .....	5-1
5.1.2	Barrier Classifications .....	5-1
5.2	WARRANTS .....	5-2
5.2.1	Embankments .....	5-2
5.2.2	Roadside Obstacles .....	5-2
5.2.3	Bystanders, Pedestrians, and Bicyclists .....	5-3
5.2.4	Motorcycles and Barrier Design .....	5-5
5.3	PERFORMANCE LEVEL SELECTION FACTORS .....	5-8

5.4	STRUCTURAL AND SAFETY CHARACTERISTICS OF ROADSIDE BARRIERS	5-8
5.4.1	Standard Sections of Roadside Barriers	5-9
5.4.1.1	Three-Strand Cable	5-9
5.4.1.2	W-Beam (Weak Post)	5-9
5.4.1.3	Ironwood Aesthetic Guardrail	5-12
5.4.1.4	Box Beam (Weak Post)	5-12
5.4.1.5	Blocked-Out W-Beam (Strong Post)	5-12
5.4.1.6	Blocked-Out Thrie-Beams	5-15
5.4.1.6.1	Blocked-Out Thrie-Beam (Wood Strong Post)	5-15
5.4.1.6.2	Blocked-Out Thrie-Beam (Steel Strong Post)	5-16
5.4.1.6.3	Modified Thrie-Beam	5-16
5.4.1.7	Merritt Parkway Aesthetic Guardrail	5-17
5.4.1.8	Steel-Backed Timber Guardrail	5-18
5.4.1.9	Concrete Barriers	5-18
5.4.1.10	Stone Masonry Wall/Precast Masonry Wall	5-21
5.4.2	Long-Span, Double-Nested Guardrail Systems	5-23
5.4.3	Transition Designs	5-23
5.5	SELECTION GUIDELINES	5-23
5.5.1	Barrier Performance Capability	5-23
5.5.2	Barrier Deflection Characteristics	5-24
5.5.3	Site Conditions	5-26
5.5.4	Compatibility	5-26
5.5.5	Life-Cycle Costs	5-26
5.5.6	Maintenance	5-26
5.5.6.1	Routine Maintenance	5-26
5.5.6.2	Crash Maintenance	5-26
5.5.6.3	Material and Storage Requirements	5-26
5.5.6.4	Simplicity of Barrier Design	5-26
5.5.7	Aesthetic and Environmental Considerations	5-27
5.5.8	Field Experience	5-27
5.6	PLACEMENT RECOMMENDATIONS	5-27
5.6.1	Lateral Offset	5-27
5.6.2	Terrain Effects	5-29
5.6.2.1	Curbs	5-29
5.6.2.2	Slopes	5-30
5.6.3	Flare Rate	5-31
5.6.4	Length of Need	5-32
5.7	UPGRADING SYSTEMS	5-37
5.7.1	Structural Inadequacies	5-37
5.7.2	Design/Placement Inadequacies	5-37
5.7.3	Establishing Priorities of Upgrading Needs	5-38

**CHAPTER 6: MEDIAN BARRIERS**

6.0	OVERVIEW	6-1
6.1	PERFORMANCE REQUIREMENTS	6-1
6.2	GUIDELINES FOR MEDIAN BARRIER APPLICATION	6-1

6.3	PERFORMANCE LEVEL SELECTION PROCEDURES .....	6-3
6.4	STRUCTURAL AND SAFETY CHARACTERISTICS OF MEDIAN BARRIERS .....	6-3
6.4.1	Crashworthy Median Barrier Systems .....	6-3
6.4.1.1	Weak-Post, W-Beam .....	6-4
6.4.1.2	Three-Strand Cable .....	6-5
6.4.1.3	High-Tension Cable Barrier .....	6-5
6.4.1.4	Box-Beam Median Barrier .....	6-6
6.4.1.5	Blocked-Out W-Beam (Strong Post) .....	6-8
6.4.1.6	Blocked-Out Thrie-Beam (Strong Post) .....	6-8
6.4.1.7	Modified Thrie-Beam Median Barrier .....	6-10
6.4.1.8	Concrete Barrier .....	6-10
6.4.1.9	Quickchange® Moveable Barrier System .....	6-14
6.4.2	End Treatments .....	6-15
6.4.3	Transitions .....	6-16
6.5	SELECTION GUIDELINES .....	6-16
6.5.1	Barrier Performance Capability .....	6-16
6.5.2	Barrier Deflection Characteristics .....	6-16
6.5.3	Compatibility .....	6-17
6.5.4	Costs .....	6-17
6.5.5	Maintenance .....	6-17
6.5.6	Aesthetic and Environmental Considerations .....	6-17
6.5.7	Field Experience .....	6-17
6.6	PLACEMENT RECOMMENDATIONS .....	6-17
6.6.1	Terrain Effects .....	6-18
6.6.2	Fixed Objects within the Median .....	6-20
6.7	UPGRADING SYSTEMS .....	6-20

## **CHAPTER 7: BRIDGE RAILINGS AND TRANSITIONS**

7.0	OVERVIEW .....	7-1
7.1	PERFORMANCE REQUIREMENTS .....	7-1
7.2	WARRANTS .....	7-1
7.3	TEST LEVEL SELECTION PROCEDURES .....	7-2
7.4	CRASH-TESTED RAILINGS .....	7-2
7.4.1	Test Level 1 Bridge Railings .....	7-2
7.4.2	Test Level 2 Bridge Railings .....	7-2
7.4.3	Test Level 3 Bridge Railings .....	7-3
7.4.4	Test Level 4 Bridge Railings .....	7-3
7.4.4.1	Solid Concrete Bridge Railings .....	7-3
7.4.4.2	Massachusetts S3 Steel Bridge Railing .....	7-4
7.4.4.3	Wyoming Two-Tube Bridge Railing .....	7-4
7.4.4.4	BR27C .....	7-4
7.4.5	Test Level 5 Bridge Railings .....	7-6
7.4.6	Test Level 6 Bridge Railings .....	7-6
7.5	SELECTION GUIDELINES .....	7-6
7.5.1	Railing Performance .....	7-7

7.5.2	Compatibility .....	7-7
7.5.3	Costs .....	7-7
7.5.4	Field Experience .....	7-8
7.5.5	Aesthetics .....	7-8
7.6	PLACEMENT RECOMMENDATIONS .....	7-8
7.7	UPGRADING OF BRIDGE RAILINGS .....	7-8
7.7.1	Identification of Potentially Deficient Systems .....	7-8
7.7.2	Upgrading Systems .....	7-10
7.7.2.1	Concrete Retrofit (Safety Shape or Vertical) .....	7-12
7.7.2.2	W-Beam/Thrie-Beam Retrofits .....	7-13
7.7.2.3	Metal Post and Beam Retrofits .....	7-14
7.8	TRANSITIONS .....	7-14

## **CHAPTER 8: BARRIER END TREATMENTS AND CRASH CUSHIONS**

8.0	OVERVIEW .....	8-1
8.1	PERFORMANCE REQUIREMENTS .....	8-1
8.2	END TREATMENTS .....	8-1
8.2.1	Three-Strand Cable Terminal .....	8-2
8.2.2	Wyoming Box Beam End Terminal (WYBET-350) .....	8-2
8.2.3	Barrier Anchored in Backslope .....	8-2
8.2.4	Eccentric Loader Terminal (ELT) .....	8-7
8.2.5	Slotted Rail Terminal (SRT-350) .....	8-7
8.2.6	REGENT Terminal .....	8-10
8.2.7	Vermont Low-Speed, W-Beam Guardrail End Terminal .....	8-10
8.2.8	Flared Energy-Absorbing Terminal (FLEAT) .....	8-11
8.2.9	Beam-Eating Steel Terminal (BEST) .....	8-11
8.2.10	Extruder Terminal (ET-2000) .....	8-13
8.2.11	Sequential Kinking Terminal (SKT-350) .....	8-14
8.2.12	QuadTrend-350 .....	8-14
8.2.13	Narrow Energy-Absorbing Terminal (NEAT) .....	8-15
8.2.14	Sloped Concrete End Treatment .....	8-15
8.3	CRASH CUSHIONS .....	8-15
8.3.1	Concepts .....	8-18
8.3.1.1	Kinetic Energy Principle .....	8-18
8.3.1.2	Conservation of Momentum Principle .....	8-19
8.3.2	Characteristics of Operational Attenuation Systems .....	8-19
8.3.2.1	Advanced Dynamic Impact Extension Module (ADIEM II) .....	8-19
8.3.2.2	Brakemaster 350 .....	8-19
8.3.2.3	Crash Cushion Attenuating Terminal (CAT) .....	8-19
8.3.2.4	Bullnose Guardrail System .....	8-22
8.3.2.5	ABSORB 350 .....	8-22
8.3.2.6	QuadGuard Family .....	8-22
8.3.2.7	Trinity Attenuating Crash Cushion (TRACC) .....	8-25
8.3.2.8	Reusable Energy-Absorbing Crash Terminal (REACT 350) .....	8-25
8.3.2.9	Narrow Connecticut Impact Attenuation System (NCIAS) .....	8-25
8.3.2.10	Sand-Filled Plastic Barrels .....	8-25

8.3.2.11	Gravel-Bed Attenuator .....	8-32
8.3.2.12	Dragnet .....	8-33
8.3.2.13	Water Twister Vehicle Arresting System (VAS) .....	8-33
8.4	SELECTION GUIDELINES .....	8-34
8.4.1	Site Characteristics .....	8-34
8.4.2	Structural and Safety Characteristics .....	8-34
8.4.3	Costs .....	8-34
8.4.4	Maintenance Characteristics .....	8-34
8.5	PLACEMENT RECOMMENDATIONS .....	8-37
8.6	DELINEATION .....	8-37

**CHAPTER 9: TRAFFIC BARRIERS, TRAFFIC CONTROL DEVICES, AND OTHER SAFETY FEATURES FOR WORK ZONES**

9.0	OVERVIEW .....	9-1
9.1	THE CLEAR-ZONE CONCEPT IN WORK ZONES .....	9-1
9.1.1	Application of the Clear-Zone Concept in Work Zones .....	9-1
9.2	TRAFFIC BARRIERS .....	9-2
9.2.1	Temporary Longitudinal Barriers .....	9-2
9.2.1.1	Portable Concrete Safety-Shape Barriers .....	9-2
9.2.1.1.1	Flare Rates .....	9-3
9.2.1.1.2	Offset .....	9-3
9.2.1.1.3	Types of Portable Concrete Barrier (PCB) Systems .....	9-4
9.2.1.1.3.1	NCHRP Report 350 Tested PCB Systems .....	9-4
9.2.1.1.3.2	Tested and Operational Connections .....	9-10
9.2.1.1.3.3	Securing PCBs to the Traveled Way .....	9-13
9.2.1.1.3.4	Special Cases .....	9-13
9.2.1.2	Other Concrete Barriers .....	9-13
9.2.1.3	Other Barriers .....	9-15
9.2.1.3.1	Water-Filled Plastic Shell with Steel Barriers .....	9-15
9.2.1.3.1.1	Triton Barrier .....	9-15
9.2.1.3.1.2	GUARDIAN Safety Barrier .....	9-15
9.2.1.3.2	Timber Barrier Curb/Rail .....	9-18
9.2.2	End Treatments .....	9-18
9.2.3	Transitions .....	9-20
9.2.3.1	PCB Steel Plate Transition .....	9-20
9.2.4	Applications .....	9-20
9.3	CRASH CUSHIONS .....	9-20
9.3.1	Stationary Crash Cushions .....	9-20
9.3.1.1	Sand-Filled Plastic Barrels .....	9-21
9.3.1.2	QUADGUARD CZ SYSTEM .....	9-21
9.3.1.3	TRACC .....	9-21
9.3.1.4	REACT 350 CZ .....	9-21
9.3.1.5	Connecticut Impact Attenuation System (CIAS) .....	9-21
9.3.1.6	ABSORB 350 .....	9-24
9.3.1.7	Advanced Dynamic Impact Extension Modules (ADIEM II) .....	9-24
9.3.1.8	DRAGNET .....	9-24

9.3.2	Truck-Mounted Attenuators (TMAs).....	9-24
9.3.2.1	Test-Level Selection for Truck Mounted Attenuators .....	9-24
9.3.2.2	Placement .....	9-26
9.3.2.2.1	Buffer Distance .....	9-26
9.3.2.2.2	Mass of a Shadow Vehicle .....	9-26
9.3.2.2.3	Delineation .....	9-26
9.3.2.3	TMAs Meeting NCHRP Report 350 Criteria .....	9-26
9.3.2.3.1	RENCO Ren-Gard 815 TMA .....	9-26
9.3.2.3.2	Connecticut TMA .....	9-27
9.3.2.3.3	ALPHA 70K TMA .....	9-28
9.3.2.3.4	ALPHA 100K TMA .....	9-28
9.3.2.3.5	Mobile Protection System 350 .....	9-28
9.3.2.3.6	Vanderbilt TMA .....	9-29
9.3.2.3.7	Safe-Stop TMA .....	9-29
9.3.2.3.8	U-MAD 100K TMA .....	9-31
9.3.2.3.9	Scorpion A 10,000 and Scorpion C 10,000 TMAs .....	9-31
9.3.2.3.10	RENCO RAM 100K TMA .....	9-31
9.4	TRAFFIC CONTROL DEVICES .....	9-31
9.4.1	Channelizing Devices .....	9-32
9.4.1.1	Performance Evaluation Criteria .....	9-32
9.4.1.2	Cones and Tubular Markers .....	9-32
9.4.1.3	Vertical Panels .....	9-32
9.4.1.4	Drums .....	9-33
9.4.1.5	Barricades .....	9-33
9.4.1.6	Longitudinal Channelizing Barricades .....	9-35
9.4.2	Signs and Supports .....	9-35
9.4.2.1	Long/Intermediate-Term Work-Zone Sign Supports .....	9-35
9.4.2.2	Wheeled Portable Sign Supports .....	9-35
9.4.2.3	Short-Term Work-Zone Sign Supports .....	9-38
9.4.2.4	Trailer-Mounted Devices .....	9-39
9.4.2.5	Warning Lights .....	9-41
9.5	OTHER WORK-ZONE FEATURES .....	9-41
9.5.1	Glare Screens .....	9-41
9.5.2	Pavement Edge Drop-Offs .....	9-42

**CHAPTER 10: ROADSIDE SAFETY IN URBAN OR RESTRICTED ENVIRONMENTS**

10.0	OVERVIEW .....	10-1
10.1	NEED FOR INDIVIDUAL STUDY OF SITES .....	10-2
10.2	DESIGN SPEED .....	10-2
10.3	ROADSIDE BARRIERS IN URBAN AND RESTRICTED AREAS .....	10-3
10.3.1	Barrier Warrants .....	10-4
10.3.2	Barriers to Protect Adjacent Land Use .....	10-4
10.3.3	Guidelines for Pedestrian and Bicyclist Barriers .....	10-4
10.3.4	Pedestrian Restraint Systems .....	10-4

10.4	MEDIAN BARRIERS IN URBAN AREAS .....	10-5
10.5	BRIDGE RAILINGS .....	10-5
10.5.1	Protective Screening at Overpasses .....	10-6
10.6	IMPACT ATTENUATORS .....	10-7
10.7	CURBS .....	10-7
10.8	DRAINAGE .....	10-7
10.9	LANDSCAPING .....	10-8
10.10	WORK ZONES .....	10-8
<b>CHAPTER 11:</b>	<b>ERECTING MAILBOXES ON STREETS AND HIGHWAYS</b>	
11.0	OVERVIEW .....	11-1
11.1	MAILBOXES .....	11-1
11.2	GENERAL PRINCIPLES AND GUIDELINES .....	11-3
11.2.1	Regulations .....	11-3
11.2.2	Mail Stop and Mailbox Location .....	11-3
11.2.3	Mailbox Turnout Design .....	11-4
11.2.4	Mailbox Support and Attachment Design .....	11-7
11.3	MODEL MAILBOX REGULATION .....	11-14
<b>APPENDIX A</b>	A Cost-Effectiveness Selection Procedure .....	A-1
<b>APPENDIX B</b>	Selected Roadside Barrier Design Details .....	B-1
<b>APPENDIX C</b>	Selected Median Barrier Design Details .....	C-1
<b>APPENDIX D</b>	Model Regulation for the Accommodation of Mailboxes and Newspaper Delivery Boxes on Public Highway Rights-of-Way .....	D-1
<b>APPENDIX E</b>	Postal Operations and Manual Delivery Services .....	E-1
<b>GLOSSARY</b> .....		G-1
<b>INDEX</b> .....		I-1

# List of Figures

<b>Figure</b>	<b>Title</b>	
1.1	Traffic fatality rate per billion vehicle kilometers [miles] by year .....	1-2
3.1a	Clear-zone distance curves (metric units) .....	3-3
3.1b	Clear-zone distance curves [U.S. customary units] .....	3-4
3.2	Example of a parallel foreslope design .....	3-8
3.3	Preferred cross slope design .....	3-9
3.4	Median transverse slope design .....	3-9
3.5	Examples of alternate median drainage .....	3-10
3.6	Preferred cross sections for channels with abrupt slope changes .....	3-11
3.7	Preferred cross sections for channels with gradual slope changes .....	3-12
3.8	Design criteria for safety treatment of pipes and culverts .....	3-16
3.9	Safety treatment for cross-drainage culvert .....	3-16
3.10	Inlet/outlet design example for parallel drainage .....	3-18
3.11	Alternate location for a parallel drainage culvert .....	3-19
3.12	Safety treatment for parallel drainage pipe .....	3-20
4.1	Breakaway support stub height measurements .....	4-3
4.2	Wind and impact loads on roadside signs .....	4-4
4.3	Impact performance of a multiple-post sign support .....	4-5
4.4	Multidirectional coupler .....	4-5
4.5	Typical uni-directional slip base .....	4-6
4.6	Slotted fuse plate design .....	4-7
4.7	Perforated fuse plate design .....	4-7
4.8	Uni-directional slip base for small signs .....	4-9
4.9	Multidirectional slip base for small signs .....	4-9
4.10	Oregon 3-bolt slip base .....	4-10
4.11	Example of a cast aluminum transformer base .....	4-11
4.12	Example of a luminaire slip base design .....	4-11
4.13	Example of a frangible coupling design .....	4-12
4.14	Prototype breakaway design for utility poles .....	4-15
5.1a	Comparative risk warrants for embankments (metric units) .....	5-3
5.1b	Comparative risk warrants for embankments [U.S. customary units] .....	5-4
5.2a	Example design chart for embankment warrants based on fill height, slope, and traffic volume (metric units) .....	5-6
5.2b	Example design chart for embankment warrants based on fill height, slope, and traffic volume [U.S. customary units] .....	5-6
5.3a	Example design chart for cost-effective embankment warrants based on traffic speeds and volumes, slope geometry and length of slope (metric units) .....	5-7
5.3b	Example design chart for cost-effective embankment warrants based on traffic speeds and volumes, slope geometry and length of slope [U.S. customary units] .....	5-7
5.4	Definition of roadside barriers .....	5-8

<b>Figure</b>	<b>Title</b>	
5.5	Three-strand cable barrier .....	5-11
5.6	Weak post W-beam barrier .....	5-11
5.7	Ironwood aesthetic guardrail .....	5-12
5.8	Weak post box beam barrier .....	5-13
5.9	Steel post W-beam with wood block-outs .....	5-14
5.10	Wood post W-beam with wood block-outs .....	5-14
5.11	Wood post thrie-beam barrier .....	5-15
5.12	Modified thrie-beam guardrail .....	5-16
5.13	Merritt Parkway aesthetic guardrail .....	5-17
5.14	Steel-backed timber guardrail .....	5-18
5.15	New Jersey safety-shape barrier .....	5-19
5.16	Ontario tall wall median barrier .....	5-20
5.17	2290 mm [90 in.] New Jersey barrier .....	5-20
5.18	Stone masonry wall .....	5-21
5.19	Precast masonry wall .....	5-22
5.20	Long-span, double-nested W-beam guardrail .....	5-22
5.21	Recommended barrier placement for optimum performance .....	5-28
5.22	Design parameters for vehicle encroachments on embankments .....	5-29
5.23	Recommended barrier location on 1V:6H .....	5-31
5.24	Approach barrier layout variables .....	5-32
5.25a	Example design chart for a flared roadside barrier installation (metric units) .....	5-35
5.25b	Example design chart for a flared roadside barrier installation [U.S. customary units] .....	5-35
5.26a	Example design chart for a parallel roadside barrier installation (metric units) .....	5-36
5.26b	Example design chart for a parallel roadside barrier installation [U.S. customary units] .....	5-36
5.27	Approach barrier layout for opposing traffic .....	5-37
5.28	Suggested roadside slopes for approach barriers .....	5-38
5.29	Example of barrier design for bridge approach .....	5-39
5.30	Example of barrier design for bridge piers .....	5-40
5.31	Example of barrier design for non-traversable embankments .....	5-41
5.32	Example of barrier design for fixed object on horizontal curve [U.S. customary units] .....	5-42
6.1	Guidelines for median barriers on high-speed, fully controlled-access roadways .....	6-2
6.2	Weak-post, W-beam median barrier .....	6-4
6.3	Three-strand cable median barrier .....	6-5
6.4	Brifex Wire Rope Safety Fence .....	6-6
6.5	The Cable Safety System (CASS) .....	6-7
6.6	U.S. High-Tension Cable System .....	6-7
6.7	Safence Cable Barrier System .....	6-8
6.8	Gibraltar Cable Barrier System .....	6-9
6.9	Box-beam median barrier .....	6-9
6.10	Strong-post W-beam median barrier .....	6-10
6.11	Modified thrie-beam median barrier .....	6-11
6.12	Concrete safety-shape median barrier .....	6-12

<b>Figure</b>	<b>Title</b>	
6.13	New York retrofit of concrete barrier .....	6-13
6.14	Single-slope concrete median barrier .....	6-13
6.15	Quickchange® moveable barrier system .....	6-14
6.16	Barrier termination at permanent openings .....	6-15
6.17	BarrierGate® .....	6-16
6.18	Recommended barrier placement in non-level medians .....	6-19
6.19	Example of a split median barrier layout .....	6-20
6.20	Suggested layout for shielding a rigid object in a median .....	6-21
7.1	Side-mounted, three-beam bridge railing .....	7-3
7.2	Wyoming two-tube bridge railing .....	7-4
7.3	Massachusetts S3 steel bridge railing .....	7-5
7.4	BR27C on sidewalk .....	7-5
7.5	Tall concrete safety-shape railing .....	7-6
7.6	Texas Type TT (Tank Truck) railing .....	7-7
7.7	End treatment for traffic railing on a bridge in low-speed situations .....	7-9
7.8	Terminating traffic barrier on bridge with end terminal .....	7-9
7.9	Inadequate railing strength .....	7-10
7.10	Lack of continuity in railing .....	7-11
7.11	Snagging potential .....	7-11
7.12	Presence of brush curb .....	7-12
7.13	Iowa concrete block retrofit bridge railing .....	7-13
7.14	Three-beam retrofit (New York) .....	7-14
7.15	Metal post and beam retrofit .....	7-15
7.16	Possible solution to intersection side road near bridge .....	7-16
7.17	W-beam transition to vertical concrete rail .....	7-17
7.18	W-beam transition to modified concrete safety shape .....	7-17
7.19	Three-beam transition to modified concrete safety shape .....	7-18
7.20a	Three-beam transition to curb-mounted steel post and beam bridge railing .....	7-18
7.20b	Three-beam transition to curb-mounted steel post and beam bridge railing .....	7-19
8.1	Grading for flared guardrail end treatment .....	8-3
8.2	Grading for non-flared guardrail end treatment .....	8-3
8.3	Three-strand cable terminal .....	8-5
8.4	Wyoming box beam end terminal .....	8-5
8.5	Barrier anchored in backslope .....	8-6
8.6	W-beam guardrail anchored in backslope .....	8-6
8.7	Eccentric loader terminal .....	8-7
8.8	Plan layout for eccentric loader terminal .....	8-8
8.9	Slotted rail terminal (SRT-350) with 1.2 m [4 ft] flare .....	8-9
8.10	Slotted rail terminal (SRT-350) with 0.9 m [3 ft] flare .....	8-9
8.11	REGENT .....	8-10
8.12	Vermont low-speed, W-beam guardrail end terminal .....	8-11
8.13	Flared Energy-Absorbing Terminal (FLEAT) .....	8-12
8.14	Beam Eating Steel Terminal (BEST) .....	8-12

<b>Figure</b>	<b>Title</b>	
8.15	Extruder Terminal (ET-2000) .....	8-13
8.16	Sequential Kinking Terminal (SKT-350) .....	8-14
8.17	QuadTrend-350 .....	8-15
8.18	Narrow Energy-Absorbing Terminal (NEAT) .....	8-16
8.19	Sloped concrete end treatment .....	8-16
8.20	Crash cushion applications .....	8-17
8.21	Kinetic energy principal .....	8-18
8.22	Advanced Dynamic Impact Extension Module (ADIEM II) .....	8-21
8.23	Brakemaster 350 .....	8-21
8.24	Crash Cushion Attenuating Terminal (CAT) .....	8-22
8.25	Bullnose guardrail system .....	8-23
8.26	ABSORB 350 crash cushion .....	8-23
8.27	QuadGuard .....	8-24
8.28	QuardGuard LMC .....	8-25
8.29	QuadGuard Elite .....	8-26
8.30	Trinity Attenuating Crash Cushion (TRACC).....	8-26
8.31	Reusable Energy-Absorbing Crash Terminal (REACT 350) .....	8-27
8.32	Narrow Connecticut Impact Attenuation System (NCAIS) .....	8-27
8.33	Conservation of momentum principal .....	8-28
8.34	The Fitch System .....	8-29
8.35	The Energite System .....	8-30
8.36	The TrafFix System .....	8-30
8.37	Suggested layout for the last three exterior modules in an inertial barrier .....	8-32
8.38	Dragnet .....	8-33
9.1	Iowa Temporary Concrete Barrier .....	9-4
9.2	Rockingham Precast Concrete Barrier .....	9-6
9.3	J-J Hooks Portable Concrete Barrier .....	9-7
9.4	Modified Virginia DOT Portable Concrete Barrier .....	9-7
9.5	GPLINK® Precast Temporary Concrete Barrier .....	9-8
9.6	Georgia Temporary Concrete Barrier .....	9-9
9.7	Idaho 20-ft New Jersey Portable Barrier .....	9-9
9.8	California K-Rail (PCB) for semi-permanent installations .....	9-10
9.9	Pin and Loop Joint .....	9-11
9.10	Channel Splice Joint .....	9-12
9.11	Vertical I-Beam Joint .....	9-12
9.12	Lapped Joint .....	9-14
9.13	J-Hook Joint .....	9-14
9.14	Quickchange® Barrier System .....	9-16
9.15	Low-Profile Barrier System .....	9-16
9.16	Triton® Barrier .....	9-17
9.17	GUARDIAN™ Safety Barrier System .....	9-17
9.18	Timber Barrier Curb/Rail System .....	9-18
9.19	Low-Profile Barrier Sloped End .....	9-19

<b>Figure</b>	<b>Title</b>	
9.20	PCB Steel Plate Transition .....	9-19
9.21	QuadGuard™ CZ .....	9-22
9.22	TRACC .....	9-22
9.23	REACT 350 CZ .....	9-23
9.24	Connecticut Impact Attenuation System .....	9-23
9.25	Example—energy-absorbing cartridge mounted in a frame (Ren-Gard 815) .....	9-28
9.26	Example—Energy-absorbing cartridge mounted in a frame (ALPHA 100K) .....	9-29
9.27	Example—Telescoping steel frame with a cutter assembly (MPS-350) .....	9-30
9.28	Example—Steel or polyethylene cylinder assembly (Vanderbilt TMA) .....	9-30
9.29	Cones and Tubular Markers .....	9-33
9.30	Portable Vertical Panel .....	9-34
9.31	Drum .....	9-34
9.32	Type II Plywood and Metal Panel Barricade (bent) .....	9-36
9.33	Type III Wood and Steel Barricade .....	9-36
9.34	Type III (Skid-Type) Barricade with perforated square tubing support .....	9-37
9.35	Longitudinal Channelizing Barricades .....	9-37
9.36	Wood, H-Leg Design Sign Support .....	9-38
9.37	Minnesota’s Perforated Steel Square Tube (PSST) Type III Barricade Sign Support with aluminum panels .....	9-39
9.38	Montana Sign Support .....	9-39
9.39	X-Base Sign Support .....	9-40
11.1	Typical single mailbox installations .....	11-1
11.2	Examples of hazardous single mailbox installations .....	11-2
11.3	Examples of hazardous multiple mailbox installations .....	11-3
11.4	Suggested minimum clearance distance to nearest mailbox in mailstops at intersections .....	11-5
11.5	Mailbox turnout .....	11-8
11.6	Mailbox support hardware, Series A .....	11-9
11.7	Single and double mailbox assemblies, Series A .....	11-10
11.8	Mailbox support hardware, Series B .....	11-11
11.9	Single and double mailbox assemblies, Series B .....	11-12
11.10	Single and double mailbox assemblies, Series C .....	11-13
11.11	Collection unit on auxillary lane (top) and neighborhood delivery and collection box units .....	11-14
11.12	Cantilever mailbox supports .....	11-15
11.13	Breakaway cantilever mailbox supports .....	11-16
11.14	Minnesota swing-away mailbox .....	11-17

## List of Tables

<b>Table</b>	<b>Title</b>	
1.1	First harmful event fixed-object fatalities by object type .....	1-5
3.1	Clear-zone distances in meters [feet] from edge of through traveled way .....	3-5
3.2	Horizontal Curve Adjustments .....	3-7
5.1	Barrier warrants for non-traversable terrain and roadside obstacles .....	5-5
5.2	Roadside barriers and approved test levels .....	5-10
5.3	Selection criteria for roadside barriers .....	5-24
5.4	Summary of maximum deflections .....	5-25
5.5	Suggested shy line offset ( $L_s$ ) values .....	5-28
5.6a	Example bumper trajectory data (metric units) .....	5-30
5.6b	Example bumper trajectory data [U.S. customary units] .....	5-30
5.7	Suggested flare rates for barrier design .....	5-32
5.8	Suggested runout lengths for barrier design .....	5-33
5.9	Roadside barrier inspection checklist .....	5-43
8.1	Crashworthy end treatments .....	8-4
8.2	Crashworthy crash cushions .....	8-20
8.3	Sample design calculation for a sand-filled barrel system .....	8-31
8.4	Reserve areas for gores .....	8-35
8.5	Comparative maintenance requirements .....	8-36
9.1	Example of clear-zone widths for work zones .....	9-2
9.2	Temporary longitudinal barriers .....	9-3
9.3	Suggested priorities for application of protective vehicles and truck mounted attenuators .....	9-25
9.4	Example of guidelines for spacing of Shadow Vehicles .....	9-27
10.1	Percentage of single vehicle run-off-the-road crashes by severity and time period for urban principal and minor arterials in Illinois .....	10-3
11.1	Suggested guidelines for lateral placement of mailboxes .....	11-6



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# Chapter 1

## 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

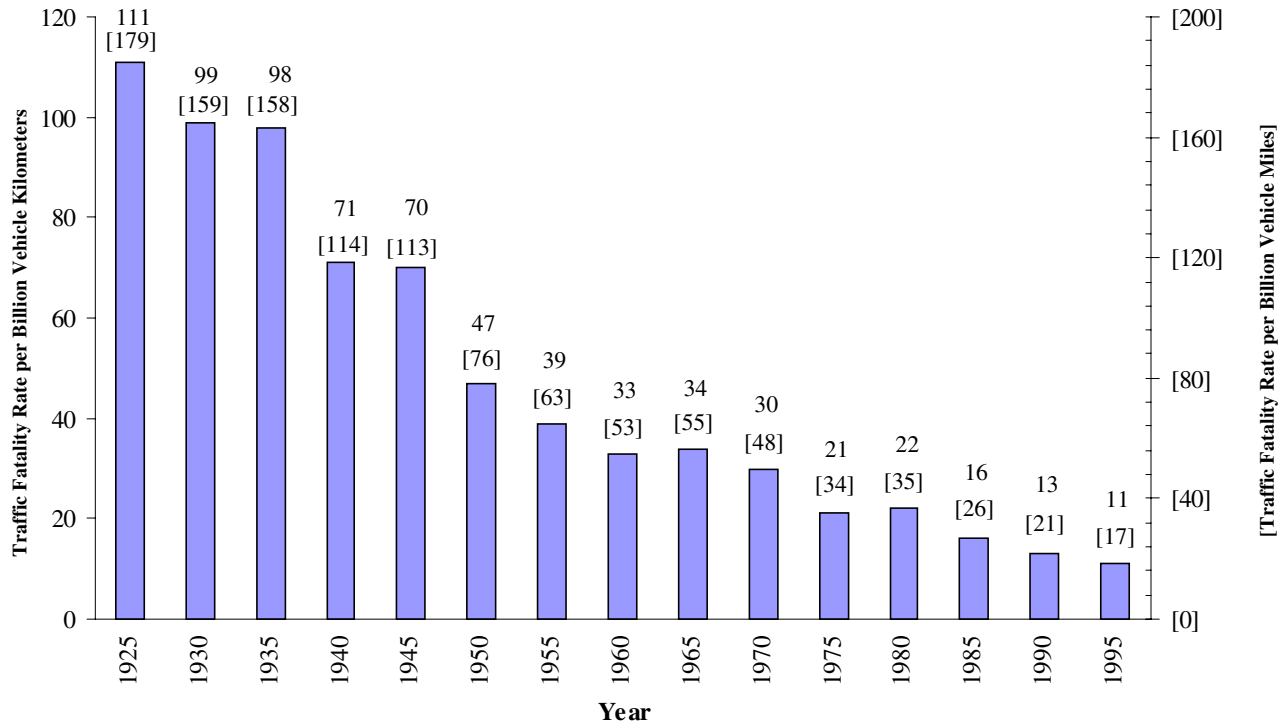
Roadside design might be defined as the design of the area between the outside shoulder edge and the right-of-way limits. Some have referred to this aspect of highway design as off-pavement design. A question com-

monly 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