American Association of
State Highway and
Transportation Officials

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December 2004

Dear Customer:

Recently, we were made aware of some technical revisions that need to be applied to the *Roadside Design Guide*, 3rd Edition.

Please replace the existing text with the following pages to ensure that your edition is both accurate and current.

Technical Corrections, August 2001–February 2003

- Table 3.1 [U.S. Customary Units]: For Foreslopes 1V:6H or Flatter and Design Speeds of 45–50 mph, change the clear-zone distances under the Design ADT of 750–1500 from 12–14 to 14–16 and under an ADT over 6000 from 18–20 to 20–22.
- Chapter 5, Figure 5.24: Move the dimension arrows for Y, the vertical dimension from the End of Barrier Need to the Edge of Pavement, directly below the right-hand dimension line for X, the End of Barrier.
- Appendix B, Figure B.1a: Change the soil plate dimension lines for 600 mm in SGR01a to be identical to those in SGR01b.
- Appendix C, Figure C.1a: Change the top cable height from 970 mm to 770 mm and the depth below ground from 840 mm to 910 mm.
- Appendix C, Figure C.1b: Change the top cable height from 0 inches to 30 inches and the depth below ground from 33½ inches to 36½ inches.
- Appendix D: In the first full paragraph of the right-hand column on page D-2, change the sentence to read “Where a mailbox is located at a driveway entrance, it shall be placed on the **far** side of the driveway in the carrier’s direction of travel.”

Revisions, March 2004

- Chapter 5, Figure 5.32: Change the figure caption to read “Example of Barrier Design for Fixed Object on Horizontal Curve.”
- Chapter 8, Table 8.4: Extend the dimension arrows for F, the minimum width for the end of rail or equivalent fixed object, in the accompanying illustration to the lines parallel to the rail end.

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Revision, December 2004

- Chapter 8, Figure 8.1: Change the dimension lines to illustrate the lateral offset from the back of the terminal to the grading PI and from the back of the guardrail posts to the grading PI.

AASHTO staff sincerely apologizes for any inconvenience.

TABLE 3.1 (Cont'd)

[U.S. Customary Units]

DESIGN SPEED	DESIGN ADT	FORESLOPES			BACKSLOPES		
		1V:6H or flatter	1V:5H TO 1V:4H	1V:3H	1V:3H	1V:5H TO 1V:4H	1V:6H or flatter
40 mph or less	UNDER 750	7 – 10	7 – 10	**	7 – 10	7 – 10	7 – 10
	750 – 1500	10 – 12	12 – 14	**	10 – 12	10 – 12	10 – 12
	1500 – 6000	12 – 14	14 – 16	**	12 – 14	12 – 14	12 – 14
	OVER 6000	14 – 16	16 – 18	**	14 – 16	14 – 16	14 – 16
45–50 mph	UNDER 750	10 – 12	12 – 14	**	8 – 10	8 – 10	10 – 12
	750 – 1500	14 – 16	16 – 20	**	10 – 12	12 – 14	14 – 16
	1500 – 6000	16 – 18	20 – 26	**	12 – 14	14 – 16	16 – 18
	OVER 6000	20 – 22	24 – 28	**	14 – 16	18 – 20	20 – 22
55 mph	UNDER 750	12 – 14	14 – 18	**	8 – 10	10 – 12	10 – 12
	750 – 1500	16 – 18	20 – 24	**	10 – 12	14 – 16	16 – 18
	1500 – 6000	20 – 22	24 – 30	**	14 – 16	16 – 18	20 – 22
	OVER 6000	22 – 24	26 – 32 *	**	16 – 18	20 – 22	22 – 24
60 mph	UNDER 750	16 – 18	20 – 24	**	10 – 12	12 – 14	14 – 16
	750 – 1500	20 – 24	26 – 32 *	**	12 – 14	16 – 18	20 – 22
	1500 – 6000	26 – 30	32 – 40 *	**	14 – 18	18 – 22	24 – 26
	OVER 6000	30 – 32 *	36 – 44 *	**	20 – 22	24 – 26	26 – 28
65–70 mph	UNDER 750	18 – 20	20 – 26	**	10 – 12	14 – 16	14 – 16
	750 – 1500	24 – 26	28 – 36 *	**	12 – 16	18 – 20	20 – 22
	1500 – 6000	28 – 32 *	34 – 42 *	**	16 – 20	22 – 24	26 – 28
	OVER 6000	30 – 34 *	38 – 46 *	**	22 – 24	26 – 30	28 – 30

* Where a site specific investigation indicates a high probability of continuing crashes, or such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear-zone shown in Table 3.1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

** Since recovery is less likely on the unshielded, traversable 1V:3H slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters which may enter into determining a maximum desirable recovery area are illustrated in Figure 3.2.

TABLE 5.7 Suggested flare rates for barrier design

Design Speed km/h	[mph]	Flare Rate for Barrier inside Shy Line	Flare Rate for Barrier beyond Shy Line *	**
110	[70]	30:1	20:1	15:1
100	[60]	26:1	18:1	14:1
90	[55]	24:1	16:1	12:1
80	[50]	21:1	14:1	11:1
70	[45]	18:1	12:1	10:1
60	[40]	16:1	10:1	8:1
50	[30]	13:1	8:1	7:1

*Suggested maximum flare rate for rigid barrier system

**Suggested maximum flare rate for semi-rigid barrier system

a flat approach to the barrier from the traveled way. This is often the case on existing facilities having relatively steep embankment slopes. It should also be noted that a flatter flare rate is suggested when a barrier must be located within the shy line offset distance.

5.6.4 Length of Need

Figure 5.24 illustrates the variables that must be considered in designing a roadside barrier to shield an obstruction effectively. The primary variables are the Lateral Extent of the Area of Concern, L_A, and the Lateral Extent of the Runout Length, L_R. Both of these factors must be clearly understood by the designer to be used properly in the design process.

The Lateral Extent of the Area of Concern, L_A, is the distance from the edge of the traveled way to the far side of the fixed object or to the outside edge of the clear zone, L_C, of an embankment or a fixed object that extends beyond the clear zone. Selection of an appropriate L_A distance is a critical part of the design process and is illustrated in the examples at the end of this section.

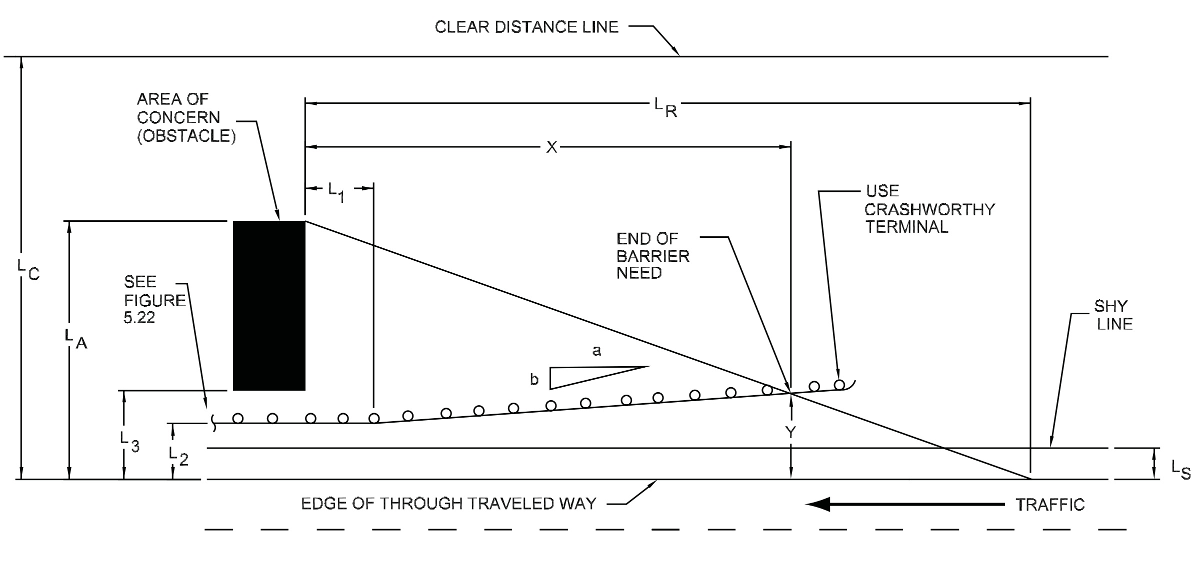
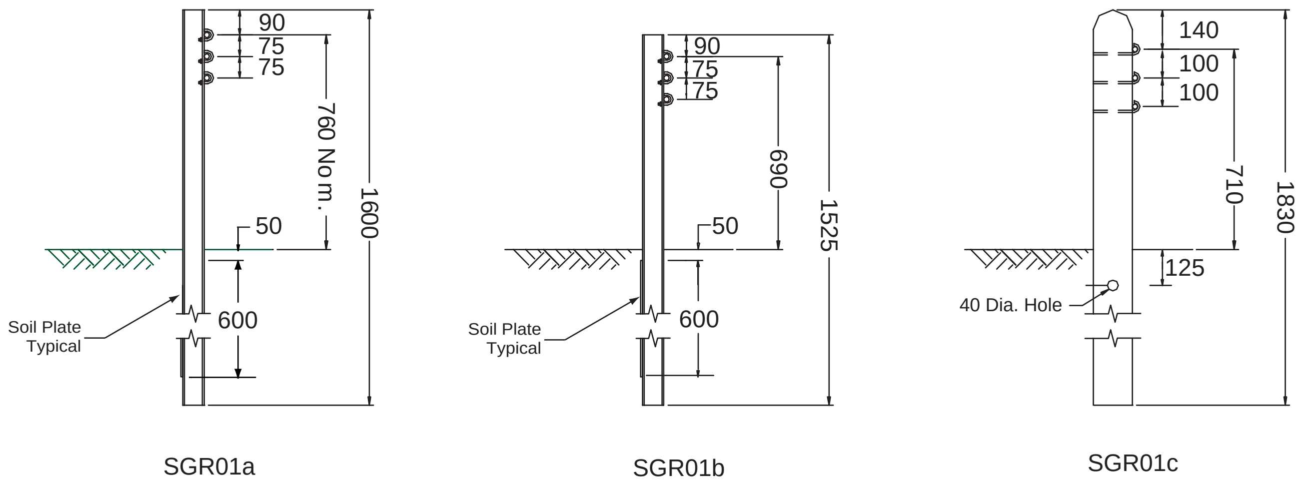


FIGURE 5.24 Approach barrier layout variables



Note: All dimensions shown are in millimeters unless otherwise noted.

FIGURE B.1a Three-strand cable (metric units)

AASHTO Designation	**SGR01b**	**SGR01b**	**SGR01c**
Post Type:	S75 x 8.5 steel	9 kg/m steel flanged channels	140-mm dia. modified wood
Post Spacing:	5000 mm	5000 mm	3800 mm
Beam Type:	19-mm dia. steel cables	19-mm dia. steel cables	19-mm dia. steel cables
Maximum Dynamic Deflection:	3.5 m	3.5 m	3.5 m

Remarks: For shallow angle impacts, barrier damage is usually limited to several posts, which must be replaced. Cable damage is rare except in severe crashes. A crashworthy end terminal is critical in each of the cable systems, both to provide adequate anchorage to develop full tensile strength in the cable and to minimize vehicle decelerations for impacts on either end of an installation.

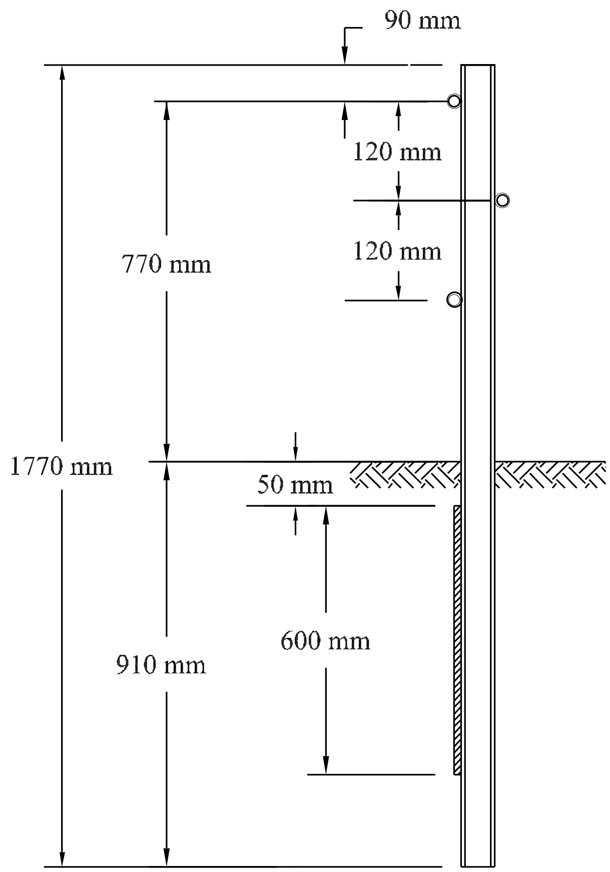


FIGURE C.1a Three-strand cable (metric units)

AASHTO Designation:	**None (The former single-strand cable "MBI" is obsolete.)**
Test Level:	TL-3
Post Type:	S75 x 8.5
Post Spacing:	4880 mm
Beam Type:	19-mm dia. steel cable
Nominal Barrier Height:	770 mm
Maximum Dynamic Deflection:	3500 mm

Remarks: Because of the high dynamic deflection for cable systems, they are not recommended for use in medians narrower than approximately 7 m. The extensive damage done during moderate to severe impacts leaves a significant length of barrier inoperative until repairs can be made. Cable median barrier systems are recommended for use on irregular terrain and on wider medians where the need is only to prevent infrequent, potentially catastrophic cross-median crashes. For proper performances it is essential that this system be installed and maintained at the correct mounting height. This system is similar to the 3-strand cable roadside barrier, except that one of the cables is mounted on the opposite side of the post from the other two. See Figure B.1 for additional remarks.

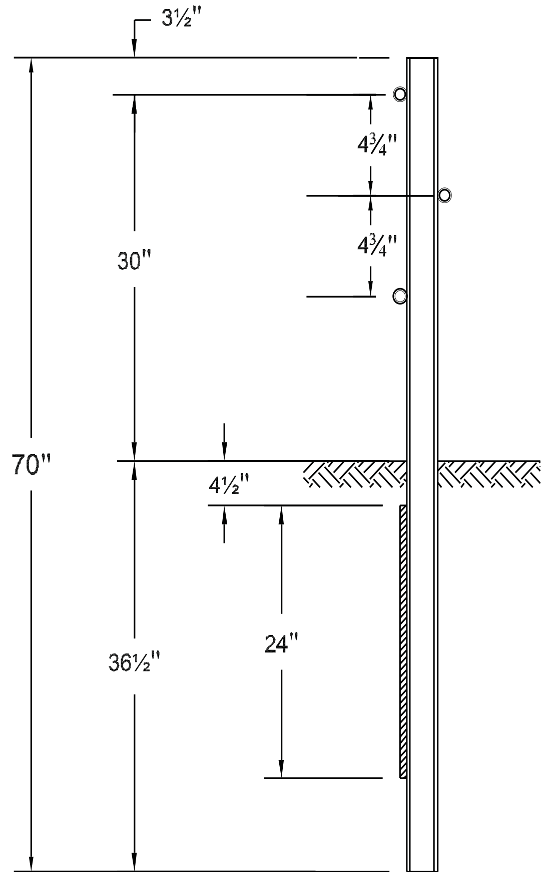


FIGURE C.1b Three-strand cable [U.S. customary units]

AASHTO Designation:	**None (The former single-strand cable "MBI" is obsolete.)**
Test Level:	TL-3
Post Type:	S3 x 5.7 Steel
Post Spacing:	16 ft
Beam Type:	$^{3}/_{4}$-in. dia. steel cable
Nominal Barrier Height:	30 in.
Maximum Dynamic Deflection:	11 ft-6 in.

Remarks: Because of the high dynamic deflection for cable systems, they are not recommended for use in medians narrower than approximately 23 feet, nor in medians which contain rigid objects. The extensive damage done during moderate to severe impacts leaves a significant length of barrier inoperative until repairs can be made. Cable median barrier systems are recommended for use on irregular terrain and on wider medians where the need is only to prevent infrequent, potentially catastrophic cross-median crashes. For proper performances it is essential that this system be installed and maintained at the correct mounting height. This system is similar to the 3-strand cable roadside barrier, except that one of the cables is mounted on the opposite side of the post from the other two. See Figure B.1 for additional remarks.

1.0 SCOPE

No mailbox or newspaper delivery box, hereinafter referred to as mailbox, will be allowed to exist on the Agency's rights-of-way if it interferes with the safety of the traveling public or the function, maintenance, or operation of the highway system. A mailbox installation not conforming to the provisions of this regulation is an unauthorized encroachment under State Code Section _____________.

The location and construction of mailboxes shall conform to the rules and regulations of the U.S. Postal Service as well as to standards established by the Agency. Agency standards for the location and construction of mailboxes are available from:

Highway Agency
Street Address or P.O. Box
City, State Zip Code
Telephone number

A mailbox installation that conforms to the following criteria will be considered acceptable unless, in the judgment of the Chief Engineer of the Agency, the installation interferes with the safety of the traveling public or the function, maintenance, or operation of the highway system.

2.0 LOCATION

No mailbox will be permitted where access is obtained from a freeway or where access is otherwise prohibited by law or regulation.

Mailboxes shall be located on the right-hand side of the roadway in the carrier's direction of travel route except on one-way streets where they may be placed on the left-hand side. The bottom of the box shall be set at an elevation established by the U.S. Postal Service, usually between 1.0 m [39 in.] and 1.2 m [48 in.] above the roadway surface. The roadside face of the box shall be offset from the edge of the traveled way a distance no less than the greater of the following:

- 2.4 m [8 ft] (where no paved shoulder exists and shoulder cross slope is 13 percent or flatter), or
- the width of the all-weather shoulder present plus 200 mm to 300 mm [8 in. to 12 in.], or
- the width of an all-weather turnout specified by the Agency plus 200 mm to 300 mm [8 in. to 12 in.].

Exceptions to the placement criteria above will exist on residential streets and certain designated rural roads where the Agency deems it in the public interest to permit lesser clearances or to require greater clearances. On curbed streets, the roadside face of the mailbox shall be set back from the face of the curb a distance between 150 mm and 300 mm [6 in. and 12 in.]. On residential streets without curbs or all-weather shoulders that carry low traffic volumes operating at low speeds, the roadside face of the mailbox shall be offset between 200 mm and 300 mm [8 in. and 12 in.] behind the edge of the pavement. On very low-volume rural roads with low operating speeds, the Agency may find it acceptable to offset mailboxes a minimum of 2 m [6 ft] from the traveled way and under some low-volume, low-speed conditions may accept clearances as low as 800 mm [32 in.].

Where a mailbox is located at a driveway entrance, it shall be placed on the far side of the driveway in the carrier's direction of travel.

Where a mailbox is located at an intersecting road, it shall be located a minimum of 30 m [100 ft] beyond the center of the intersection road in the carrier's direction of travel. This distance shall be increased to 60 m [200 ft] when the average daily traffic on the intersection road exceeds 400 vehicles per day.

Where a mailbox is installed in the vicinity of an existing guardrail, it should, wherever practical, be placed behind the guardrail.

3.0 STRUCTURE

Mailboxes shall be of light sheet metal or plastic construction conforming to the requirements of the U.S. Postal Service. Newspaper delivery boxes shall be of light metal or plastic construction of minimum dimensions suitable for holding a newspaper.

No more than two mailboxes may be mounted on a support structure unless crash tests have shown the support structure and mailbox arrangement to be safe. However, lightweight newspaper boxes may be mounted below the mailbox on the side of the mailbox support.

Mailbox supports shall not be set in concrete unless crash tests have shown the support design to be safe.

A single 100 mm x 100 mm [4 in. x 4 in.] square or 100 mm [4 in.] diameter wooden post; or metal post, Schedule 40, 50 mm [2 in.] (nominal size IPS)(external diameter 60 mm [2 $^3/_8$ in.]) (wall thickness 4 mm [0.154 in.] or smaller), embedded no more than 600 mm [24 in.] into the ground, shall be acceptable as a mailbox support. A metal post shall not be fitted with an anchor plate, but it may have an anti-twist device that extends no more than 250 mm [10 in.] below the ground surface.

The post-to-box attachment details should be of sufficient strength to prevent the box from separating from the post top if the installation is struck by a vehicle. The exact support hardware dimensions and design may vary, such

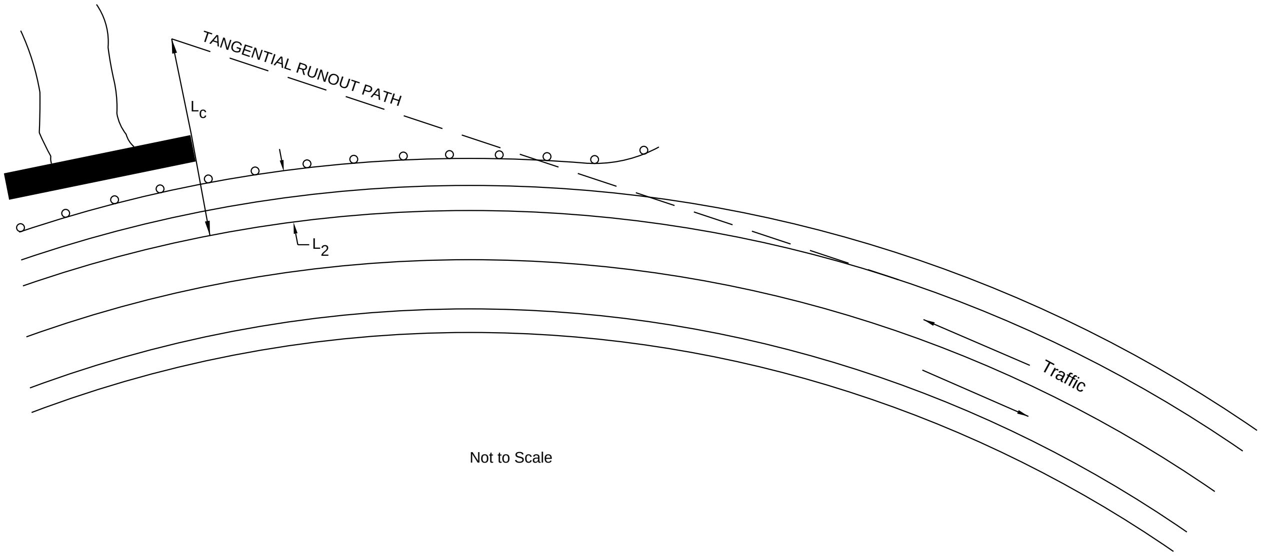


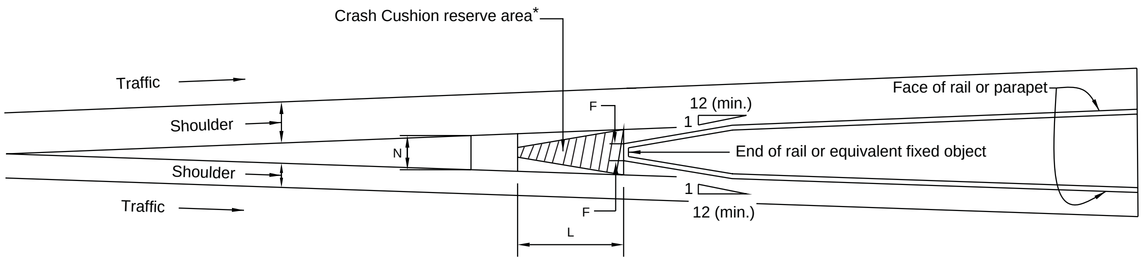
FIGURE 5.32 Example of barrier design for fixed object on horizontal curve [U.S. customary units]

Given: ADT = 650 vpd
Speed = 100 km/h [60 mph]
Embankment slope = 1V:6H
Horizontal curvature = 450 m [1,475 ft] radius

Select: Clear Zone, L_C = 5.0–5.5 m [16–18 ft] (Table 3.1)
(5.5 m [18 ft] chosen by designer)
Adjustment factor for curvature = 1.4 (Table 3.2)
Adjusted clear zone = (5.5) (1.4) = 7.7 m or (18) (1.4) = 25 ft
Runout length, L_R = not applicable (see discussion below)
Barrier offset, L_2 = 1.2 m [4 ft]
Flare rate: not applicable

Discussion: The length of need formula for a traffic barrier is applicable to straight highway alignment only. A vehicle leaving the road on the outside of a curve will generally follow a tangential runout path if the area outside the roadway is flat and traversable. Thus, rather than using the theoretical L_R distance to determine a barrier length of need, a line from the outside edge of the obstacle (or from the outside edge of the clear zone if a continuous non-traversable terrain feature, such as the stream bed shown in Figure 5.32, is being shielded) to a point tangent to the curve should be used to determine the appropriate length of barrier needed. If this distance, measured along the roadway, is shorter than L_R, it should be used to determine the appropriate length of barrier to install. If L_R is shorter, as might be the case on a flat curve, the L_R distance should be used to determine the appropriate barrier length. The barrier length then becomes a function of the distance it is located from the edge of the driving lane and can most readily be obtained graphically by scaling. A flare rate is not generally used along a horizontal curve.

TABLE 8.4 Reserve areas for gores



* No curbs, raised pavement, or prows to be built or to remain in the area surrounding or occupied by the crash cushion

Design Speed on Main line (km/h)	Dimensions for Crash Cushion, Reserve Area (meters)								
	Minimum						Preferred		
	Restricted Conditions			Unrestricted Conditions					
	N	L	F	N	L	F	N	L	F
50	2	2.5	0.5	2.5	3.5	1	3.5	5	1.5
80	2	5	0.5	2.5	7.5	1	3.5	10	1.5
110	2	8.5	0.5	2.5	13.5	1	3.5	17	1.5
130	2	11	0.5	2.5	17	1	3.5	21	1.5

Design Speed on Main line [mph]	Dimensions for Crash Cushion, Reserve Area [feet]								
	Minimum						Preferred		
	Restricted Conditions			Unrestricted Conditions					
	N	L	F	N	L	F	N	L	F
30	6	8	2	8	11	3	12	17	4
50	6	17	2	8	25	3	12	33	4
70	6	28	2	8	45	3	12	55	4
80	6	35	2	8	55	3	12	70	4

in many cases, play an important role in the selection process. Pertinent maintenance characteristics of each crash cushion are summarized in Table 8.5. This information is based primarily on subjective evaluations. Where available, individual agency maintenance records should be used to establish costs associated with the types of crash cushions in actual use. Although the information in Table 8.5 will permit a designer to compare the relative maintenance characteristics of candidate systems, there is no substitute for knowing the actual maintenance requirements and costs for in-service installations. Each agency should document this information so it is available to the designer.

Maintenance characteristics can conveniently be categorized as regular (or routine) maintenance, crash maintenance, and material storage requirements. Each of these categories is discussed in the following paragraphs.

Most systems described in this chapter require relatively little regular or routine maintenance. However, it is important that periodic maintenance checks are performed and recorded to ensure that each installed unit remains fully functional. If a crash cushion is located in an area

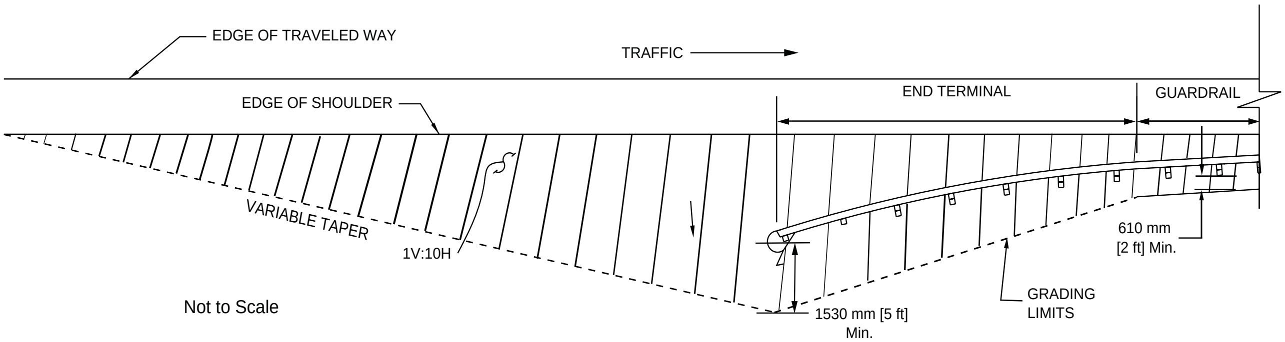
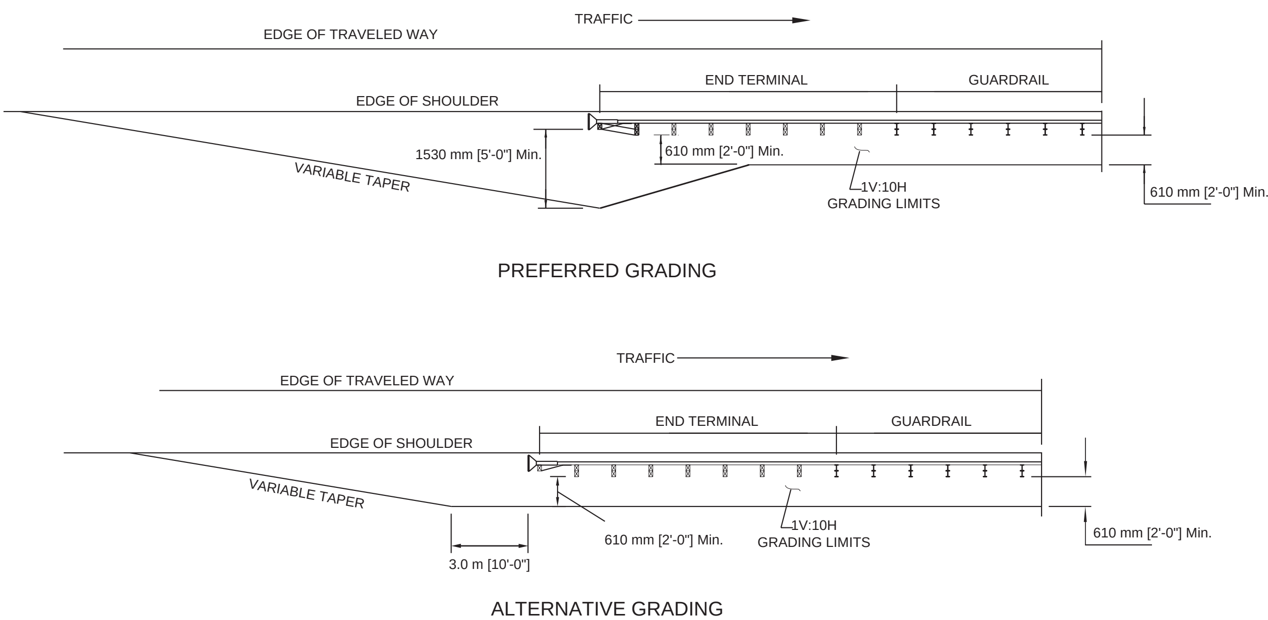


FIGURE 8.1 Grading for flared guardrail end treatment



*The preferred grading layout should be used wherever practical. However, because of site limitations, when upgrading an existing terminal with a crashworthy terminal meeting NCHRP Report 350 criteria, the alternative grading layout may be used.

Not to Scale

FIGURE 8.2 Grading for non-flared guardrail end treatment