ROADSIDE BARRIER DESIGN

ORDER OF PREFERENCE

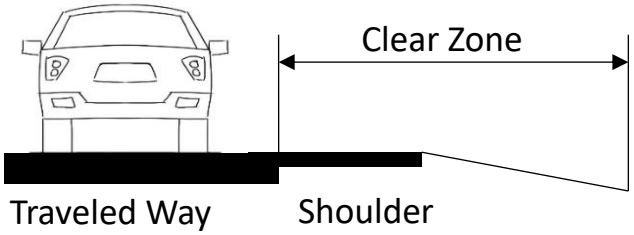
1. Remove the obstacle.
2. Redesign the obstacle so it can be safely traversed.
3. Relocate the obstacle to a point where it is less likely to be struck.
4. Reduce impact severity by using an appropriate breakaway design.
5. Shield the obstacle with a longitudinal traffic barrier designed for redirection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

Ref: AASHTO ROADSIDE DESIGN GUIDE, 4th EDITION, Pg 1-4

CLEAR ZONE DEFINITION

The unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery of errant vehicles. The clear zone includes shoulders, bike lanes, and auxiliary lanes, except those auxiliary lanes that function like through lanes.

Ref: AASHTO ROADSIDE DESIGN GUIDE, 4th EDITION, Glossary



BARRIER WARRANTS

Obstacle	Guidelines
Bridge piers, abutments, and railing ends	Shielding generally needed.
Boulders	Judgment decision based on nature of fixed object and likelihood of impact.
Culverts, pipes, headwalls	Judgment decision based on size, shape and location of obstacle.
Foreslopes and backslopes (smooth)	Shielding not generally required.
Foreslopes and backslopes (rough)	Judgment decision based on likelihood of impact.
Ditches (parallel)	Refer to Figures 3-6 and 3-7 in Roadside Design Guide.
Ditches (transverse)	Shielding generally required if likelihood of head-on impact is high.
Embankment	Judgment decision based on fill height and slope (see Figure 5-1 in Roadside Design Guide).
Retaining Walls	Judgment decision based on relative smoothness of wall and anticipated maximum angle of impact.
Sign/Luminaire supports	Shielding generally required for non-breakaway supports.
Traffic signal supports	Isolated traffic signals within clear zone on high-speed rural facilities may need shielding.
Trees	Judgment decision based on site-specific circumstances
Utility poles	Shielding may be needed on a case by case basis.
Permanent bodies of water	Judgment decision based on location and depth of water and likelihood of encroachment.

Ref: AASHTO ROADSIDE DESIGN GUIDE, 4th EDITION – TABLE 5.2, Pg. 5-9

DESIGN CLEAR ZONE DISTANCE

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	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

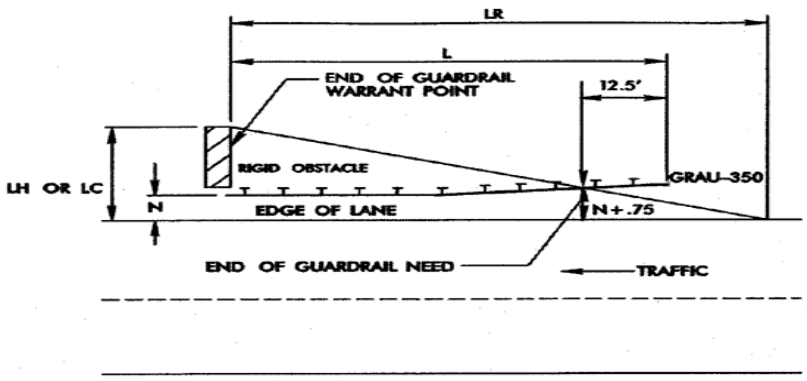
* Clear zone distances can be limited to 30 feet unless in a high accident rate area.

Ref: NCDOT Roadway Design Manual, Part I.

BARRIER DESIGN PRINCIPLES

1. **Deflection Distance** – The distance from the face of barrier to rigid obstacle; NCDOT standard for guardrail 3'-6" min. and 5'-6" desirable. (See Standard 862.01 for diagram and stiffening). For High Tension Cable Barrier (HTCB) refer to Manufacturer.
2. **Slope in Front of Barrier** – The slope in front of w-beam guardrail shall be 10:1 or flatter. High tension cable barrier (HTCB) can be placed on 6:1 (or even 4:1) slopes with restrictions.
3. **Guardrail and Curbs** – The combination of curbs and guardrail on high speed roadways is not desirable. When necessary at high speed locations (45 mph or greater), a 6" curb with face of curb no more than 6" in front of face of rail may be used.
4. **Soil Backing** – A flat area (10:1) of 2.0 feet measured from the back of post should be provided. See standard XXX for special applications including an 8' long steel post up to 18" beyond the breakpoint (to back of post). Note additional deflection needed.
5. **Flare rate** – Refer to Table below.

LENGTH OF NEED (LON) CALCULATION



LH =

LC = Clear Zone Distance

LR =

N =

Calculate the Length of Need (L) from the following equation for straight or nearly straight sections of the roadway:

$$L = \frac{LH - (N + 0.75)}{LH/LR} + 12.50$$

For two way traffic use the centerline as edge of travelway for determining clear zone and length of need for the opposite direction.

Add 12' to the LON calculated to account for each terminal. If one way traffic, add an End Anchor beyond the end of needed effective barrier. Subtract out from LF of guardrail any effective barrier that is paid for under another item such as bridge rail.

SUGGESTED FLARE RATES

RUNOUT LENGTHS

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

Ref: AASHTO ROADSIDE DESIGN GUIDE, 4th EDITION – TABLE 5.10 & 5.7

Design Speed (mph)	Flare Rate for Barrier Inside the Shy Line	Flare Rate for Barrier at or Beyond Shy Line	
		Rigid Barrier	Semi-Rigid Barrier
70	30:1	20:1	15:1
60	26:1	18:1	14:1
55	24:1	16:1	12:1
50	21:1	14:1	11:1
45	18:1	12:1	10:1
40	16:1	10:1	8:1
30	13:1	8:1	7:1

If the barrier can be flared – only over flat ground – see the AASHTO Roadside Design Guide section on Length of Need for the formula including a flared layout

REF: AASHTO ROADSIDE DESIGN GUIDE, 4th EDITION – TABLE 5.9