ROADSIDE

BARRIER DESIGN

Illinois Department of Transportation

ORDER OF PREFERENCE

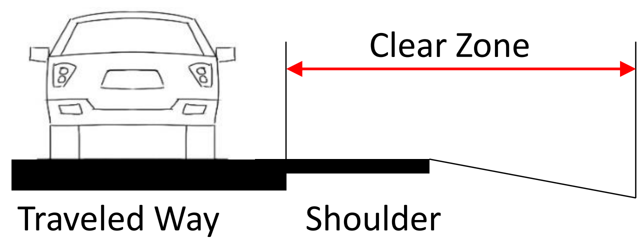
- Eliminate the hazard (flatten embankment, remove rock outcroppings, etc.);
- Redesign the hazard so it can be safely traversed (e.g., culvert grating);
- Relocate the hazard to a point where it is less likely to be struck;
- Where applicable, make the hazard breakaway (sign posts, luminaire supports);
- Shield the hazard with a roadside barrier;
- Delineate the hazard; or
- Do nothing

Ref: BDE Manual, Ch. 38-4.02. Range of Treatments

CLEAR ZONE DEFINITION

The area provided beyond the edge of through traveled way for the recovery of errant vehicles, which ideally should be kept clear of any non-traversable hazards or fixed objects. The clear zone includes shoulders, bike lanes, and auxiliary lanes, except those auxiliary lanes that function like through lanes.

Ref: BDE Manual, Ch. 38-2. Definitions



BARRIER GUIDELINES

38-4.01 Examples of Roadside Hazards

- non-breakaway sign supports, non-breakaway luminaire supports, traffic signal poles, and <u>railroad signal poles</u>;
- concrete footings, traffic signal foundations, etc., extending more than 4 in (100 mm) above the ground;
- bridge piers and abutments at underpasses;
- culvert headwalls;
- trees with diameters greater than 4 in (100 mm) (at maturity);
- rough rock cuts;
- large boulder;
- critical parallel slopes (i.e., embankments);
- streams or permanent bodies of water (where the depth of water ≥ 2 ft (600 mm));
- non-traversable ditches
- utility poles or towers;
- drainage appurtenances; and
- transverse slopes.

Ref: BDE Manual, Ch. 38-4.01 Examples of Roadside Hazards

DESIGN CLEAR ZONE DISTANCE

Design Speed (mph)	Design ADT	Front Slopes			Back Slopes		
		1V:6H or flatter	1V:5H to 1V:4H	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
≤40	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	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	18-20	24-28	**	14-16	18-20	20-22
55	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	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[a]	36-44[*]	**	20-22	24-26	26-28
65-70[6]	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

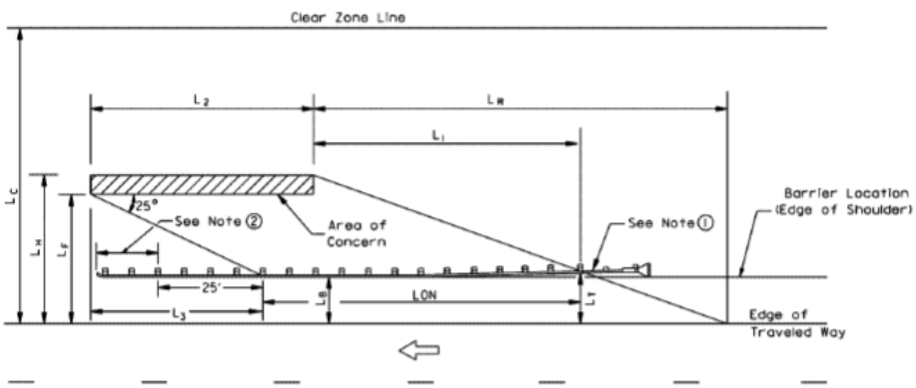
RECOMMENDED CLEAR ZONE DISTANCES
NEW CONSTRUCTION/RECONSTRUCTION

Ref: BDE Manual Chp. 38-3 Roadside Clear Zones

BARRIER DESIGN PRINCIPLES

1. **Deflection Distance** – The distance from the back of barrier to rigid obstacle; BDE Manual. Figure 38-6.V. Deflection Distance by Guardrail Type. For High Tension Cable Barrier Systems refer to Manufacturer.
2. **Slope in Front of Barrier** – The slope in front of guardrail and concrete barrier shall be 10:1 or flatter. High tension cable barrier 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 (greater than 45 mph), a 6” curb with face of curb no more than 6” in front of face of rail may be used. IDOT Standard No. 630001-12, SH 4. Less restrictive for speeds 45 mph and less.
4. **Soil Backing** –A flat sloped embankment of 2 feet measured from the back of post should be provided. See IDOT Standard No. 630001-12, SH 1. If < 2 feet, follow NOTE on standard.
5. **Flare rate** – Refer to Table below.

LENGTH OF NEED (L_1) CALCULATION BY FORMULA



L_T = Distance to barrier at the third post of the terminal
L_B = Distance to the barrier
L_C = Distance to the Clear Zone
L_H = Distance to the back of the hazard
L_F = Distance to the front of the hazard
L_R = Runout length
L_1 = Length of need for the approach end
L_2 = Length of the hazard
L_3 = Distance from the downstream end of the hazard
LON = Length of need

Calculate the Length of Need (L_1) from the following equation:

$$L_1 = \frac{L_H + \left(\frac{b}{a}\right)(L_P) - L_T}{\left(\frac{b}{a}\right) + \left(\frac{L_H}{L_R}\right)}$$

Flared Installation

$$L_1 = \frac{L_H - L_T}{\left(\frac{L_H}{L_R}\right)}$$

Parallel Installation

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

If one way traffic, add 25’ of guardrail plus a Terminal Type 2 (L_3) beyond the end of needed effective barrier.

Subtract out from guardrail length any effective barrier that is paid for under another item such as End Treatment (TBT Type 1), Bridge Rail, or Guardrail Transition (TBT Type 6).

Design Speed		Traffic Volume (ADT)*							
		Over 10,000		5000-10,000		1000-4999		Under 1000	
		Runout Length L_R		Runout Length L_R		Runout Length L_R		Runout Length L_R	
mph	(km/h)	ft	(m)	ft	(m)	ft	(m)	ft	(m)
75	(130)	415	(127)	380	(116)	335	(102)	290	(86)
70	(110)	360	(110)	330	(101)	290	(88)	250	(76)
60	(100)	300	(91)	250	(76)	210	(64)	200	(61)
55	(90)	265	(81)	220	(67)	185	(57)	175	(54)
50	(80)	230	(70)	190	(58)	160	(49)	150	(46)
45	(70)	195	(60)	160	(49)	135	(42)	125	(38)
40	(60)	160	(49)	130	(40)	110	(34)	100	(30)
30	(50)	110	(34)	90	(27)	80	(24)	70	(21)

**Based on a 10 year projection from the anticipated date of construction.*

RUNOUT LENGTHS (L_R) FOR BARRIER DESIGN

Figure 38-6.E

Design Speed		Flare Rate for Barrier Inside Shy Line*	Flare Rate for Barrier Beyond Shy Line*		
(mph)	(km/h)		Rigid (Concrete)	Semi-Rigid (W-Beam)	Flexible (Cable)
70	110	1:30	1:20	1:7 (15:1**)	1:50
60	100	1:26	1:18	1:7 (14:1**)	1:50
55	90	1:24	1:16	1:7 (12:1**)	1:50
50	80	1:21	1:14	1:7(11:1**)	1:50
45	70	1:18	1:12	1:7(10:1**)	1:50
40	60	1:16	1:10	1:7 (8:1**)	1:50
30	50	1:13	1:8	1:7 (7:1**)	1:50

**See Figure 38-6.R for shy line distances.*

***Use these flare rates as maximum if the barrier is set in a rock formation, or in a paved area with a paved thickness exceeding 8 in (200 mm).*

MAXIMUM FLARE RATES FOR BARRIER DESIGN

Figure 38-6.V