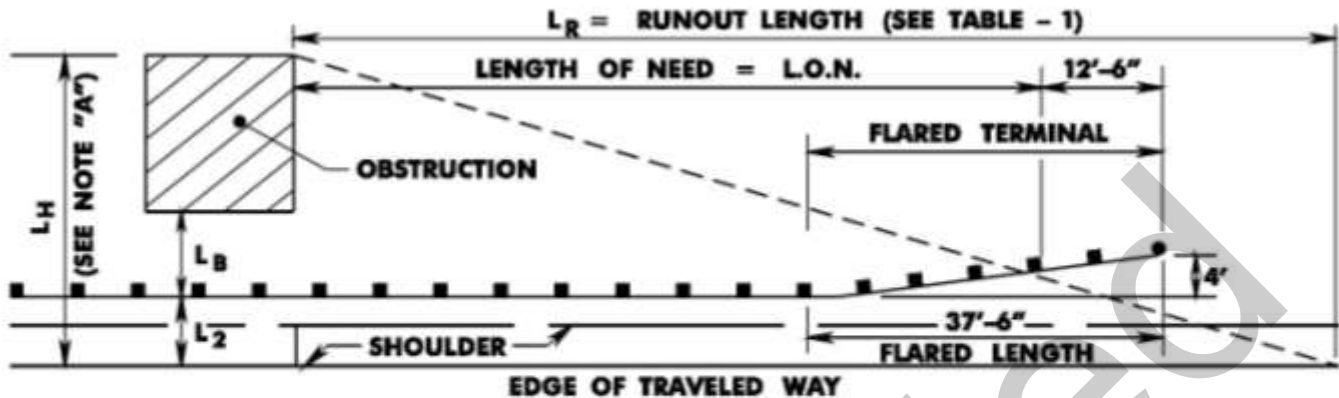


APPROACH LENGTH OF NEED ON EMBANKMENT (FILL) SLOPE

FIGURE: 8-E

BDC13MR-04



DESIGN SPEED (M.P.H.)	TRAFFIC VOLUME (A.D.T.)				SHY LINE OFFSET (FEET)	STRAIGHT FLARE RATE
	OVER 10,000	5,000-10,000	1,000-5,000	UNDER 1,000		
70	360	330	290	250	9	15:1
60	300	250	210	200	8	14:1
55	265	220	185	175	7	12:1
50	230	190	160	150	6.5	11:1
45	195	160	135	125	6	10:1
40	160	130	110	100	5	8:1
30	110	90	80	70	4	7:1

STEP 1. DETERMINE THE REQUIRED L.O.N. FOR 37' 6" FLARED TERMINAL AT 4' OFFSET

$$L.O.N. = \frac{L_R (L_H - L_2 - 2.7)}{L_H}$$

NO FLARE (TANGENT TERMINAL)

$$L.O.N. = \frac{L_H - L_2}{L_H / L_R}$$

NOTE A: If obstruction extends beyond clear zone, make L_H equal to clear zone, except if obstruction is critical slope, See Figure 8-H.

NOTE B: If roadway is curved, draw layout to scale and obtain L.O.N. directly by scaling from drawing.

STEP 2. Increase L.O.N. to nearest multiple of 12'-6", which is the length of one rail element.

STEP 3. Add an additional 12'-6" to get required L.O.N. including the flared or tangent terminal.

STEP 4. Compare the required length in Step 3 to the minimum functional length shown in Table 2 and to the suggested recovery area (A) in Table 1 Figure 8-D. Use the greater of the three lengths.

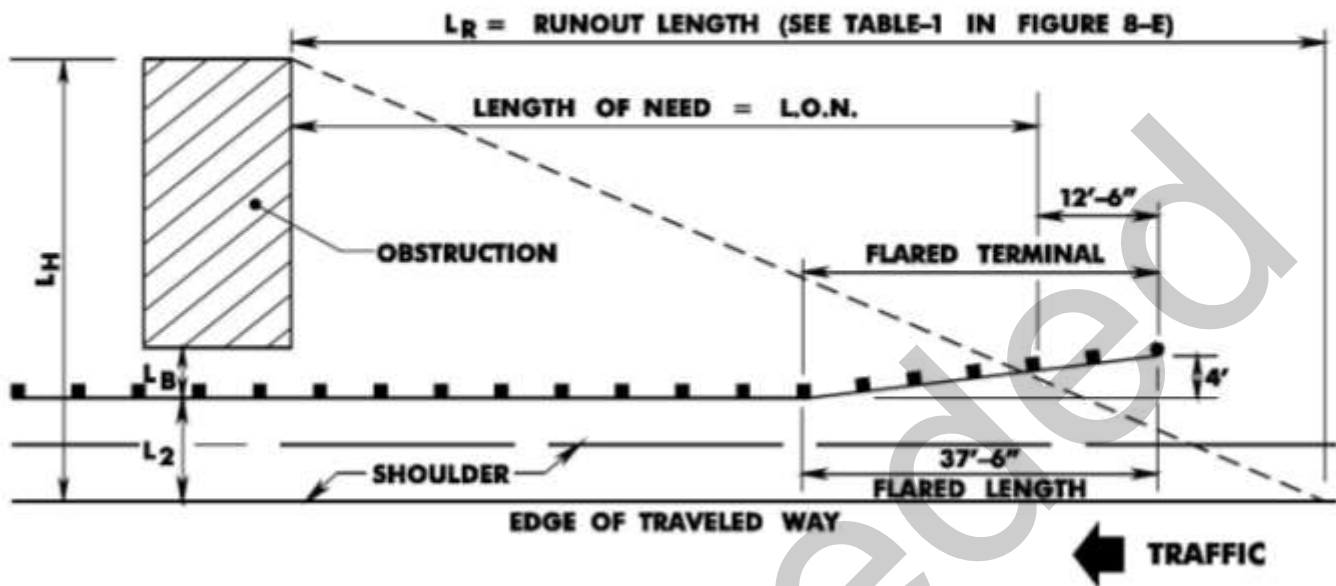
DISTANCE FROM BACK OF RAIL ELEMENT TO OBSTRUCTION (L_B)	MINIMUM FUNCTIONAL LENGTH	
	FLARED TERMINAL	TANGENT TERMINAL
$L_B \geq 4'$	50'-0"	50'-0"
$2' \leq L_B < 4'$	50'-0"	62'-6"
$L_B < 2'$	62'-6"	75'-0"
THREE BEAM ATTACHMENT	56'-3"	68'-9"
W-BEAM ATTACHMENT	62'-6"	75'-0"

NOTE C: The total length of a freestanding guide rail installation including approach and trailing end treatments should not be less than 62'-6".

EXAMPLE OF APPROACH LENGTH OF NEED ON EMBANKMENT (FILL) SLOPES

FIGURE: 8-G

BDC13MR-04



EXAMPLE

DESIGN SPEED = 70 M.P.H.

TANGENT ROADWAY

A.D.T. = 7000

L_B = 4'

L_H = 22'

L_R = 330'

L₂ = 16'

STEP 1.
$$L.O.N. = \frac{L_R (L_H - L_B - 2.7')}{L_H}$$

$$L.O.N. = \frac{330' (22' - 16' - 2.7')}{22'}$$

$$L.O.N. = 49.5'$$

STEP 2. Increase 49.5' to nearest multiple of 12'-6", L.O.N. = 50'.

STEP 3. Add an additional 12'-6" to get required L.O.N. including flare terminal, use L.O.N.-plus-flare terminal = 62.5'.

STEP 4. From Table 1, Figure 8-D and Table 2, Figure 8-E, the minimum length = 75'. Since L.O.N.-plus-flare terminal is less than 75', use 75'.

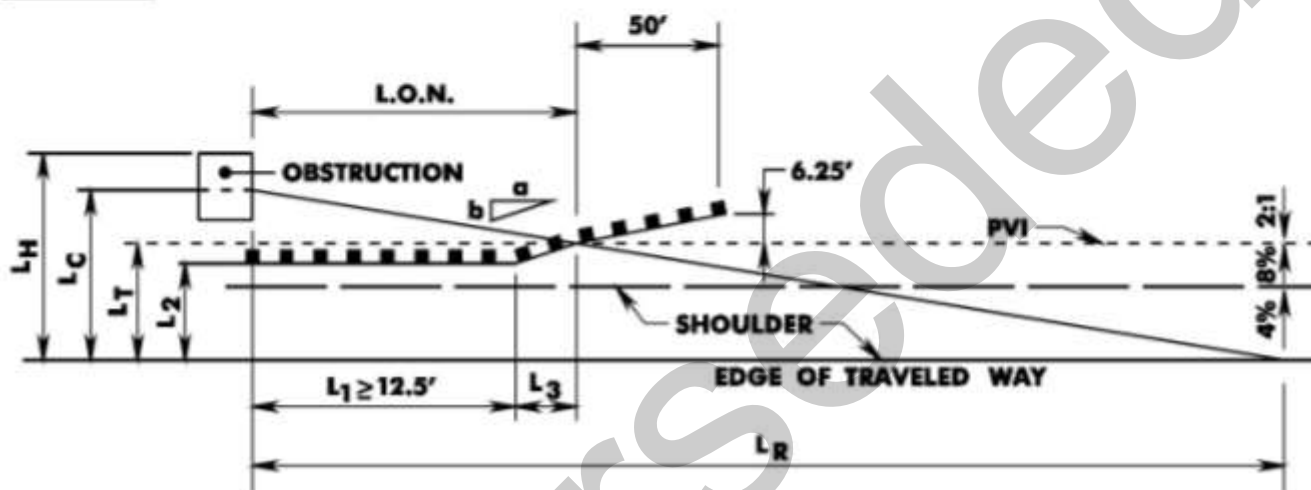
APPROACH LENGTH OF NEED IN CUT SECTIONS

FIGURE: 8-M

BDC13MR-04

Where an obstruction is encountered in a cut section and it is to be shielded with guide rail, it is desirable that the length of need (L.O.N.) end at the PVI. See Figure 8-N. In order to accomplish this, the length of guide rail (L_1) parallel to the PVI must be obtained. The following example shows how the L.O.N. is computed:

EXAMPLE



$V = 60$ M.P.H.

A.D.T. = 6,000

$L_2 = 16$ FEET

$L_H = 32$ FEET

$L_R = 250'$ (FROM FIGURE 8-E, TABLE-1)

$L_T = 19$ FEET

$\alpha b = 14:1$ STRAIGHT FLARE (FROM FIGURE 8-E, TABLE-1)

$L_C = 30$ FEET (FROM FIGURE 8-A, $L_C = 26'$ TO $30'$) FOR 8% FILL SLOPE

IF $L_H > L_C$ USE L_C IN FORMULA BELOW, IF $L_H < L_C$, REPLACE L_C WITH L_H IN FORMULA BELOW

$$L_1 = L_R - (L_R L_T / L_C) - \alpha b (L_T - L_2)$$

$$L_1 = 250 - (250 \times 19 / 30) - 14 / 1 (19 - 16) = 49.7'$$

$49.7' / 6.25'$ POST SPACING = 7.95 POSTS, THEREFORE, USE 8 POSTS AT $6.25' = 50.0$ FT. = L_1

FLARE LENGTH $L_3 = (L_T - L_2) \alpha b = (19 - 16) 14 / 1 = 42$ FT.

$42' / 6.25'$ POST SPACING = 6.72 POSTS, THEREFORE, USE 7 POSTS AT $6.25' = 43.75$ FT. = L_3

L.O.N. = 50.0 FEET + 43.75 FEET = 93.75 FEET

FROM TABLE 1, FIGURE 8-D MINIMUM RECOVERY AREA = $75'$

SINCE L.O.N. IS GREATER THAN $75'$, USE L.O.N. = $93.75'$