SOLUTION TO CLASS EXERCISE #3 - NE QUADRANT

GUARDRAIL WORKSHEET

(REV. 7-2017)

FOR APPROACH TERMINALS ON R-61-SERIES AND R-62-SERIES

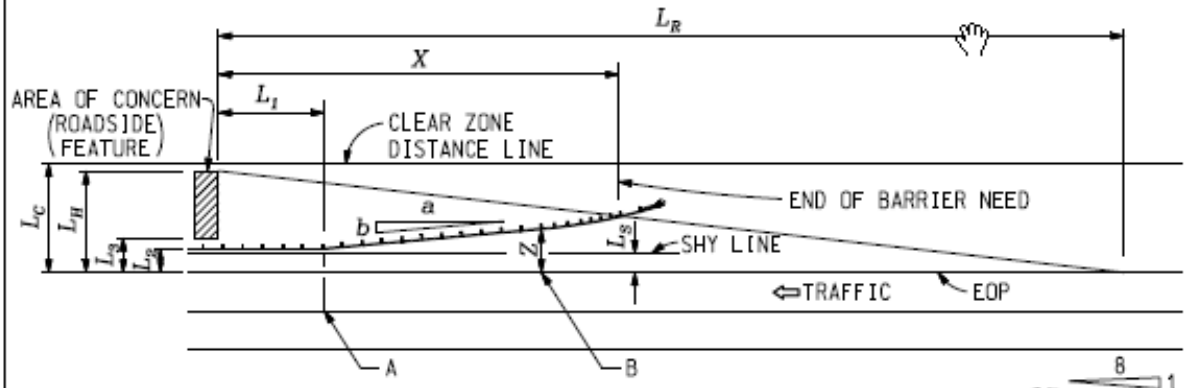
ROUTE Rural Road (Exercise #3) CONTROL SECTION 99999 JOB # EXAMPLE

DESIGNED BY ABC DATE 00/01/18 CHECKED BY XYZ DATE 00/01/18

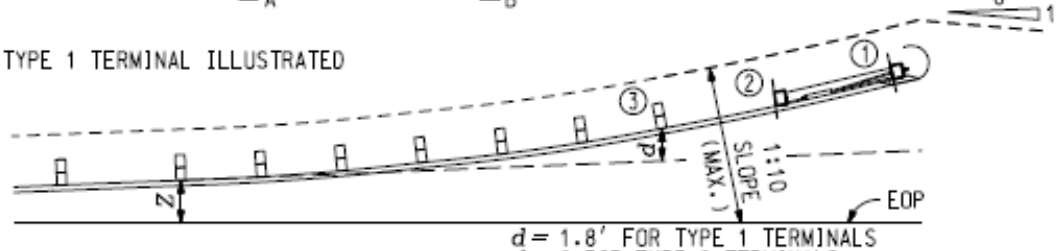
APPROX. STATION OR M.P 346+78 DESCRIPTION Class Exercise #3

GUARDRAIL RUN # NE Quad

IF STATIONING IS NOT AVAILABLE, LOCATE TO NEAREST FIXED OBJECT



NOTE: TYPE 1 TERMINAL ILLUSTRATED



$d = 1.8'$ FOR TYPE 1 TERMINALS
$d = 0$ FOR TYPE 2 TERMINALS

$$X = \frac{L_H + (\frac{b}{a})(L_1) - (L_2 + d)}{\frac{b}{a} + \frac{L_H}{L_R}}$$

$$X = \frac{L_H - (L_2 + d)}{\left(\begin{smallmatrix}\text{No Flare}\\ \text{or Type 2}\\ \text{Terminals}\end{smallmatrix}\right)\frac{L_H}{L_R}}$$

$$Z = (X - L_1 - 25)(\frac{b}{a}) + L_2$$

$Z = L_2$ (For Type 2 Terminals)

LENGTH OF NEED	X = 113.76'	DESIGN ADT	5,000 vpd
RUNOUT LENGTH (7.01.19)	L_R = 185'	DESIGN SPEED	55 mph
GUARDRAIL TAPER RATE (R-59-SERIES)	$\frac{b}{a}$ = 1/12	APPROACH SLOPE	1:5
E.O.P. TO FACE OF BARRIER (DESIGNED)	L_2 = 4'		
CLEAR ZONE (7.01.11)	L_C = 30'	L_1 = 23.125'	' MIN.)
E.O.P. TO ROADSIDE FEATURE (MEASURED)	L_3 = 4'	L_S = 7'	SHY LINE (7.01.18)
EFFECTIVE TURNED OUT DISTANCE OF ANCHORAGE	d = 0	STATION AT A	347+01.1
LATERAL EXTENT OF ROADSIDE FEATURE (MEASURED)	L_H = 30'	STATION AT B	347+66.8
LATERAL OFFSET AT END OF FLARE	Z = 9.47' **		

NOTE: DISTANCE OF OBJECT FROM BACK OF BARRIER MUST BE GREATER THAN THE MAXIMUM DEFLECTION (7.01.20)

$L_H \leq L_C$

** Refer to Calculations and Notes

REFER TO STANDARD PLAN R-59-SERIES AND DESIGN MANUAL SECTION 7.01.30 FOR GUARDRAIL AT EMBANKMENTS

SHEET 1 OF 2

(REV. 7-2017)

PROPOSED TREATMENT

CALCULATIONS OR NOTES

***** Calculations and notes shown on the following sheets *****

PAY ITEMS

65.625 Ft * Guardrail, Type MGS-8

_1_ Ea Guardrail Anchorage, Bridge, Det T-1

_____ Ft Bridge Railing, Thrie Beam Retrofit

_1_ Ea Guardrail Approach Terminal, Type 2M

_____ Ea Guardrail Departing Terminal, Type ___

__6_ Ea Guardrail Reflector

_____ Cyd Embankment, LM

* FOR THIS PAY ITEM, THE GUARDRAIL APPROACH TERMINAL, TYPE ___ PORTION OF LENGTH OF NEED (X) MUST BE DEDUCTED

DEDUCTION TABLE		
	GUARDRAIL APPROACH TERMINAL	
	TYPE 1	TYPE 2
GUARDRAIL TYPE B	25'	37.5'
GUARDRAIL TYPE T	31.25'	43.75'
GUARDRAIL TYPE MGS-8**	N/A	34.3'

PAY LENGTHS MUST BE DIVISIBLE BY 12.5'. ROUND TO NEXT HIGHEST RAIL LENGTH, EXCEPT WHEN ATTACHING GUARDRAIL APPROACH TERMINAL TYPES 1B AND 2B, RESPECTIVELY, TO GUARDRAIL, TYPE MGS-8.

** NOTE:
DEDUCTION VALUE PROVIDED FOR GUARDRAIL, TYPE MGS-8 IS ONLY APPLICABLE WHEN USING A MASH-COMPLIANT GUARDRAIL APPROACH TERMINAL (I.E., GUARDRAIL APPROACH TERMINAL, TYPE 2M). USE DEDUCTIONS VALUES FOR GUARDRAIL APPROACH TERMINAL TYPES 1B AND 2B, RESPECTIVELY, WHEN ATTACHING NCHRP 350-COMPLIANT GUARDRAIL APPROACH TERMINALS (I.E., GUARDRAIL APPROACH TERMINAL TYPES 1B AND 2B, RESPECTIVELY) TO TYPE MGS-8 GUARDRAIL.

Class Exercise #3 – NE Quadrant
Calculations and Notes

Length of Need (X)

$$X = \frac{30 + \left(\frac{1}{12}\right) \times (23.125) - 4}{\left(\frac{1}{12}\right) + \left(\frac{30}{185}\right)} = 113.76'$$

Guardrail Length

Using a Guardrail Approach Terminal, Type 2M with Guardrail, Type MGS-8 in this case

$\therefore$ Min. Guardrail Length = 113.76’ – 23.125’ – 34.3’ = 56.34’

However, the MGS (9’-4.5”) beam element and thrie-beam transition panel must be considered due to T-1 anchorage

$\therefore$ # of 12.5’ panels = ($\frac{56.34-9.375-6.25}{12.5}$) = 3.26 $\rightarrow$ 4 panels

Type MGS-8 guardrail length = (12.5)(4) + 9.375 + 6.25

= 65.625 feet

Reflectors

# of reflectors = $(\frac{65.625 + 23.125}{50})$ +1 = 2.78 → round up to 3

**** But two-way roads require reflectors facing both sides ****

∴ # of reflectors = 3 x 2 = 6 reflectors

Stations

Station A = (346+78) + 23.125' ≈ 347+01.1

Station B = (346+78) + 23.125 + 65.625' ≈ 347+66.8

Calculating Z

$Z_{formula}$ = (113.76 – 23.125 – 34.3) × $(\frac{1}{12})$ + 4 = 8.69'

Z_{actual} = L_2 + $(Distance_{B-A}) \times (\frac{b}{a})$

= 4 + (65.625) × $(\frac{1}{12})$ = 9.47'