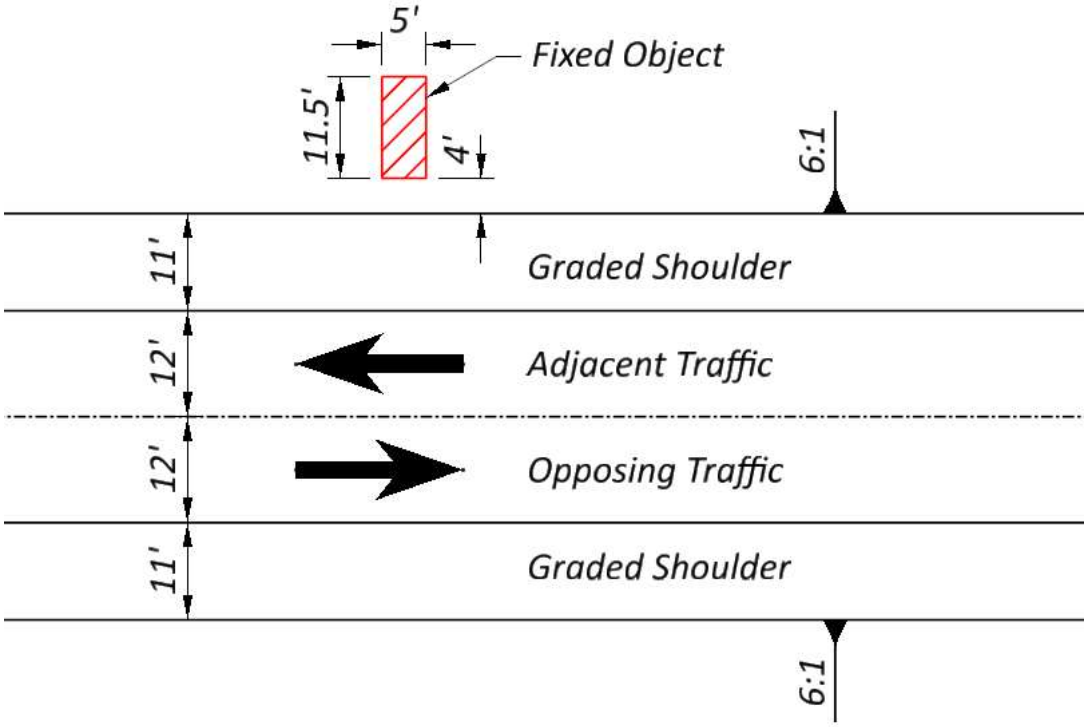
SAMPLE CALCULATIONS

Ex. 602-1

Tangent Barrier Design For a 2-Lane Road

Problem 1: Design barrier if needed to shield the fixed object located on the two-lane rural collector shown below. The project has a design speed of 60 mph, a design year traffic volume of 2,200 ADT, and a 6:1 foreslope. Assume that the object cannot be removed, relocated, or made traversable.



Solution 1: **Step 1** – Determine whether the fixed object is in the clear zone for adjacent traffic. Refer to **Figure 600-1** (for 6:1 or flatter foreslope, 60 mph design speed, and 1,501 ≤ ADT ≤ 6,000) to determine that the required clear zone distance is 28 feet.

The available clear area for adjacent traffic is 11’ + 4’ = 15’

Since the object cannot be removed, relocated, or made traversable and it is inside the required clear zone, a barrier should be installed to shield it.

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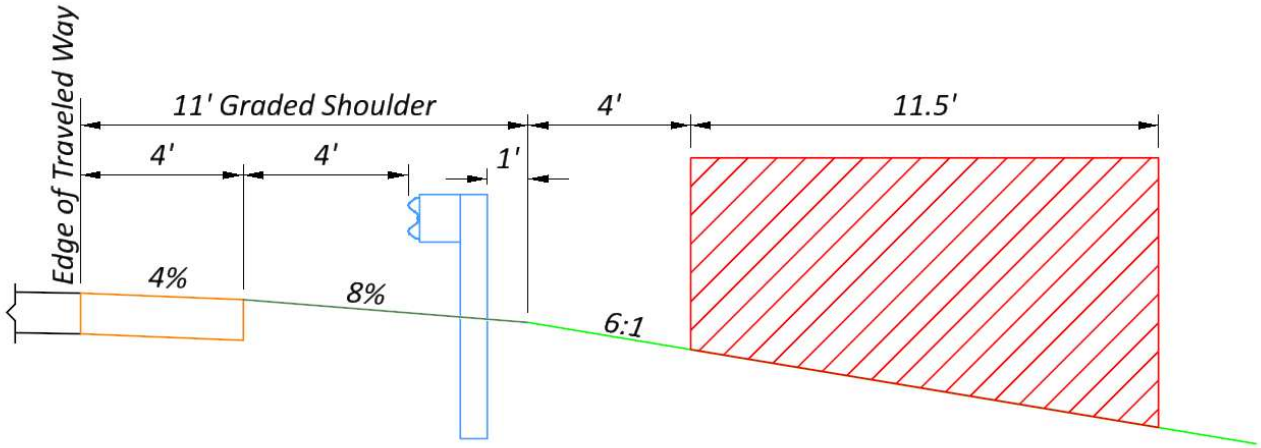
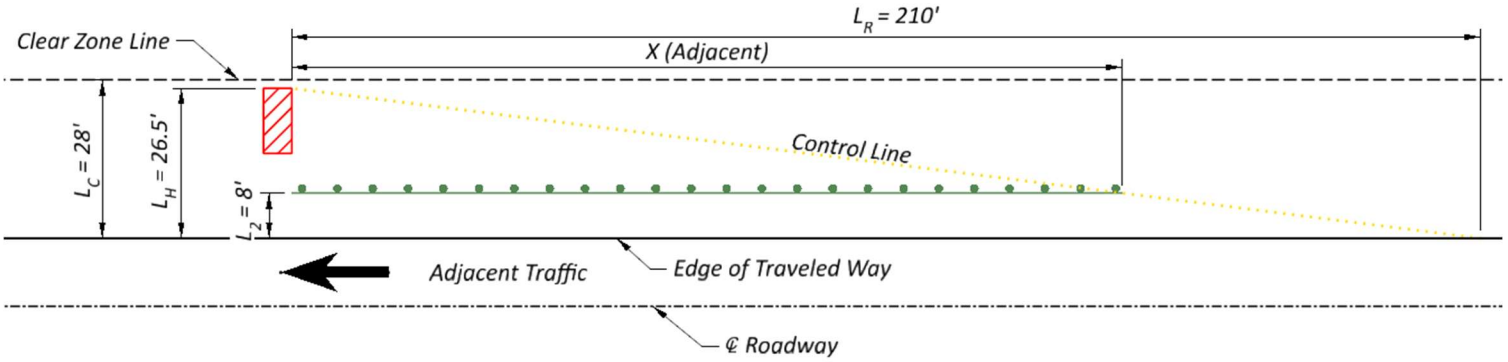
(continued)

Step 2 – Select the type of barrier to be installed. Using **Figure 301-3**, the normal (minimum) barrier offset for a rural collector (Design Year ADT greater than 2,000) is 8 feet away from the edge of traveled way. The available barrier clearance at this location is (11' – 8') + 4' = 7 ft; therefore, use MGS Guardrail which has a minimum barrier clearance of 5 ft. (See **Figure 603-2**).



Step 3 – Calculate the length of need for adjacent traffic. Assume the area along the front of the fixed object cannot be graded to provide 10:1 foreslopes; therefore, the guardrail cannot be installed with a flare.



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(continued)

From **Figure 602-1**, L_R = 210 ft. (for design speed = 60 mph and 1,000 ≤ ADT ≤ 5,000). Since the lateral offset to the back of the object (L_H) is less than the required clear zone distance (L_C), use L_H in the LON formula.

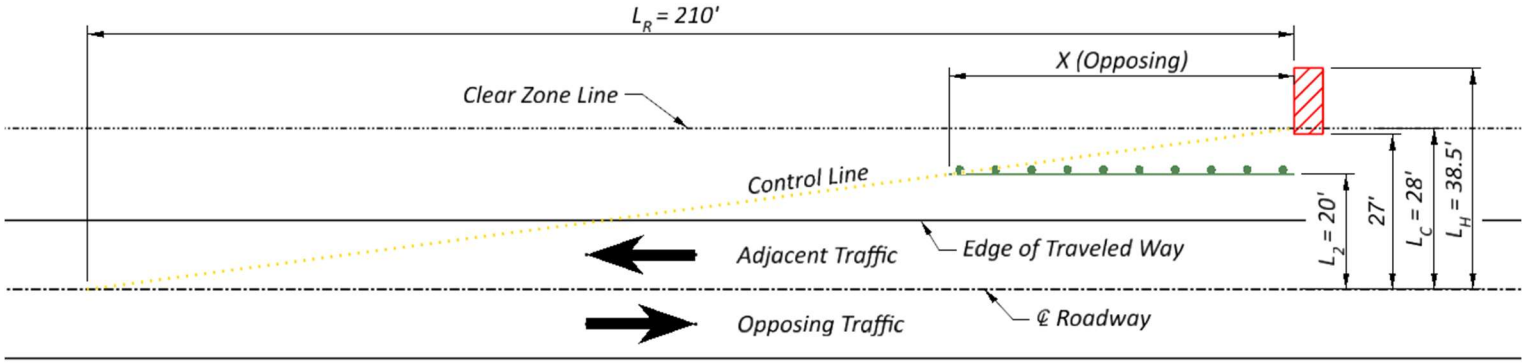
$$X = \frac{L_H + L_1\frac{b}{a} - L_2}{\frac{b}{a} + \frac{L_H}{L_R}}$$

Start measuring the length of the guardrail needed at the edge of the fixed object. Since the guardrail will not be flared, b/a = 0.

$$X_{\text{(adjacent)}} = \frac{26.5 + 0 - 8}{0 + \frac{26.5}{210}} = 146.60 \text{ ft.}$$

Step 4 – Determine whether the fixed object is in the clear zone for opposing traffic. The required clear zone is still 28 feet. The available clear area is 12’ $_{\text{(lane width)}}$ + 15’ = 27 ft. Since the object is in the clear zone, calculate the offset to the back of the object, L_H.

L_H = 12’ + 15’ + 11.5’ = 38.5 ft.



Since $L_H > L_C$, protection only needs to be provided up to the clear zone.

$$X_{\text{(opposing)}} = \frac{L_C + L_1\frac{b}{a} - L_2}{\frac{b}{a} + \frac{L_C}{L_R}} = \frac{28 + 0 - 20}{0 + \frac{28}{210}} = 60.00 \text{ ft.}$$

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(continued)

The total length of guardrail required is:

$X_{(adjacent)}$ + width of object + $X_{(opposing)}$ = 146.60’ + 5’ + 60.00’ = 211.60 ft.

The length provided should be a multiple of even 12’-6” panel lengths.

X = 211.60’/12.5’ = 16.93 → Use 17 panels of 17(12.5’) = 212.5 ft.

Note – If the designer had chosen to shield the entire object from opposing traffic instead of providing protection up to the clear zone, then

$$X_{(opposing)} = \frac{L_H + L_1\frac{b}{a} - L_2}{\frac{b}{a} + \frac{L_H}{L_R}} = \frac{38.5 + 0 - 20}{0 + \frac{38.5}{210}} = 100.91 \text{ ft.}$$

The total length of guardrail needed would have been:

146.60’ + 5’ + 100.91’ = 252.51 ft. (or 21 panels)

Four additional panels (50 feet) of guardrail would be installed. In some cases, the designer may choose to shield the entire object even though a portion of it is outside the clear zone; however, in some cases it may be uneconomical to do so.

Step 5 – Select Anchor Assemblies. Since the slopes do not allow the guardrail to be flared, MGS Type E anchor assemblies should be installed. With the trailing end of the barrier run within the clear zone of opposing traffic, a MGS Type E anchor assembly should be installed on the trailing end of the guardrail run as well.