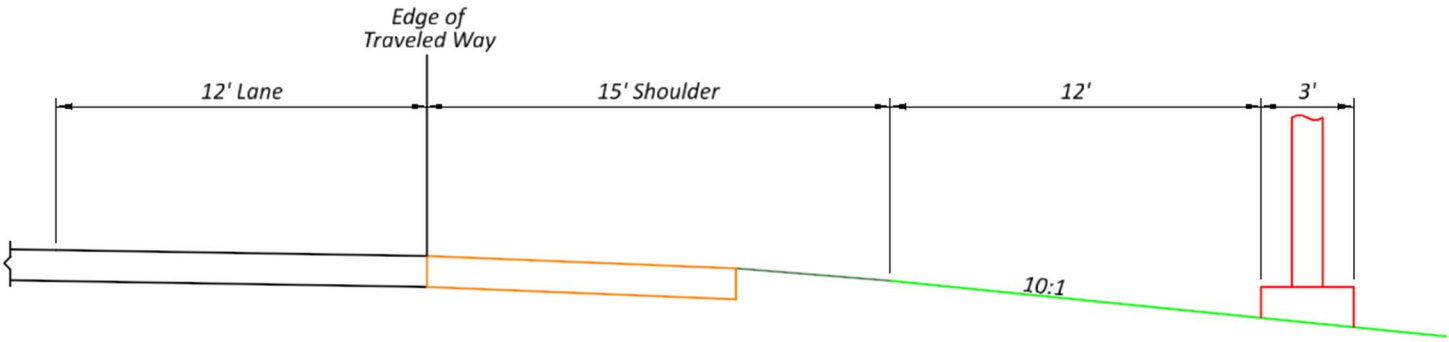
SAMPLE CALCULATIONS

Ex. 602-3

Tangent and Flared Barrier Design For a Divided Highway

Problem 3: Design barrier if needed to shield the 3' diameter footing located on the 4-lane, divided, NHS, urban, interstate reconstruction project shown below. The project has a design speed of 70 mph, a design year traffic volume of 12,000 ADT and a 10:1 foreslope. If barrier is needed, calculate how much should be provided if it is installed a) at the normal (minimum) barrier offset on a tangent, b) at the normal (minimum) barrier offset on a flare, c) as close to the footing as permissible on a tangent and d) as close to the footing as permissible on a flare.



Solution 3: **Step 1** - Determine whether the footing is in the clear zone for adjacent traffic. Refer to **Figure 600-1** (for foreslopes 6:1 or flatter, 70 mph design speed, and ADT > 6,000) to determine that the required clear zone distance is 32 feet measured from the edge of traveled way. However, since this is not a high accident area a maximum clear distance of 30' should be used.

The available clear area for adjacent traffic is 15' + 12' = 27'.

Assuming the footing cannot be relocated outside the clear zone, barrier should be provided.

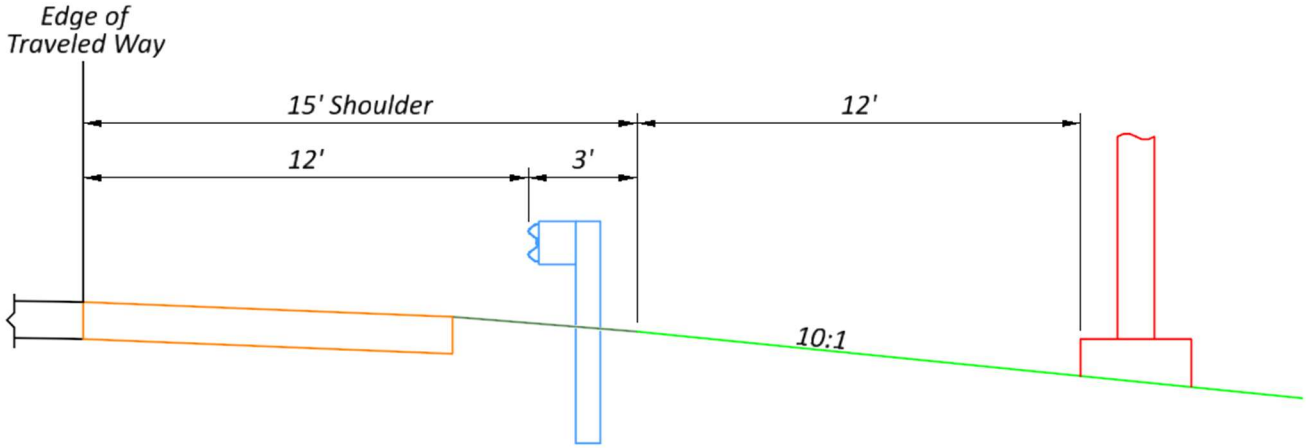
Step 2 - Select the type of barrier to be installed. Using **Figures 301-4** & **301-3**, the normal (minimum) barrier offset for an urban interstate route is 12' from the right edge of traveled way. The available barrier clearance at this location is 3' + 12' = 15'; therefore, use MGS Guardrail, which has a minimum barrier clearance of 5'. (See **Figure 603-2**).

SAMPLE CALCULATIONS

Ex. 602-3

Tangent and Flared Barrier Design For a Divided Highway

(continued)



Step 3 – Calculate the length of need for adjacent traffic. (A calculation for opposing traffic is unnecessary because the concrete median barrier prevents encroachments by opposing vehicles).

From **Figure 602-1**, L_R = 360 ft. (For Design Speed = 70 mph and ADT over 10,000).

a) For tangent guardrail at the normal (minimum) barrier offset, $L_H = L_C$ = 30', L_2 = 12', and b/a = 0.

$$X = \frac{L_H + L_1\frac{b}{a} - L_2}{\frac{b}{a} + \frac{L_H}{L_R}} = \frac{30 + 0 - 12}{0 + \frac{30}{360}} = 216' \rightarrow \text{Use 18 panels}$$

b) For flared guardrail at the normal (minimum) barrier offset, b/a = 1/7. (See **Figure 602-1**). Let L_1 = 12'-6" (one panel length). In this case, this is an arbitrary selection. Site conditions typically control the amount of tangent barrier that should be provided past the warranting feature before a flare is introduced. For instance, where a flared section of MGS Guardrail is attached to a tangent section of MGS Guardrail with Half Post Spacing, it is advisable to extend the tangent MGS Guardrail with Half Post Spacing past the warranting feature such that L_1 is at least equal to 25 feet (two panels) to ensure adequate protection at the edge of the warranting feature.

$$X = \frac{30 + 12.5\left(\frac{1}{7}\right) - 12}{\frac{1}{7} + \frac{30}{360}} = 87.47' \rightarrow \text{Use 7 panels.}$$

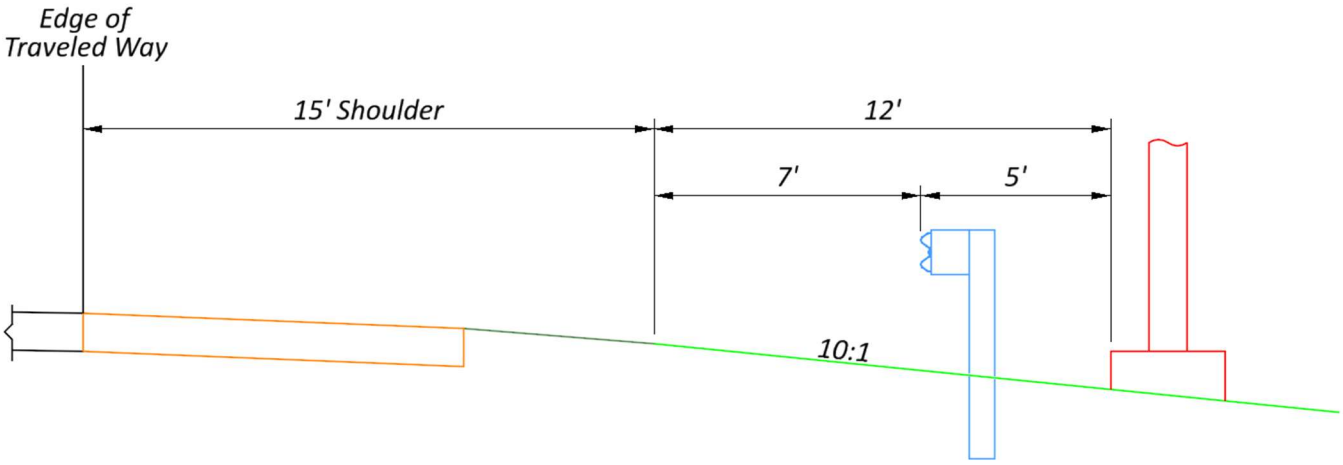
SAMPLE CALCULATIONS	
Ex. 602-3	**Tangent and Flared Barrier Design For a Divided Highway**

(continued)

c) Guardrail can be installed on slope that are 10:1 or flatter. Since MGS Guardrail has a minimum barrier clearance of 5' the guardrail can be placed at this distance in front of the footing.

L_2 = 15' + 12' - 5' = 22'. For tangent guardrail, b/a = 0. L_H is still equal to 30'.

$$X = \frac{30 + 0 - 22}{0 + \frac{30}{360}} = 96' \rightarrow \text{Use 8 panels.}$$



d) For flared guardrail offset at 22':

$$X = \frac{30 + 12.5\left(\frac{1}{7}\right) - 22}{\left(\frac{1}{7}\right) + \frac{30}{360}} = 43.26' \rightarrow \text{Use 4 panels.}$$

All of these solutions are correct; however, d) is the best solution because it provides the most recovery area with the least amount of barrier.