# Index 400 Guardrail

This IDS is provided per Roadway Design Bulletin 14-13 and only addresses the guardrail system length calculations. Additional information will be provided in the future.

## Design Assumptions and Limitations

Concerning Guardrail Length Calculations: These calculations are provided to determine the Location Stations for end anchorage assemblies in accordance with Index 400 for the Summary of Guardrail table. A 15'-7½" W-Beam Panel must be used to transition to each end anchorage assembly to ensure that the guardrail splice is offset from the post by 3'-1½". The 15'-7½" panel is installed directly adjacent to the proprietary end anchorage assembly as shown in the vendor drawings or directly adjacent to the standard end anchorage assembly as shown in the Design Standards. The remaining W-Beam panels are calculated at the standard length of 12'-6".

## Plan Content Requirements

In the Summary of Guardrail table within the Roadway Plans, show the Location Station for each end anchorage assembly. See Index 400, Sheets 3 and 4, Figures 1 and 2, respectively to calculate the Location Station for the End Anchorage Assemblies.

The Location Station for One-Way Traffic may be calculated as follows:

1. Determine the length of the Hazard parallel to the Edge of Traffic Lane and located within the clear zone.
2. The Type II End Anchorage Assembly is located a minimum 6' downstream from the Hazard Station.
3. Determine the Location Station (location of the first post) for the Type II End Anchorage Assembly by adding or subtracting 6 feet from the Hazard Station based on the direction of traffic (see Index 400, Sheet 4 Figure 2, "One Way Traffic").
4. Calculate Length of Advancement, X, for the Approach End based on Index 400, Sheet 3, Figure 1.

   $X = 13(D-d)$ for $\geq 50$ mph and $X = 16(D-d)$ for $\leq 45$ mph.

   D = the distance from the edge of traffic lane to the back of hazard or clear zone, whichever is less.

   d = the distance from the edge of traffic lane to the face of the proposed guardrail.
5. Determine the Length of Need (LON) distance by adding the lengths from Steps 1, 2, and 4.
6. Calculate the Beginning of Length of Need Station for the Approach End Anchorage Assembly by adding the LON to the Location Station of the Type II End Anchorage Assembly from Step 2.

7. To determine the number of 12'-6" panels, subtract one 15"-7½" panel for each end anchorage assembly from the LON.
8. Divide the length determined in Step 7 by 12.5' and round up to the next whole number, and then add one more panel. The number of 12'-6" panels will be added to the number of 15'-7½" panels to get to the Location Station.
9. Determine the Location Station for the Approach End Anchorage Assembly by adding the number of 12'-6" and 15'-7½" panels to the Location Station of the Type II End Anchorage Assembly.
10. Check by subtracting the two location stations and verifying that that distance is at least or more than the LON plus 12'-6". LON Station (Actual) ≥ LON Station (Calculated).

The Location Stations for Two Lane, Two-Way Traffic may be computed as follows:

1. Determine the length of the Hazard parallel to the Edge of Traffic Lane and located within the clear zone.
2. Calculate length of Hazard.
3. Calculate Length of Advancement, X, for the Approach End based on Index 400, Sheet 3, Figure 1.

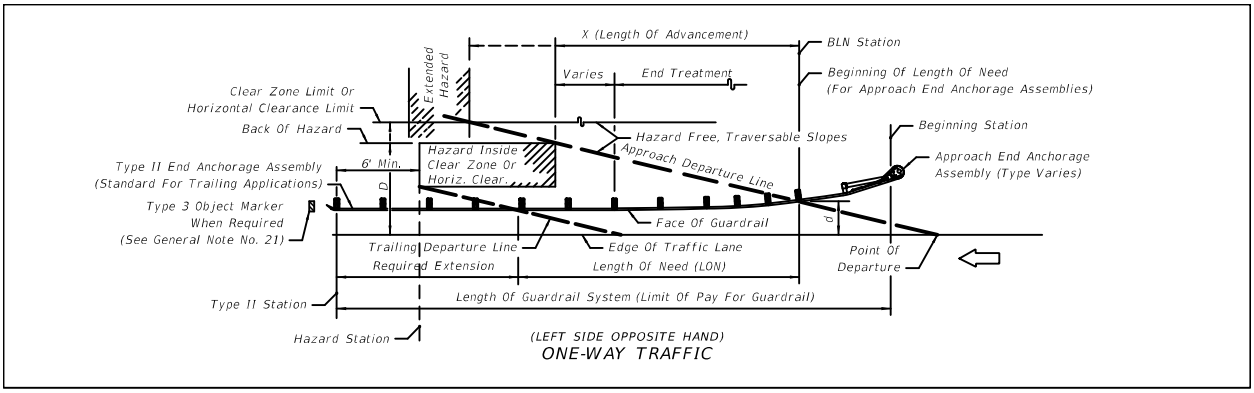
   X = 13(D-d) for ≥ 50 mph and X = 16(D-d) for ≤ 45 mph.

   D = the distance from the edge of traffic lane to the back of hazard or clear zone, whichever is less.

   d = the distance from the edge of traffic lane to the face of the proposed guardrail.
4. Determine the Length of Need by summing the Length of Advancement LA, Length of Advancement RA and the Hazard Length.
5. Calculate Beginning Length of Need (BLN) Stations for the left approach and right approach.
6. Determine BLN LA Station (actual) = LA Hazard Station - Length of Advancement (LA)
7. Calculate location Station for LA end anchorage assembly = BLN LA Station (actual - one Panel)
8. Subtract a 15'-7½" panel for each end anchorage assembly from the LON.
9. Divide the length determined in Step 8 by 12.5' and round up to the next whole number, and then add two more panels. The number of 12'-6" panels will be added to the number of 15'-7½" panels to get to the Location Station.
10. Determine the Location Station for the Approach End Anchorage Assembly.
11. Check by subtracting the two location stations and verifying that that distance is at least or more than the LON plus two panels or 25 feet. LON Station (Actual) ≥ LON Station (Calculated)

# EXAMPLES

ONE-WAY TRAFFIC EXAMPLE:




Assume that the Hazard is located within the clear zone from Station 15+00 to 15+40. Assume a 55 MPH Design Speed, D = 28' and d= 12'. Calculate the Location Stations for the Type II End Anchorage Assembly and the Approach End Anchorage Assembly.

1. Given: Length of Hazard = H = 1540' - 1500' = 40'
2. Given: Length to Type II End Anchorage Assembly from Hazard Station = 6'.
3. Location Station for Type II End Anchorage Assembly = 1500' - 6' = 1494' or 14+94
4. Length of Advancement = X = 13(D-d) = 13(28-12) = 208'
5. Determine Length of Need (LON):

   LON = H + 6' + X = 40'+ 6'+ 208' = 254'
6. Calculate the Beginning Length of Need Station for the Approach End Anchorage Assembly:

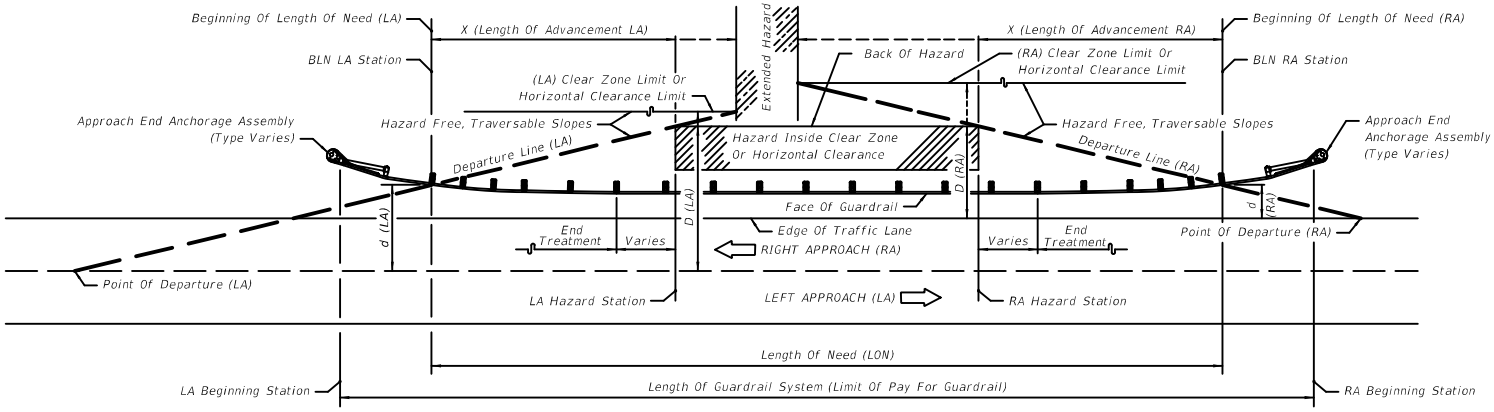
   Add LON to Type II End Anchorage Location Station = 1494' + 254' = 1748' or 17+48
7. Subtract a 15'-7½" panel for each end anchorage assembly from the LON.

   254 - 2 panels (15.625') = 222.75'
8. Calculate the number of 12'-6" panels needed plus add one panel to get to the Location Station:

   222.75'/12.5' = 17.82 or 18 + 1 = 19 panels
9. Determine the Location Station for the Approach End Anchorage Assembly

   1494' + 2(15.625') +19(12.5') = 1762.75 or 17+62.75
10. Check: LON (Actual) 1762.75 ≥ LON (Calculated) 17+48 = OK!
11. Insert the Location Stations for the end anchorage assemblies into the Summary of Guardrail table.

## TWO-WAY TRAFFIC EXAMPLE:




*TWO-LANE TWO-WAY TRAFFIC*

*For description of the dimensions D, d and X, see Length of Advancement - Figure 1.*
*For additional shoulder guardrail information, see Details B and C.*

1. Given: LA Hazard Station is 15+00 and the RA Hazard Station is 16+00. Assume a 55 MPH Design Speed, D (LA) = 28' and d (LA)= 16' and D (RA) = 24 and d (RA) = 10.
2. Calculate length of Hazard = RA Hazard station - LA Hazard station = 16+00 - 15+00 = 100 feet
3. Calculate Length of Advancement.

   Length of Advancement (LA) = X = 13(28-16) = 156'

   Length of Advancement (RA) = X = 13(24-10) = 182'
4. Determine the length of Need = Length of Advancement (LA)+ Length of Advancement (RA)+ Length of Hazard:

   156 + 182 + 100 = 438 feet.
5. Calculate Beginning length of Need stations:

   BLN LA Station (Calculated) = LA Hazard Station - Length of Advancement (LA) = 15+00 - 156 = 13+44.

   BLN RA Station (Calculated) = RA Hazard Station + Length of Advancement (RA) = 16+00 + 182 = 17+82.
6. BLN LA Station (actual) = LA Hazard Station - Length of Advancement (LA) = 15+00 - 156 = 13+44.
7. Calculate location Station for LA end anchorage assembly = BLN LA Station (actual - one Panel):

   1344 - 12.5 = 1331.5 or 13+31.50.
8. Subtract a 15'-7½" panel for each end anchorage assembly from the LON.

   438 - 2 panels (15.625') = 406.75'
9. Calculate the number of 12'-6" panels needed plus add two panels to get to the Location Station:

   406.75'/12.5' = 32.54 or 33 + 2 = 35 panels
10. Determine the Location Station for the Approach End Anchorage Assembly

    1331.5' + 2(15.625') +35(12.5') = 1800.25 or 18+00.25
11. Check: RA location station - RA location station ≥ LON +25

    = 18+00.25-13+31.50 ≥ 438+25 = OK!
12. Insert the Location Stations for the end anchorage assemblies into the Summary of Guardrail table.