Sheet No (3)

Horizontal Alignment

*1- Given Δ = 40, D= 3.50^0, and the P.I. station 120+40.0, **calculate** the different properties of the curve and the station of **P.C.** and **PT.***

*2- The radius of a horizontal curve on a two-lane rural highway is 1500ft; **compute** the required super elevation assuming a 70mph design speed, and a 0.13 coefficient of side friction. Also, **find** the minimum spiral length necessary for a smooth transition from tangent to the circular curve*

*3-A horizontal curve on a rural two-lane highway of 8.00m width has a super elevation rate of 4%. Knowing that the allowed relative slope (Δs) between the profile of centerline and the outer pavement edge equals 0.25% and Δs =0.04 radian, **find** the design speed of this curve. Also, **what** is the length of tangent runout if q (cross slope of the crown section) =1.50% ?*
(Rotation of pavement edges is attained around centerline)

4-A left turn horizontal curve exists on a 2-lane highway has the following information:

- *Super elevation =4%*
- *Crown cross slope=1.5%*
- *Lane width=3.25 m*
- *Degree of curve =4 degree*

Draw the progress of pavement edges if rotation is achieved around the inside edge of pavement, and find the highway cross section at 2/3 of the spiral length.

*5-A highway engineer has to use a compound curve to connect two tangents intersecting at station 32+86 and having a deflection angle of 42.50^0. If D2=2^0, **compute** all curves . If the allowable super elevation is 0.06, **what** will be the maximum operating speed on this curve?*

Does this compound curve satisfy safety requirements? If not, how can you correct this situation?

6-Using the sketch shown in Figure 1, answer the following:

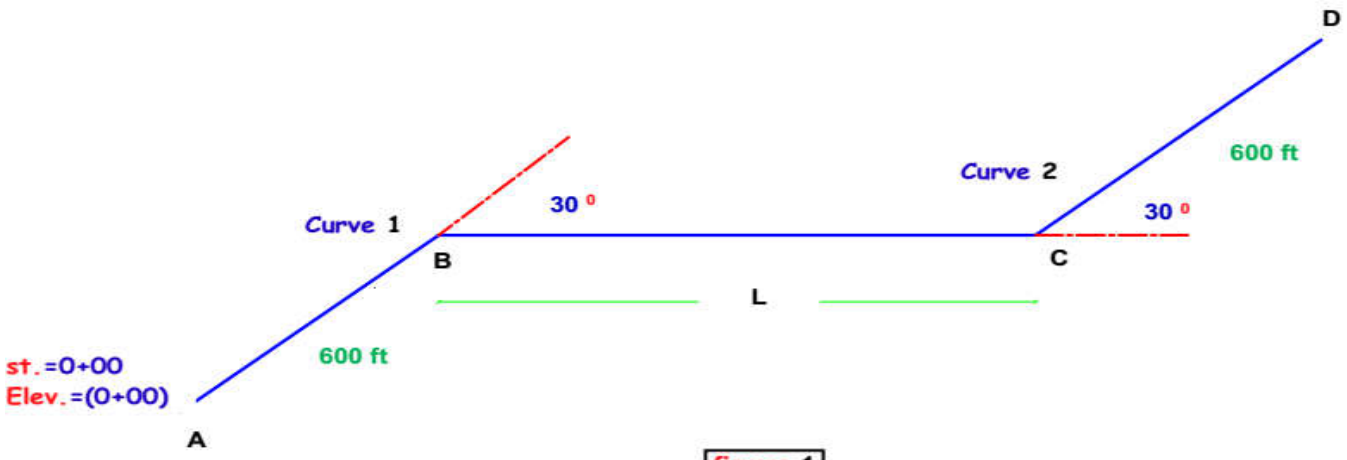

figure 1

a) Is it possible to fit two circular horizontal curves at points B and C ($D1=4^0$ & $D2=3^0$) if the distance L equals 750ft? (Show all calculation)

b) Calculate the minimum length of the distance L to insert the appropriate transition curves between the two circular curves. (Assume design speed = 60mph)

c) Draw to a reasonable scale the progress of pavement edges if rotation is achieved around the centerline. Also give all elevations and stations of the main points in the longitudinal section of pavement edges (assume longitudinal grade = +1.80% in the direction from A to D, pavement width=24 ft and q= 1.5%)

7**-A simple horizontal curve is designed with a 2000ft radius. The curve has a tangent of 400 ft and the P.I. station is 103+20. **Determine the station of P.T.

8**-A section of a 2-lane road, with a 7.2m width and a design speed of 80km/h, has a curve radius of 200m. A high solid fence is required to be built along the inner side of this curve, **Determine:

- *The minimum distance between the fence and the edge of the road to provide a minimum stopping sight distance of 140m*

- The available sight distance on the curve if spirals were inserted at both ends of the curve
- The super elevation of the curved section.

9-Draw to a reasonable scale the progress of pavement edges around the outside edge for the distance between TS and SC for a 2-lane highway, show stations along roadway by assuming station at TS point equals 162+48.33, given that:

- Lane width = 3.75m
- Deflection angle = 30^0
- Design speed= 90km/h
- Crown cross slope= 2.00%

10-A corner of an existing obstruction is 26ft from centerline on a 12^0 curved portion of two-lane highway having a lane with of 12ft. Considering horizontal sight distance along the centerline of the inside lane, determine the following:

.a) The safe operating speed.

b) If the desired operating speed is 60mph, how far the obstruction should be set back to satisfy the stopping sight distance.

11-Derive the following relation :

$$M = \frac{L\,(2S - L)}{8R}$$