CE 34500: Transportation Engineering
Homework 6

Problem 1: A +2 % grade intersects with a 1 % grade at station (535+24.25) at an elevation of 300 ft. If the design speed is 65 mph, determine:

a) The minimum length of vertical curve using the rate of vertical curvature. Then using the length found in part (a), find:
b) The stations and elevations of the BVC and EVC
c) The elevation of each 100-ft. station
d) The station and elevation of the high point

Problem 2: Determine the minimum length of a crest vertical curve, using the minimum length based on SSD criteria if the grades are +4% and -2%. Design speed is 70 mph. State assumptions used.

Problem 3: Determine the minimum length of a sag vertical curve if the grades are -4% and +2%. Design speed is 70 mph. State assumptions used. Consider the following criteria: stopping sight distance, comfort, and general appearance.

Problem 4: Given a sag vertical curve connecting a -1.5 % grade with a +2.5% grade on a rural arterial highway, use the rate of vertical curvature, and a design speed of 70 mph to compute the elevation of the curve at 100 ft. stations if the grades intersect at station (475+00) at an elevation of 300 ft. Identify the station and elevation of the low point.

Problem 5: A crest vertical curves connects a +4.44% grade and a -6.87% grade. The PVI is at station 43+50.00 at an elevation of 1240.00 ft. The design speed is 30 mph.

a) The length of the vertical curve using the AASHTO method ("K" factors)
b) The stations and elevations of the BVC, EVC, and high point
c) The elevation of station 44+23.23

Problem 6: A horizontal curve is to be designed for a two-lane road in mountainous terrain. The following data are known: intersection angle 40 degrees, tangent length 436.76 ft., and station of PI: $2700 + 10.65, fs = 0.12, e = 0.08$. Determine:

a) Design speed
b) Station of the PC and PT
c) Deflection angle and chord length to the first 100 ft. station

Problem 7: Given a sample circular curve with the following properties: $D = 11°$, bearing on incoming (back) tangent is $N\ 89°27'25''\ E$, bearing on outgoing (forward) tangent is $S\ 60°10'05''E$. The station of the PI = 22+69.77. Determine

a) The intersection angle, Radius, and Tangent
b) The external distance
c) The middle ordinate
d) The long chord
e) The length of the curve
f) Station of the PC and PT