CVG4150 Fall – 2017
Highway & Transportation
ASSIGNMENT #1
Due on October 10 (by 17:00)

Roadway Design

Q1. Given the acceleration pattern of a car shown in Figure 1, derive and plot the relationships of **time versus speed** and **time versus distance** if the car made **complete stop at *t* = 25** seconds. At $t = 0$ the vehicle was traveling at 30 km/hr.

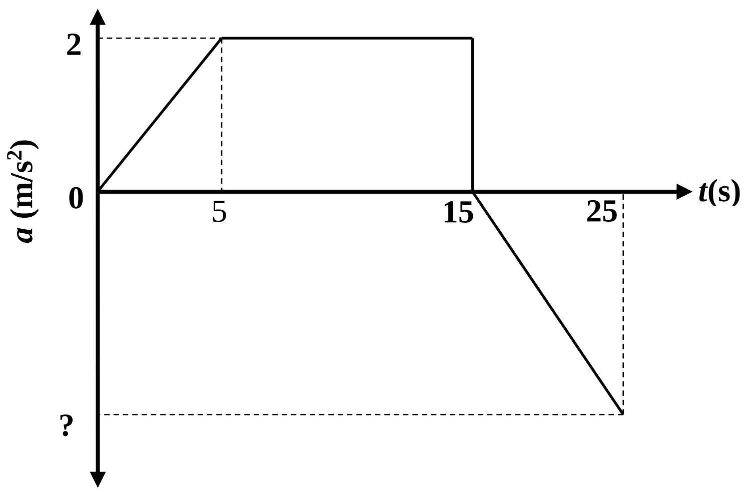

Figure 1

Q2. Draw a longitudinal profile (i.e. superelevation development as a simple curve) of a two-lane crowned urban roadway with necessary distances. Given that a normal crown = 2%, e_{max} = 4%, lane width = 3.7 m and design speed = 90 km/hr. The pavement was revolved about the centerline and the length of tangent runout was determined based on a 1:400 slope.

Table 2.1.2.12 Length of Superelevation Runoff for Two-Lane Crowned Urban Roadways[9]

Superelevation Rate (m/m)	Length of Runoff (Ls) (m)							
	Design Speed (km/h)							
	40	50	60	70	80	90	100	110
3.7 m lanes								
0.02	11	12	13	14	15	16	17	18
0.04	22	23	25	27	29	32	34	37
0.06	32	35	37	41	44	48	51	55
3.5 m lanes								
0.02	10	11	12	13	14	15	16	17
0.04	20	22	24	26	28	30	32	35
0.06	30	33	35	39	42	45	48	52

Q3. A simple highway curve (i.e. high speed urban roadway) is planned to connect two horizontal tangents that intersect at sta. 2500 + 00.00 at an external angle of 50°. For a curve radius of about 1.25 times the minimum allowable, determine

- **a.** Design rate of superelevation (design speed = 110 km/hr, e_{max} = 0.06, f_{max} = 0.1)
- **b.** Δ, E, M, T, L, and LC in Figure 2.

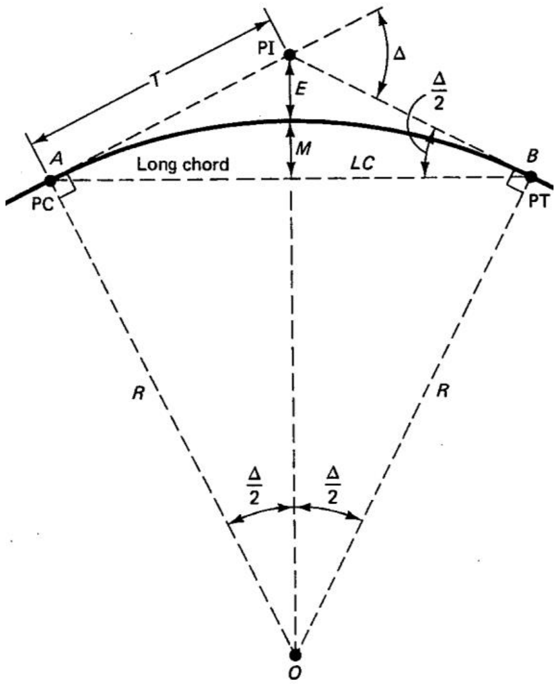

Figure 2

Q4. A vertical curve joins a 1.2% grade to a 0.8% grade (Figure 3). The VPI of the vertical curve is at station 75 + 00 (100 m station) and elevation 50.90 m above sea level. The centerline of the roadway must clear a pipe located at station 75 + 40 by 0.80 m (i.e. C in Figure 3). The elevation of the top of the pipe is 51.10 m above sea level. What is the minimum length of the vertical curve that can be used?

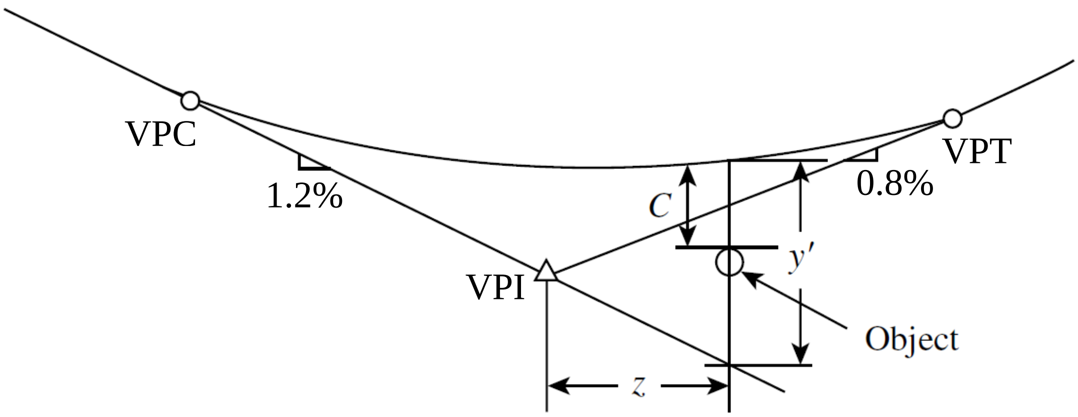

Figure 3