SCHOOL OF CIVIL ENGINEERING
ENGINEERING CAMPUS
UNIVERSITI SAINS MALAYSIA
14300 NIBONG TEBAL

ACADEMIC SESSION SEM 1 2020/2021
EAL 431 HIGHWAY DESIGN

ASSIGNMENT 1

Question 1

[a] Horizontal curves provide transitions between two tangent lengths of a roadway. To attain a smooth transition, a simple circular curve that the PI at station 20+50.25, with the Δ equal to 35° has been designed. The degree of curvature is approximately 6°. Based on the given information, you are required to sketch an appropriate diagram and locate the station of the point of curvature (PC) and the point of tangent (PT) **(10 marks)**

[b] A two-lane rural highway (Figure 1) with a design speed of 100km/h goes from normal crown with 2.5% cross slope to 6% super-elevation by means of a spiral transition curve. The spiral curve is 85m long. If the super-elevation is attained by rotating the road section around the centreline, sketch a cross-section diagram of the road at 10, 30, 50, and 70m from the tangent to spiral (TS)

Lane width = 3.35m / lane
Carriageway type = Single

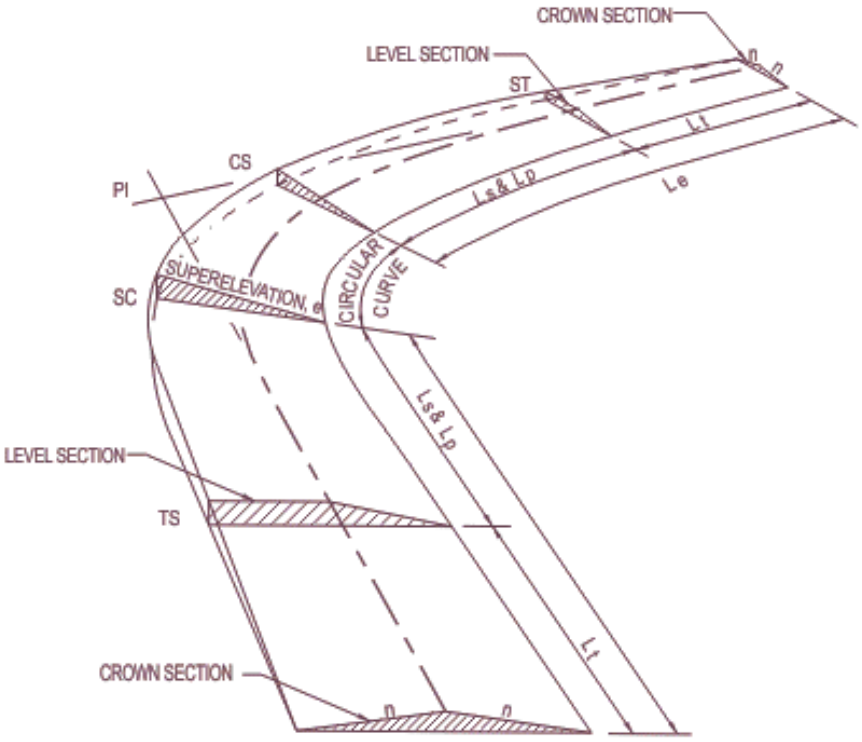

Figure 1

(20 marks)

Question 2

[a] For road network designed based on the JKR requirements, the parabolic curve is adopted in the vertical alignment design to provide a safe and comfort ride for the road users. Based on your understanding, state the basic equation of a parabolic curve. Additionally, justify why this curve type is preferred. **(7 Marks)**

[b] State ONE important design criteria for crest vertical curve and sag vertical curves, respectively. **(5 Marks)**

[c] As a road design engineer, you are required to design a vertical curve for an expressway located at rural area. The design speed is 65 mph, the grades are +4% uphill and 2% downhill. Determine the minimum length of the vertical curve. Additionally, state ONE important criteria for the selected length of the vertical curve. (Refer Table 1 for additional design parameter) **(8 Marks)**

Table 1. Vertical Curve Design: Important Parameters

Metric				US Customary			
Design speed (km/h)	Stopping sight distance (m)	Rate of vertical curvature, K*		Design speed	Stopping sight distance (ft)	Rate of vertical curvature, K*	
		Calculated	Design			Calculated	Design
20	20	0.6	1	15	80	3	3
30	35	1.9	2	20	115	6.1	7
40	50	3.8	4	25	155	11.1	12
50	65	6.4	7	30	200	18.5	19
60	85	11	11	35	250	29	29
70	105	16.8	17	40	305	43.1	44
80	130	25.7	26	45	360	60.1	61
90	160	38.9	39	50	425	83.7	84
100	185	52	52	55	495	113.5	114
110	220	73.6	74	60	570	150.6	151
120	250	95	95	65	645	192.8	193
130	285	123.4	124	70	730	246.9	247
				75	820	311.6	312
				80	910	383.7	384

* Rate of vertical curvature, K, is the length of curve per percent algebraic difference in intersecting grades (A). K = L/A

[d] A 500-meter equal-tangent sag vertical curve has the PVC at station 100+00 with an elevation of 1000 m. The entrance grade is -4% and the exit grade is +2%. Determine the stationing and elevation of the PVI, the PVT, and the lowest point on the curve. **(10 Marks)**

Due date: 24/11/2020 (5.00 PM)