VIT
Vellore Institute of Technology

Continuous Assessment Test – I

Programme Name & Branch: B.Tech Civil Engineering
Course Name & Code: CLE 2005 Transportation Engineering
Class Number: **Slot:** D1 **Exam Duration:** 90min. **Maximum Marks:** 50

General instruction(s): Answer all questions.

1. As a highway runs in a valley, the vertical profile shown in Figure 1 is encountered.

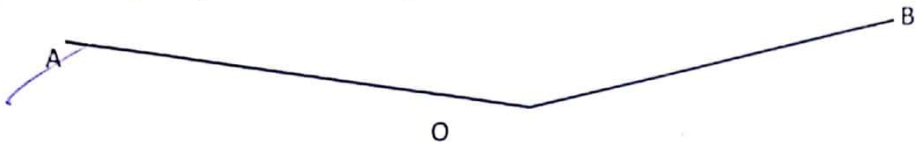

Figure 1

Answer the following questions. (8)

a) Why do we have to "design" a vertical curve at A-O-B?

b) Discuss the factors we should consider in such a design.

c) With a drawing, show how we check whether the safe stopping sight distance is available in Figure 1 section.

2. In Figure 2 given to you (page 3), various geographical features are shown. Draw the best alignment for a highway between towns A and B. Write the reasons why you selected this alignment. Remove Page 3 and attach to your answer book. (8)

3. Answer the following with regards to overtaking sight distance: (10)

a) Derive the expression to calculate the sight distance necessary for a vehicle A to safely overtake a slower vehicle B on a two-lane two-way road. Assume necessary parameters.

b) Calculate the minimum length of the overtaking zone to be provided on a highway with design speed 65 kmph. Assume overtaken vehicle has 16kmph less than design speed. Assume actual overtaking time (T) is 9sec.

4. A single-lane one-way traffic road (traffic stream speed is 30kmph) is crossing an undivided two-lane two-way traffic road (speed is 50kmph). A clear sight triangle for safe stopping should be assured at this intersection. Calculate the minimum lengths of the sides of the sight triangle along the roads and show the sight triangles on a sketch diagram. Perception-reaction time is 2.5s. (8)

5. Answer the following with regards to horizontal curves. (8)

a) A four lane state highway is going through a horizontal curve of radius 340m. Design speed is 100kmph. Design the superelevation for this curve so that both slower and faster vehicles can move safely.

b) Draw the cross section of the superelevated portion of the above road showing

the dimensions (show centreline and edges)

6 An upward gradient of 2.5% meets a downward gradient of 1 % on a highway Design a suitable vertical curve connecting the gradients so that sufficient stopping sight distance at design speed of 80kmph is available. Relevant tables from IRC 73-1980 are given below. (8)

TABLE 11. STOPPING SIGHT DISTANCE FOR VARIOUS SPEEDS

Speed	Perception and brake reaction		Braking		Safe stopping sight distance (metres)	
V (km/h)	Time, t (sec.)	Distance (metres) $d_1 = 0.278Vt$	Coefficient of longitudinal friction (f)	Distance (metres) $d_2 = \frac{V^2}{254f}$	Calculated values $d_1 + d_2$	Rounded off values for design
20	2.5	14	0.40	4	18	20
25	2.5	18	0.40	6	24	25
30	2.5	21	0.40	9	30	30
40	2.5	28	0.38	17	45	45
50	2.5	35	0.37	27	62	60
60	2.5	42	0.36	39	81	80
65	2.5	45	0.36	46	91	90
80	2.5	56	0.35	72	118	120
100	2.5	70	0.35	112	182	180

Table 20 of IRC 73-1980 Minimum Length of Vertical Curves on I

Design speed (km/h)	Maximum grade change (per cent) not requiring a vertical curve	Minimum length of vertical curve (metres)
Upto 35	1.5	15
40	1.2	20
50	1	30
65	0.8	40
80	0.6	50
100	0.5	60