

[Time : 3 Hours]

[Marks : 80]

- N.B:
1. Question No. 1 is compulsory.
 2. Attempt any three questions from remaining five questions.
 3. Assume any data suitably if not given and state it clearly.

1. Attempt any four :

- (a) Explain PIEV Theory. [5]
- (b) What are the various requirements of an ideal highway alignment? Discuss briefly. [5]
- (c) Discuss the various types of intersections with neat sketches. [5]
- (d) Discuss the importance of highway drainage. [5]
- (e) What are the various test on Bitumen? Explain briefly any one. [5]

2. (a) The speed of overtaking and overtaken vehicle are 70 kmph and 40 kmph respectively on a two way road. If the acceleration of overtaking vehicle is 0.99 m/sec^2 .

- i) Calculate safe overtaking sight distance.
- ii) Draw a neat sketch of overtaking zone showing position of sign post.

- (b) Design the rate of super elevation for horizontal highway curve of radius 500 meter and speed 100kmph [5]
- (c) Derive an expression for finding extra widening required on horizontal curve. [7]

3. (a) Speed studies were carried out at a certain stretch of a highway and the consolidated data are given below (10)

Speed Range (kmph)	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of Vehicle Observed	12	18	68	89	204	255	119	43	33	9

Determine :

- i) Upper and lower values of speed limit.
 - ii) Design speed to check highway geometric elements.
- (b) What are the various traffic control devices? Draw the neat sketches of various traffic signs [10]



TURN OVER

4. (a) A two-lane two-way carriageway carries a traffic of 2500 cvpd. The rate of growth [10] of traffic is 7.5% per annum. The design life is 15 years. The vehicle damage factor is 3. The CBR value of soil is 5%. Design the Flexible pavement and draw the neat sketch of cross section of flexible pavement. Refer Table No. 1.

Cumulative Traffic (msa)	Total Pavement Thickness (mm)	PAVEMENT COMPOSITION		Granular Base and Sub-base (mm)
		Bituminous Surfacing		
		BC (mm)	DBM(mm)	
10	660	40	70	Base= 250 mm
20	680	40	100	
30	710	40	120	
50	730	40	140	Sub Base=300
100	750	50	150	
150	770	50	170	

Table No. 1

- (b) Design a cement concrete pavement for the following conditions :

Design wheel load	=	5100 Kg
Present traffic	=	300 cvpd
Design Life	=	20 years
Traffic growth rate	=	7.5%
Temperature variation	=	14°C
Modulus of subgrade reaction	=	6 Kg/cm ³
Modulus of elasticity	=	3 x 10 ⁵ Kg/cm ²
Poisson's ratio	=	0.15
Coeff. of thermal expansion	=	10 x 10 ⁻⁶ /°C

Refer Fig. 1, 2, 3 & Table No. 2.

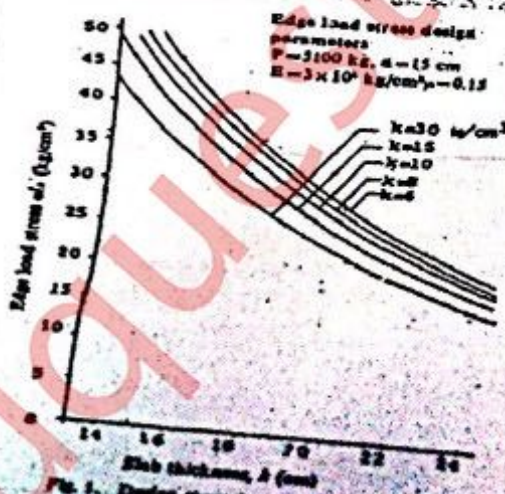


Fig. 1. Design chart for calculation of edge load stress

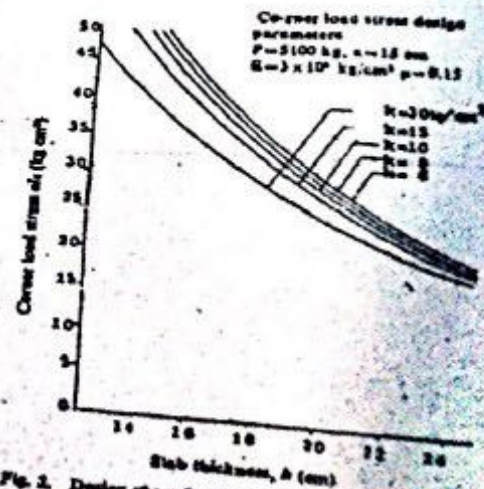


Fig. 2. Design chart for calculation of corner load stress

Chart for determination of coefficient C

L/l or W/w	C	L/l or W/w	C
1	0.000	7	1.030
2	0.040	8	1.077
3	0.175	9	1.080
4	0.440	10	1.075
5	0.720	11	1.050
6	0.920	12	1.000

Table No. 2

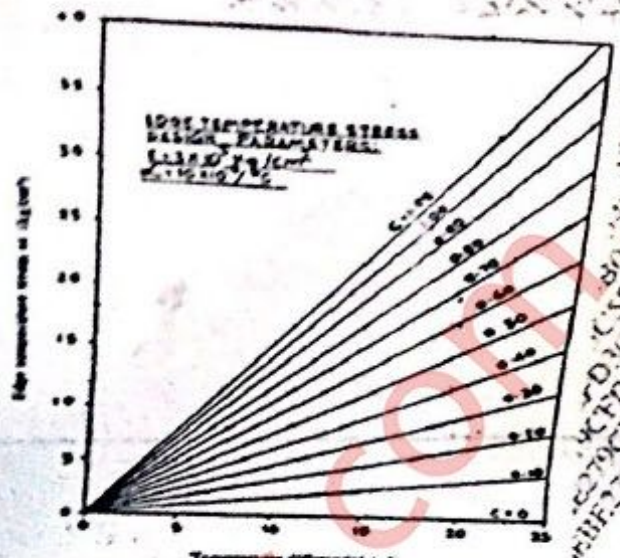


Fig. 3

5. (a) Explain the typical flexible pavement failure with neat sketches. [10]
- (b) Design the spacing between contraction joints for 3.5 meter wide pavement slab having thickness 20 cm and $f=1.5$, for the following cases :
- Plain cement concrete, allowable $S_c = 0.8 \text{ kg/cm}^2$
 - Reinforced cement concrete, 1.0 cm dia bars at 30 cm spacing.
6. (a) What are the assumption for economical span of a bridge? Derive the equation for [10] economical span.
- (b) Benkelman Beam Deflection test has been carried out on 15 selected points on a [10] stretch of flexible pavement. Design flexible overlay using IRC: 81-1997. Following are the data
- Deflection Values : 1.40, 1.32, 1.25, 1.35, 1.48, 1.60, 1.65, 1.55, 1.45, 1.40, 1.36, 1.46, 1.50, 1.52, 1.45 mm. Test Temperature: 39°C , VDF=3.5, Rate of traffic growth: 7%, Multiplying factor for Moisture correction factor = 1.0.

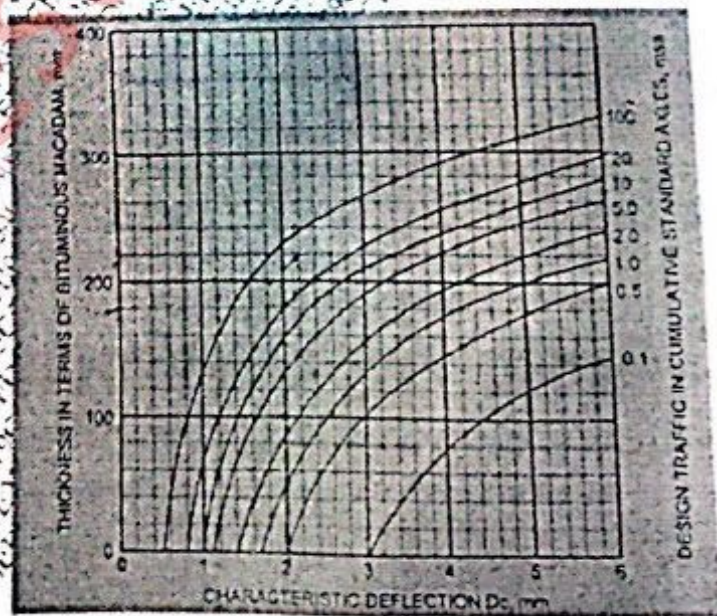


Chart as per IRC: 81-1997