SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION JUNE 2008

CE 04 705 (D)—PAVEMENT DESIGN

(2004 admissions)

Time : Three Hours   Maximum : 100 Marks

Answer the following questions.
Missing data if any may suitably assumed.

1. (a) Explain Flexible and Rigid Pavements and bring out the point of differences.

   (b) Explain ESWL and the concept in the determination of the equivalent wheel load.

   (c) Explain how the elastic modulii of subgrade and base course are estimated using plate bearing test.

   (d) Discuss the effects of repeated applications of loads on pavements. Explain equivalent load factors for load repetitions.

   (e) What are the various types of failures in flexible pavement ? Explain the causes.

   (f) Write a descriptive note on pavement evaluation.

   (g) Explain the critical locations of loading as regards wheel load stress in cement concrete pavement. Discuss the Westergaard's concept and assumptions.

   (h) Discuss the application of Burmister's two layer theory in pavement design.

                                                                                             (8 × 5 = 40 marks)

2. (a) (i) Classify and list the various factors effecting design and performance of pavements mentioning the importance of each.

                                                                                             (9 marks)

      (ii) Mention the difference in loading characteristics of highway and runway pavements.

                                                                                             (6 marks)

                                                  Or

   (b) (i) Explain briefly the Marshall method of Designs.   (8 marks)

      (ii) Explain briefly the Hveem method of bituminous mix design.   (7 marks)

3. (a) (i) Explain Group Index Method of Pavement Design. What are the limitations of this method ?

                                                                                             (6 marks)

      (ii) The CBR value of subgrade soil is 5%. The different pavement materials available near the construction site are as follows :

         Sandy soil with CBR = 10 %

         Soil Kankar Mix with CBR value = 40 %

         WMM with CBR = 98 %

         WBM with CBR = 95 %

         Provide at least 50 mm thick BC as surface course

         Design the flexible pavement using three layers for commercial vehicles of 2000 per day with growth rate of 6.5%.

                                                                                             (9 marks)

                                                  Or

                                                                                     Turn over

(b) (i) Calculate the thickness of Bituminous concrete using

Triaxial Method for the following data :—

E value of subgrade = 10 N/mm.^{2} Wheel Load = 51 kN

E Value of sub-base = 40 N/mm^2

Tyre Pressure = 0.60 N/mm^2

E value of BC (50 mm thick) = 120 N/mm^2

Pavement deflection = 2.5 mm Traffic coefficient = 1.50

Rainfall coefficient = 0.95.

(8 marks)

(ii) Discuss the CBR method of pavement design by Cumulative Standard Axle load method.

(7 marks)

4. (a) (i) Explain the following terms :—

(1) Modulus of subgrade reaction.

(2) Radius of relative stiffness.

(3) Radius of resisting section.

(6 marks)

(ii) Calculate the stresses at interior, edge and corner of rigid pavement by Westergaard's stress equations

Modulus of elasticity of concrete = 3.2×10^4 N/mm^2

Poisson's ratio of concrete = 0.15

Thickness of CC pavement = 250 mm

Spacing of contraction joints = 4.5 m

Width of the slab = 3.5 m

Wheel load = 51 kN   Tyre Pressure = 0.70 N/mm^2

(9 marks)

Or

(b) Estimate the thickness of concrete pavement by the method suggested by IRC for the following data :—

Modulus of Elasticity of Concrete = 3.2×10^4 N/mm^2

Modulus of rupture = 4.2 N/mm^2

Poisson's ratio of concrete = 0.15

Modulus of subgrade reaction = 0.10 N/mm^3

Spacing of contraction joint = 3.75 m

Width of the slab = 3.75 m

Wheel load = 51 kN Tyre Pressure = 0.70 N/mm^2

Slab thickness (mm)	150	200	250	300
Temp. differential in slab in the region, °C	14.6	15.8	16.2	17.0

Bradbury's Temp. Coefficients :

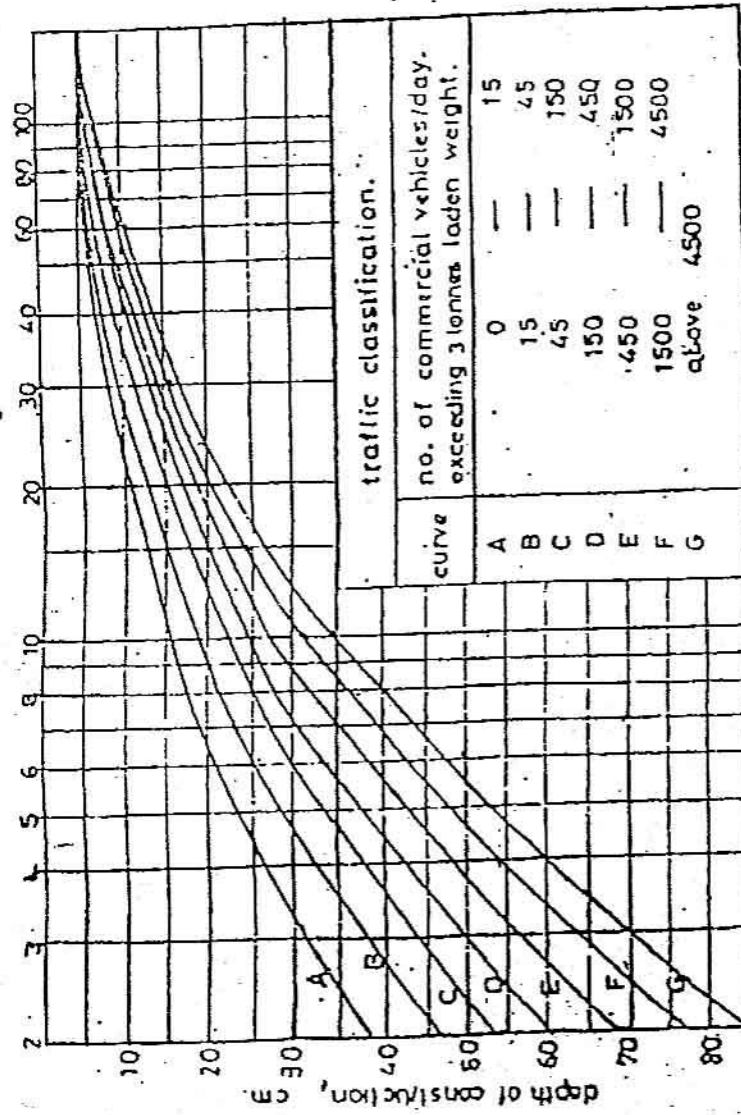| L/1	C	L/1	C	L/1	C
1.000	0.000	4.000	0.440	7.000	1.030
2.000	0.040	5.000	0.720	8.000	1.077
3.000	0.175	6.000	0.920	9.000	1.080

(15 marks)

5. (a) (i) Explain the principle and use of Benkelman Beam Test. (6 marks)

(ii) Benkelman beam rebound deflection studies were carried out during summer season on a stretch of a pavement. The pavement surface temperature was found to be 40°C. The pavement was resting on a clayey subgrade. The moisture correction factor was found to be 1.2. Design the thickness of flexible overlay using IRC 81 :1997. Rebound deflection values measured are,

1.25,1.36,1.85,1.75,1.85,1.90,1.75,1.60, 1.55,2.10,1.82,

1.35,1.45,1.55,1.65,1.75,1.80,1.90,2.10,2.05

(9 marks)

Or

(b) (i) Write a descriptive note on Pavement rehabilitation programme. (6 marks)

(ii) What are various types of failures in flexible pavement ? Explain the causes. (9 marks)

traffic classification.

curve	no. of commercial vehicles/day. exceeding 3 tonnes laden weight.		
A	0	—	15
B	15	—	45
C	45	—	150
D	150	—	450
E	450	—	1500
F	1500	—	4500
G	above	4500	

depth of construction, cm
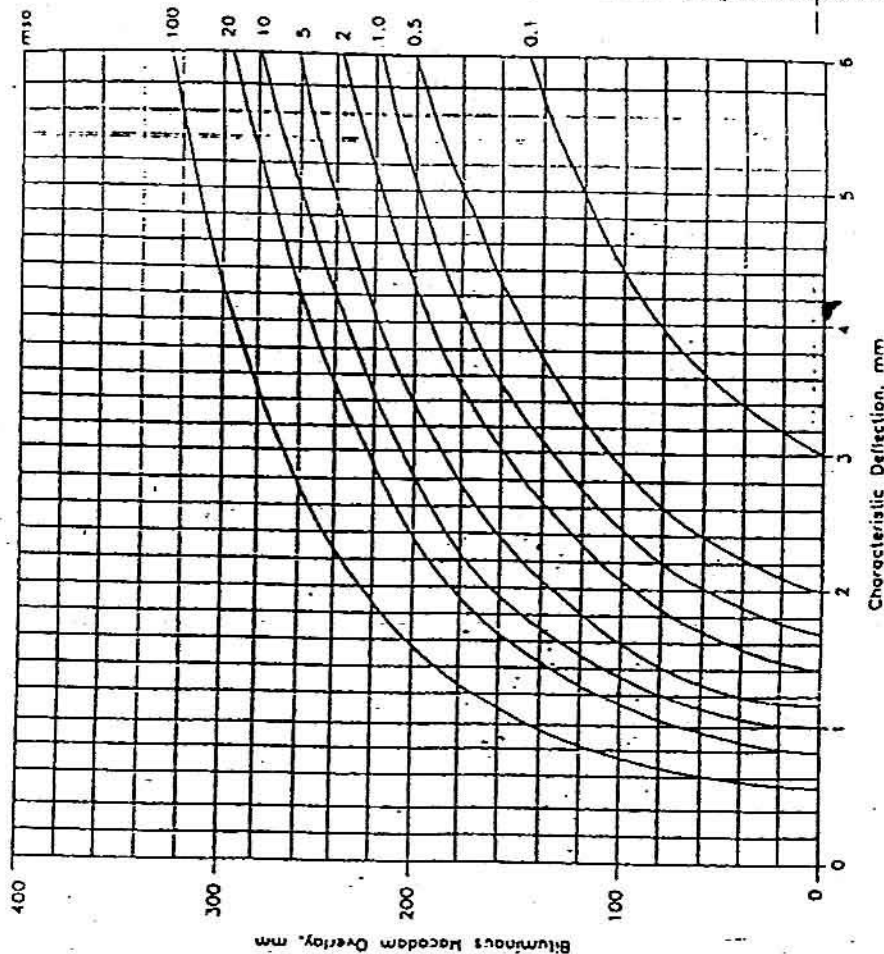
C.B.R. DESIGN CHART. (RECOMMENDED BY I.R.C.)