B.E.Eighth Semester (Civil Engineering) (C.B.S.)

Elective - II : Pavement Analysis & Design

P. Pages : 5 **NKT/KS/17/7532**

Time : Three Hours * 0 7 2 7 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Discuss the various stress influencing factors in Flexible and Rigid pavement. **6**

b) What is ESWL ? Estimate the ESWL for dual-in-tandem wheel assembly for an aircraft. **7**
Data :
i) Gear load = 35000 kg
ii) Tyre pressure = 10.5 kg/cm^2
iii) Tandem spacing = 250 mm
iv) Dual spacing = 180 mm
v) Flexible crust thickness = 65 cm, 80 cm, 115 cm

OR

2. a) Explain the concept of ESWL and explain the assumptions on which it is based. **4**

b) Clearly distinguish between Airfield and Highway pavement. **4**

c) Calculate total fatigue from given traffic data with 15 year life ad 2 years construction period with growth rate of 6%. **5**

Axle load Kg	1150	2050	4000	6150	8100	10150	12100
Avg. Daily traffic ADT	130	85	110	150	160	85	60

3. a) Explain in detail Marshall's method of Bituminous Mix Design. **6**

b) Soil subgrade sample collected from the site was analysed and the result obtained are as given below. Design the pavement section by Group Index method for the anticipated traffic volume of over 300 CVD. **7**
i) Passing 425 micron 82%
ii) Passing 75 micron 65%
iii) Liquid limit 53%
iv) Plastic limit 28%

OR

4. a) Explain plate load test for evaluating modulus of subgrade reaction and corrections to be applied. **7**

b) Calculate the cone bearing value from following data of North Dakota Cone test. Half angle of cone is 7°45' : **6**

Load (kg)	Penetration (mm)
4.5	22.3
9.0	35.1
18.0	53.4
36.0	72.5

5. a) What is difference between AASHTO & IRC methods of classification of bitumen ? **6**

b) The following observations were noted in a laboratory CBR tests conducted on subgrade soil. Calculate CBR of the soil and hence design the pavement. **8**

Penetration (mm)	Load (kg)
0.0	0
0.5	9
1.0	34
1.5	69
2.0	91
2.5	106
3.0	131
4.0	154
5.0	176
7.5	200
10.0	230
12.5	240

It is further proposed to use the following material for different.
Pavement layers :
Compacted soil with 8% CBR
Poorly graded gravel with 25% CBR
Well graded gravel with 85% CBR
The traffic survey revealed the present ADT of commercial vehicle as 1400. The annual rate of growth of traffic is found to be 7.5%, the pavement construction is to be completed in three years after the best traffic count. Design the pavement section using CBR method as recommended by IRC, assuming 15 years service life. (Use CBR design chart)

OR

6. a) What is the objective of Triaxial Compression test ? Explain the test in detail. **6**

b) Determine the required thickness of an airfield flexible pavement based on Burmister's Theory using the following plate load test data and other input parameters : **8**

- Diameter of plate used = 75 cm
- Pressure observed at 1.25 mm deflection when the plate load test is conducted on the sub-grade = 0.82 kg/cm^2
- Pressure observed at 1.25 mm deflection when the plate load test is conducted on a base course of 16 cm thickness = 2.1 kg/cm^2
- Design wheel load = 23000 kg
- Tyre pressure = 15 kg/cm^2

(i) If allowable deflection = 0.125 cm and (ii) If allowable deflection = 0.50 cm

7. a) Write in detail about different kinds of stresses in rigid pavements. **6**

b) For the above pavement calculate safe spacing of contraction and expansion joints and design a longitudinal Tie-bar joint from following data : **7**

i) Permissible shrinkage stress in C. C. = 0.85 kg/cm^2
ii) Width of Expansion joint = 25 mm
iii) Seasonal Temperature variation m = 45°C
iv) Permissible tensile stress inn Tie-bar = 2000 kg/cm^2
v) Bond stress in steel = 25 kg/cm^2
vi) Lane width = 3.0 m.

OR

8. a) Explain LCN method of Airfield pavement design. **6**

b) Explain PCA method of rigid pavement design in detail. **7**

9. a) State the need & scope of plate load test. What are the standard specifications of the test. **6**

b) Benkelman Beam Deflection studies were carried out on 15 points using a dual wheel load of 4085 kg & 5.6 kg/cm^2 pressure. If the traffic consist of 750 CVD, determine the thickness of bituminous overlay required, if the pavement temperature during the test was 30°C and moisture content is 1.3. Assume annual rate of growth of traffic as 7.5% Adopt IRC guideline. Deflection values in mm are given bellows. **7**
1.4, 1.32, 1.25, 1.35, 1.48, 1.6, 1.65, 1.55, 1.45, 1.4, 1.36, 1.46, 1.5, 1.52, 1.45.

OR

10. a) Define the following terms : **4**
i) Field Density ii) Profilometer

b) Design a rigid pavement for a two lane highway from the given data : **9**
Design wheel load = 5100 kg
Radius of contact area = 15 cm
Grade of concrete = M30
Modulus of subgrade reaction = 8 kg/cm^2
Cx = 0.92
Cy = 0.72
Temperature Gradient = 0.6°C/cm
Assume any other required suitable data.

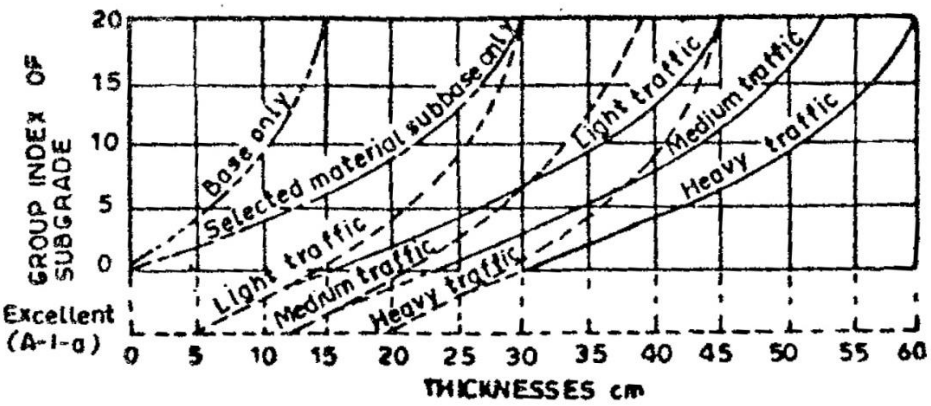
11. Check the adequacy of rigid pavement from IRC criteria : **14**
i) Slab thickness 150 mm
ii) 'E' of concrete 3 x 10^5 kg/cm^2
iii) Poissons ratio of concrete 0.15
iv) Thermal expansion coefficient 10 x 10^{-6}/°C
v) M.O.R. of concrete 48 kg/cm^2
vi) Anticipated thermal gradient across slab 0.5°C/cm
vii) 'K' of subgrade soil 6.5 kg/cm^2/cm
viii) Cx & Cy 0.82 & 0.45 resp.
ix) Wheel load 3000 kg
x) Tyre pressure 4.5 kg/cm^2

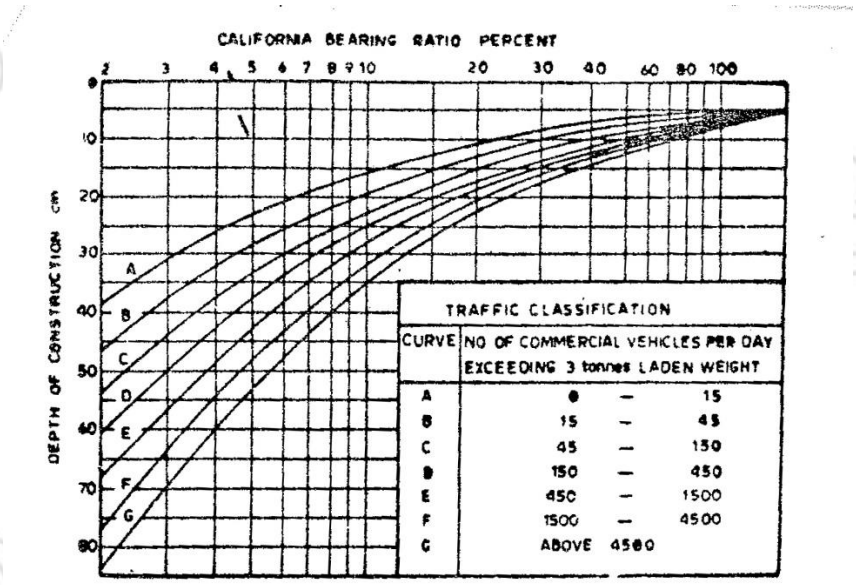
OR

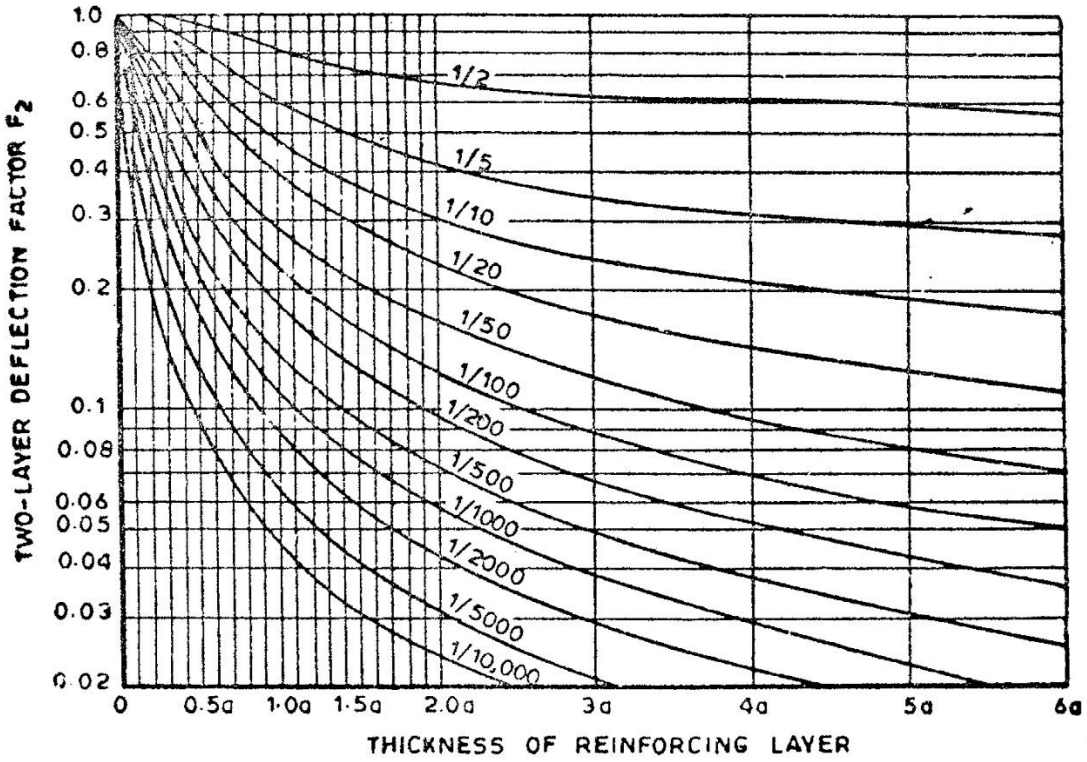
12. a) Explain the various methods used for the maintenance and rehabilitation of flexible and Rigid pavements. **7**

b) Design a dowel bar system for the following data : **7**

i) Pavement thickness = 200 mm
ii) Radius of relative stiffness = 55 cm
iii) Width of relative expansion joint gap = 20 mm
iv) Permissible shear stress in dowel bar (F_s) = 1000 kg/cm^2
v) Permissible flexural stress in dowel bar (F_f) = 1400 kg/cm^2
vi) Bearing stress in concrete (F_b) = 100 kg/cm^2
vii) Wheel load = 4000 kg







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