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

Elective - II : Pavement Analysis & Design

P. Pages : 4 **KNT/KW/16/7532**

Time : Three Hours 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. Diagrams and chemical equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.

1. a) Cleary distinguish between Highway and Airfield pavements. **6**

b) Estimate the ESWL for Dual-in-tandem wheel assembly for an aircraft with the following data : **7**
Gear load 30000 kg
Tyre pressure 9.8 kg/cm^2
Dual spacing 300 mm clear
Tandem spacing 450 mm clear
Crust thickness 500, 750 and 800 mm

OR

2. a) Compare flexible and rigid pavements. **6**

b) Estimate total fatigue in a service life of 15 years in terms of standard axle load of 8100 kg. Assume growth rate of traffic as 7.5 percent per annum and delay in opening to traffic of 2 years. **7**

Axle load Group	Present ADT	Eg. load factor
<1000 kg	160	0.0025
1 - 3 t	220	0.03
3 - 5 t	170	0.35
5 - 7 t	158	0.60
7 - 9 t	189	1.00
9 - 11 t	108	2.32
11 - 13 t	82	4.52
13 - 15 t	68	7.60
> 15 t	07	12.80

3. a) Estimate the group index of subgrade soil from following data and discuss its rating as subgrade : **7**

i)	Passing 425 micron	73%
ii)	Passing 75 micron	58%
iii)	Liquid Limit	54%
iv)	Plastic Limit	26%

b) Calculate cone bearing value for following data : **7**

Load (kg)	Cone penetration (mm)
4.5	21.9
9.0	32.7
18.0	51.3
36.0	71.6

Assume that the half angle of cone is 7°45'.

OR

4. a) Estimate the vertical compressive stress at depth = 24 cm and surface deflection for a subgrade with the following data **7**

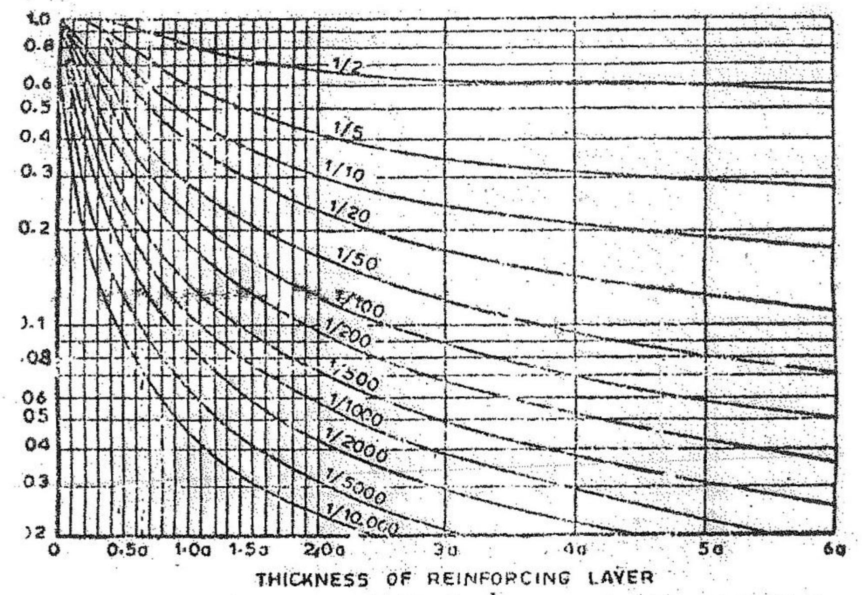
i) Wheel load = 3200 kg at 4.5 kg/cm^2 T.P.

ii) E of subgrade = 250 kg/cm^2.

iii) Poisson's Ratio = 0.47

b) A flexible pavement is to be constructed over subgrade CBR of 5%. Estimate total crust thickness if maximum wheel load is 8000 kg at T.P. = 6.5 kg/cm^2. **7**

5. a) A plate load test conducted with 30 cm dia. plate on subgrade and also on 20 cm thick base recorded a load of 1800 kg and 5400 kg respectively for 2.5 mm deformation. Design the pavement section for a wheel load of 5200 kg at 5.1 kg/cm^2 tyre pressure for allowable deformation of 3.5 mm. Assume Poisson's ratio of subgrade = 0.48. **7**



Relationship of F_2 and h in a Two-Layer System (Burmister's Method)

Fig. Q No. 5(a)

b) The CBR test carried out on a subgrade soil gave following readings. **7**

Penetration (mm)	Load (kg)	Penetration (mm)	Load (Kg)
0.0	0.0	4.0	74.0
0.5	5.0	5.0	75.5
1.0	12.0	7.5	92.3
1.5	32.0	10.0	103.4
2.0	43.0	12.5	112.6
2.5	48.0		
3.0	56.0		

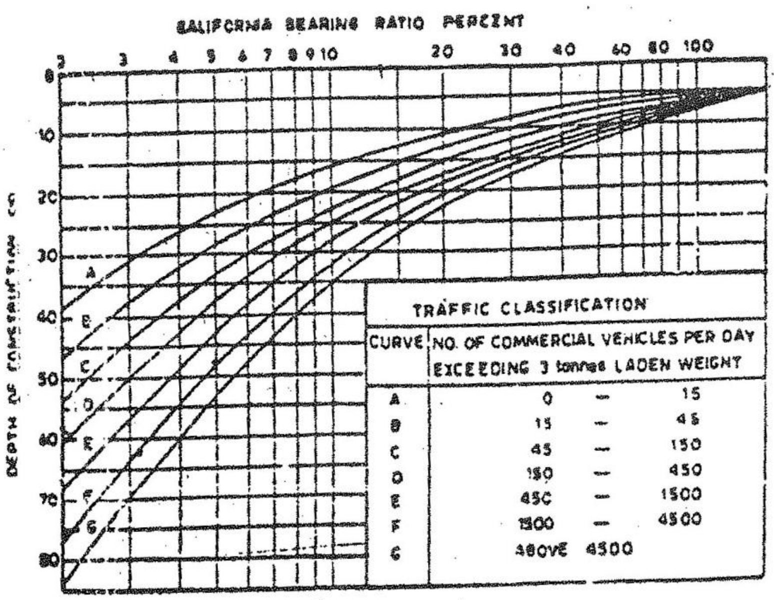
The different pavement materials available near the construction site are as follows.

i) Sandy soil of CBR = 12%

ii) Soil - Kankar mix of CBR = 20%

iii) Crusted Gravel of CBR = 80%

Design a flexible pavement if initial traffic is 300 CVD, traffic growth rate is 7.5% and design life of pavement 20 yrs. Minimum bituminous surfacing be 5 cm.



C.B.R. Design Chart (Recommended by IRC)

Fig. Q No 5(b)

OR

6. a) Design a flexible highway pavement if maximum surface deflection is not to exceed 1.5 mm from following data : **7**

i) Wheel load - 4000 kg at T. P. = 5.5 kg/cm^2

ii) 'E' of surface - 2000 kg/cm^2

iii) 'E' of base course - 1000 kg/cm^2

iv) 'E' of sub base - 4000 kg/cm^2

v) 'E' of subgrade - 100 kg/cm^2

vi) Traffic coefficient - 1.6

vii) Saturation coefficient - 0.80

b) Explain LCN method of Air field pavement design. **7**

7. Design a Rigid pavement for a two lane highway from the given data : **13**

i) Wheel load 5100 kg
ii) Tyre pressure 5.7 kg/cm^2
iii) Grade of concrete M30
iv) Modulus of subgrade reaction 7.2 $kg/cm^2/cm$
v) $C_X = 0.8$, $C_Y = 0.7$
vi) Temperature gradient 0.52 ºC/cm
vii) Projected traffic volume 2500 CVD.

OR

8. a) Estimate the load factor at all regions of runway concrete pavement of 300 mm thickness under ESWL = 12000 kg at 8.5 kg/cm^2 tyre pressure. Assume grade of concrete M30 and 'K' for subgrade soil = 7.5 $kg/cm^2/cm$. **7**

b) Explain in detail AASHO method of Rigid pavement design. **6**

9. a) Explain plate load test for evaluation of modulus of subgrade reaction and correction to be applied. **7**

b) Explain the following. **6**

i) Serviceability Index.
ii) Profilometers.

OR

10. a) Explain Benkelman Beam Test in detail. **7**

b) Explain Marshall's method of Bituminous mix Design. **6**

11. a) Following observation were recorded in a Benkalman Beam deflection investigation for certain section of a state highway 1.42, 1.34, 1.28, 1.30, 1.61, 1.58, 1.54, 0.96, 1.44, 1.36, 1.54, 1.45mm (corrected values). Design a bituminous overlay if maximum allowable deflection is 0.80 mm. Assume layer equivalency factor. **7**

b) Explain maintenance & Rehabilitation of pavements. **6**

OR

12. a) Explain strengthening of Existing pavements and design of overlap. **7**

b) What are IRC specification for the highway pavements. **6**

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