

## UNIT – III

### DESIGN OF RIGID AND FLEXIBLE PAVEMENTS

#### Two Marks Questions and Answers

##### **1) Define Pavement?**

The Pavement consisting of a few layers of Pavement material is constructed over a prepared soil sub grade to serve as a carriageway.

One of the objectives of a designed Pavement is to keep this elastic deformation of the Pavement within the Permissible limits.

##### **2) What are the types of Pavement Structure?**

Based on the structural behaviour, Pavements are generally classified in to two categories.

- i) Flexible Pavements.
- ii) Rigid Pavements.

##### **3) What is mean by Flexible Pavements?**

Flexible Pavements are those, which on the whole have low or negligible flexural strength and are rather flexible in their structural action under the loads. The Flexible Pavements layers reflect the deformation of the lower layers on to the surface of the layer.

##### **4) What are the components in Flexible Pavements?**

A typical flexile pavement consists of four components

- i) Soil sub grade
- ii) Sub base course
- iii) Base course
- iv) Surface course

##### **5) Define rigid pavement.**

Rigid pavements are those, which possess note worthy flexural strength or flexural rigidity. The stresses are not transferred from grain to the lower layers as in the ease of flexible

pavement layers. The rigid pavements are made of Portland cement concrete either plain, reinforced or prestressed concrete.

**6) What are the functions are in pavement components?**

The functions are:

- 1) Soil subgrade are its evaluation
  - a. California bearing ratio test
  - b. California resistance value test
  - c. Triaxial compression test
  - d. Plate bearing test.
- 2) Sub base and base courses and their evaluation
- 3) Wearing course and its evaluation

**7) Define the two parts of pavement design?**

Pavement design consists of two parts:

- i) Mix design of materials to be used in each pavement component layer
- ii) Thickness design of he pavement and the component layer.

**8) What are the factors considered in design of pavements?**

The various factors to be considered for the design of pavements are given below.

- i) Design wheel load
- ii) Sub grade soil
- iii) Climatic factors
- iv) Pavement component materials
- v) Environmental factors
- vi) Special factors in the design of different types of pavements.

**9) Give the equation for Boussineq's theory?**

The equation for vertical stress computations under a uniformly distributed circular load based on Boussineq's theory is given by:

$$\sigma_z = P \left[ 1 - \frac{z^3}{(a^2 + z^2)^{3/2}} \right]$$

Here,

$\sigma_z$  = Vertical stress at depth Z

P=Surface pressure

Z= depth at which  $\sigma_z$  is computed

a= Radius of loaded area.

### 10) Define the three types of pressure?

The types of pressure are:

A) Tyre pressure    B) Inflation pressure    C) Contact pressure

### 11) How to measure the contact pressure?

Contact pressure can be measured by relationship:

$$\text{Contact pressure} = \frac{\text{Load on wheel}}{\text{Contact area (or) area of imprint}}$$

**12) Calculate ESWL of a dual wheel assembly carrying 2044 kg each for pavement thickness of 15,20 and 25 cm. Centre to center tyre spacing 27cm and distance between the walls of the tyres=11 cm.**

**Solution:**

Here=2044 kg 2P= 4088kg D= 11cm S=27cm

X and Y points are plotted on a log graph between ESWL and pavement thickness

X has coordinates (P, d/2) = (2044, 5.5)

Y has coordinates (2P, 2S) = (4088, 54)

### 13) Define moduli.

Depending upon the design methods the elastic moduli of different pavement materials is evaluated. Mainly plate bearing test is employed for this purpose.

The elastic moduli values of the following are determined by plate bearing tests:

- i) Sub grade modulus
- ii) Elastic moduli of base course and sub base course materials.

**14) What are the major effects in climatic variations?**

The climatic variations cause following major effects:

- i) Variation in moisture condition
- ii) Frost action
- iii) Variation in temperature.

**15) What is mean by semi-empirical?**

When the design is based on stress strain function and modified  $n$  based on experience it may be called semi-empirical (or) Semi theoretical.

**16) What are the design methods available in flexible pavement?**

The following methods are:

- i) Group index method
- ii) California bearing ratio method
- iii) Stabilometer method
- iv) Triaxial test method
- v) McLeod method
- vi) Burmister method

**17) Which formula is used for estimating the design traffic?**

The formula is:

$$A = P [1 + r]^{(n + 10)}$$

Where,

A= number of heavy vehicles per day for design

P=number of heavy vehicles per day at least count

r= annual rate of increase of heavy vehicles

n= number of years between the last count and the year of completion of construction

**18) Define critical load positions.**

There are three typical locations namely the interior, edge and corner, where differing conditions of slab continuity exist. These are termed as critical load positions.

**19) What are the types of loading?**

Interior loading --- When load is applied in the interior of the slab surface

Edge loading ----- When load is applied in an edge of the slab.

Corner loading ---- When the center of the load application is located on the bisector of the corner angle formed by two intersecting edges of the slab.

**20) Define Wheel load stresses?**

A.T.Goldbeck indicated that many concrete slabs failed at the corners. He derived a corner load formula due to a point load at the corner of the slab. It is given by:

$$S_c = \frac{3P}{H^2}$$

$S_c$  = Stress due to corner load, kg/cm<sup>2</sup>

P=Corner load assumed as a concentrated point load, kg

H=Thickness of the slab, cm

## **16 Marks questions and Answers**

1. Briefly explain the comparison of rigid and flexible pavements?
2. Briefly explain about types of pavement structure?
3. Describe the various functions of pavement components?
4. Explain the various factors to be considered in pavement design? Discuss the significance in each.
5. Write short notes on
  - i) Characteristic of pavement materials
  - ii) Climatic variation
6. Enumerate the various methods of flexible pavement design? Briefly indicate the basis of design in any three cases.
7. Briefly explain the type of stresses?
8. Calculate the stresses at interior, edge and corner regions of a cement concrete pavement using Westergaards stress equations.