

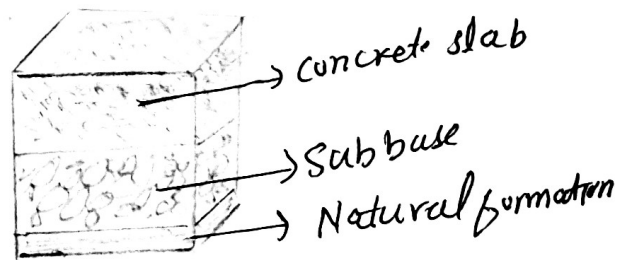
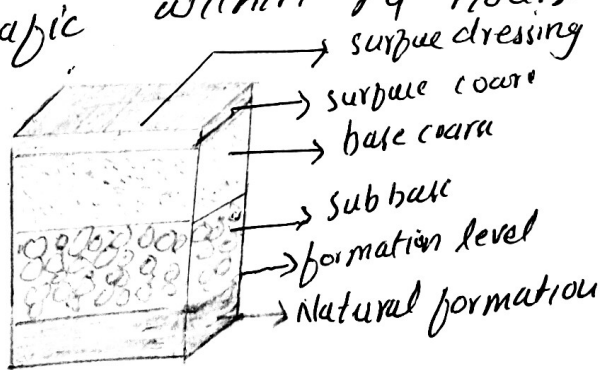
Question # 04: Draw comparison between flexible and Rigid pavement

Ans: Flexible pavement

Rigid pavement

- ① Bitumen is used as a binder in flexible pavement.
- ② Deformation in the subgrade is transferred to the upper layers.
- ③ Load is transferred by grain to grain contact
- ④ Flexible pavement have low initial construction cost but have high maintenance cost
- ⑤ Have low life span usually 10-15 years
- ⑥ Surfacing cannot be laid directly on the subgrade but a sub base is needed
- ⑦ in flexible pavement strength of road highly dependent on strength of sub grade
- ⑧ Road can be used for traffic within 24 hours

- Cement is used as a binder in Rigid pavement
- Deformation in the subgrade is not transferred to subsequent layers.
- No such phenomenon of grain to grain load transfer exists.
- Rigid pavement have low maintenance cost but high initial cost of construction.
- Life span is more as compare to flexible 30+ years.
- Surfacing can be directly laid on the sub grade.
- strength of road is less dependent on strength of sub grad in Rigid pavement.
- Road cannot be used until 14 days of curing.



(2)

Question # 02:- Define and explain base, sub base, water bound macadam, Dry bound macadam, wet mix macadam and penetration macadam

Ans:-

Base:-

A base course is the defined is the layer of granular material which lies immediately below the wearing surface of a pavement.

Base course under flexible pavements are primarily to increase the load supporting capacity by distributing the load through a finite thickness of pavement this will reduce shear and consolidation deformation in the subgrade.

Sub base:-

A sub base is a layer of material between base and subgrade sometime a granular material under a rigid pavement is called a sub base.

⇒ Sub base may consist of select materials such as natural gravels that are stable but that have characteristic which make them not completely suitable as base course. they may also be stabilized soil/borrow material

⇒ The purpose of sub base is to permit building of relatively thick pavements at low cost thus the quality of sub base can vary with in wide limits as long as the thickness design criteria are fulfilled.

(3)

⇒ Water Bound Macadam:-

The dense and compact course of a road pavement composed of stone aggregate bound together by a thin film of cementing medium consisting of fine mineral filler with cementitious properties and containing a minimum laden moisture to impart to the binder necessary cohesive and adhesive properties to enable it to binder the aggregate together.

⇒ The strength of a water-bound macadam is due to the following properties.

- primarily due to the through mechanical interlock in the aggregate particles
- cohesion between the aggregate particles due to the cementitious film of soil moisture binder
- The water bound Macadam is constructed by spreading loose material which gives a consolidated thickness of 75mm - 100mm

⇒ Dry Bound Macadam:-

The aggregates are held together by mechanical interlock. The void in a layer of almost single sized stone are filled with a dry cohesionless fine aggregate filler. The voids are filled with filler through the use of compaction equipment only and no water is used.

⇒ Wet Mix Macadam:⁽⁴⁾

The graded stones are mixed with water and compacted

Wet mix macadam is a specification in which a well graded aggregate is mixed with water in a mechanical mixer and the resultant mixture is laid by pavers and compacted.

The aggregate generally crusher run and include fine also. Because of the close grading, the coarse will have good interlock with excellent density.

⇒ penetration Macadam:

if a Bitumenous material is sprayed over the stone and allowed to penetrate into the coarse and by premix macadam if the bitumenous material is mixed with the aggregate prior to laying.

Question # 03: →

Define and explain bitumen, asphalt, asphalt cement, bituminous emulsion and cut back products. also write down composition Asphalt.

Ans:-

(i) Bitumen:- A class of black or dark colored cementitious substances natural or manufactured, composed principally of high molecular weight hydrocarbons found in Asphalt, Tar, pitch and Asphaltites are typical.

(ii) Asphalt:- A dark brown to black cementitious material in which the predominating constituents are bitumens which occur in nature or are obtained in fractional distillation of petroleum along with certain mineral matter.

in American terminology Both Asphalt and Bitumen are same and are Asphalt.

(iii) Asphalt cement:-

A fluxed or unfluxed asphalt specially prepared as to quality and consistency for direct use in the manufacture of bituminous pavement and having a penetration between 5 to 300.

(6)

(V) Bituminous Emulsions:

A suspension of minute globules of bituminous material in water or in an aqueous solution

As suspension of minute globules of water or of an aqueous solution in a liquid bituminous material.

(VI) cut back product:

A petroleum or tar residue which have been blended with distillates

(VII) Asphalt composition:

The chemical composition of Asphalt - semi solid material. According to Simpson they generally consist of the following.

Carbon	70-85%
Hydrogen	7-12%
Nitrogen	0-1%
Sulfur	1-7%
Oxygen	0-5%

Also a small amount of metals either dispersed in the form of oxides and salt or in metal containing organic compound.

Question # 04:

Write are factor considered AASHTO flexible pavement design in 1993 guide. differentiate between functional and structural performance of pavement

Ans:

The factor consider in the AASHTO procedure for the design of flexible pavement as presented in the 1993 guide are:

- ① pavement performance.
- ② Traffic
- ③ Roadbed soil (subgrade material)
- ④ material of construction
- ⑤ Environment
- ⑥ Drainage
- ⑦ Reliability.

⇒ The primary factors considered under pavement performance are the structural and functional performance of the pavement

⇒ structural performance:

structural performance is related to the physical condition of the pavement such as the capacity of the pavement to carry the traffic load.

(8)

⇒ Factor which reduce the structural performance of the pavement included cracking, faulting, raveling and so forth

⇒ Functional performance!

functional performance is an indication of how effectively the pavement serves the user. the main factor consider under functional performance is riding comfort

→ To quantify pavement performance a concept known as the serviceability performance was developed and is measured using pavement serviceability index (PSI)

The scale ranges from 0 to 5 where 0 is the lowest PSI and 5 is the highest

⇒ structural performance

1) characteristic of pavement that directly effect by damage of one or more component causing the pavement can no longer restrain traffic load

2) The level of pavement service is assessed through structural capacity to cumulative traffic load

⇒ functional performance.

The pavement directly effect the safety and comfort of road users and road service, skid resistance, structural & surface texture, road roughness in serviceability

⇒ The road damage study used the pavement condition index (PCI)

(9)

Question # 09:

Explain Alligator cracking, block cracking longitudinal cracking and Transverse cracking.

Ans:

(I) Alligator cracking:

Alligator cracking may be considered a combination of fatigue and block cracking

→ It is a series of interconnected cracks of various stages of development

→ Alligator cracking develops into a many sided pattern that resembles chicken wire or alligator skin

→ occurs in area subjected to repeated traffic loading?

(II) Block cracking:

A pattern of cracks that divided the pavement into approximately rectangular pieces with sides generally longer than one feet

Rectangular block Remy in size from approximately 0.1 m^2 to 10 m^2

possible cause shrinkage of asphalt

(10)
③ Longitudinal cracking

cracks predominantly parallel to pavement centerline location within the lane is significant.

possible cause:

Expansion and contraction of pavement material, roadbed settlement, poorly constructed paving joints.
subsoil settlement

Cures:

- joint sealing
- Full depth replacement
- subsurface stabilization

④ Transvers cracking

cracking across the centerline not due to reflection cracking

possible cause:

Expansion and contraction of pavement roadbed settlement poorly constructed paving joint

- slab longer than required
- Excessive thermal stress

Cures:

- crack sealing
- Full depth repair
- Dowel bar retrofit