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Sec: B

Subject: Transportation

Semester: 6th

Q No 1 part(a)

What is the Diffrent b/w flexible and Rigid.

Answer:

	flexible Pavement		Rigid Pavement
(1)	Bitumen is used a binder in flexible pavement.	1	cement is used as a binder in rigid pavements.
(2)	Deformation in the sub grade is transfered to the upper layers.	2	Defformation in the sub grade is not transferred to subsequent layers.
(3)	load is transfered by grain to grain contact.	3,	No such phenomeon of grain to grain load transffer Exist.
(4)	Have low life span usually 10-15 years.	4	life span is more is compare to flexible usually 30 + years.

b. What are the advantages of water bound over Wet mix macadam.?

=> the main advantages of Wet-mix macadam over Water bound macadam is that is composed of a well graded mixtures. this ensures good interlock and high stability.

=> Addition of Water While Mixing facilitates the handling of the Mixture. the operation of laying is much simples than that of Water-bound Macadam. Where the screenings and Binding Material have to be added in stages and forced into voids. if a crusher-run Material is used, there is no possibility of plastic fine entering into the Mixture.

=> the compaction is greatly facilitated by the moisture added Which lubricates the individual particles.

=> the Aggregates for Wet mix Macadam will have to be crusher-run. Whereas the aggregates for Water bound macadam are generally hand-broken.

Q No 1

What is the difference between asphalt and Bitumen?

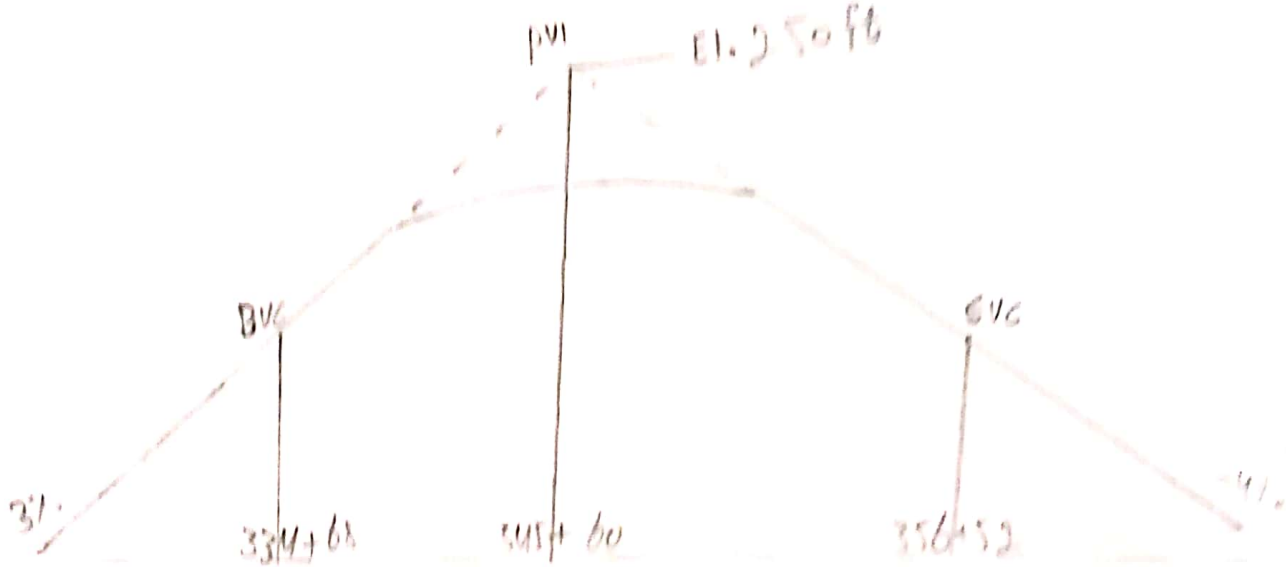
Answer:

Difference Between ASphalt and Bitumen :-

	Bitumen	ASphalt
1-	A class of black or dark colored (solid - semi solid or viscous) cementitious substance natural or manufactured, composed of highly molecular weight	1- A dark brown to black cementitious material in which predomin-ating constituents are bitumen which occur in nature or obtained by frictional distilation.
	In American terminology both are same.	asphalt and Bitumen
2.	In some litrature Bitumin in actually the liquid binder that hold asphalt together	ASphalt is generally used as 2- term refer to the combination and gravel specefically for road construction.

Question No (2)

A crest vertical curve joining a +3 percent and a -4 percent grade is to be designed for 75 mi/h. If the tangent intersect at Station (345+~~00~~ 60.00) at an elevation of 250 ft. determine the stations and elevations of the BVC and EVC. Also calculate the elevations of intermidiate points on the curve at the whole Stations.



Solution :-

for a designed speed of 75 mi/h. K = 312. from table 15.5

$K = 312$

min length $= 312 \times [3 - (-4)] = 2184$ ft.

station of BVC $= (345+60) - \left(\frac{21+84}{2}\right) = 334+68.$

station of EVC $= (334+68) + \left(\frac{21+84}{2}\right) = 356+52.$

Elevation of BVC $= 250 - \left(0.03 \times \frac{2184}{2}\right) = 217.24$ ft

Question No 03

⇒ A flexible Highway is to be desinged to carry a desinged from within the — — — — — — — — — — is available.

⇒ Resilient Modulus of asphalt concrete at 68°F 450,000 lb/in²

- CBR Value of Base course Material, 100 Mr
  Mr 31,000 lb/in²
- CB value of Sub base course Material 22, Mr 13,500 lb/in²
- CBR value of Subgrade Material 6
- Mr of Subgrade 6 × 15,00 lb/in² = 9000 lb/in²

⇒ ## flexible pavement Design :-

- Reliabelity level (R) = 99 %
- standard deviation So = 0.49
- initial Serviceability Index, pi = 4.5
- Terminal Servicabelity Index, Pt = 2.5
- ΔPSI = 4.5 − 2.5 = 2.0

Step :- 01

Draw a line joining the reliability level of 99% and the overall standard deviation S_o of 0.49. and extend this line the intersect the first TL at point A.

find value of SN_1 and D_1 :

Step :02

Draw a line joining point A to the ESAL 2×10^6. and this line to intersect the second TL line at point B.

Step : 03

Draw a line joining point B and resilient Modulus (MR) of Base course and extent this line to intersect the design serviceability loss chart at point C.

Step : 04 =

Draw a horizontal line from point c to intersect the design serviceas.

Loss (PSI) curve at point D_1

$\Delta PSi = Pi - Pt = 4.5 - 2.5 = 2.0$

So that structure number required to protect the base course and to find the thickness D1, of surface course is

2.6

Step : 06

Determine the appropiate structure layer coefficent for each construction Material.

Resilient value of asphalt =

450,000 lb/in², there fore $a_1 = 0.44$

finding SN_2 and D_2 (Base course)

$$D_2 = (SN_2 - SN_1) / a_2 m_2$$

- SN_2 from table = 3.8
- $\therefore a_2 = 0.14$
- $\therefore m_2 = 0.80$

$$= (3.8 - 2.64) / 0.14 \times 0.80$$

$$D_2 = 10.36''$$

Use $12''$

So thickness of base course $12''$

$$SN_2 = 0.14 \times 0.80 \times 12 + SN_1$$

$$SN_2 = 1.34 + 2.64$$

$$= 3.98$$

finding SN_3 and D_3

$$D_3 = (SN_3 - SN_2) / a_3 m_3$$

- $\therefore SN_3 = 4.4$
- $\therefore a_3 = 0.10$
- $\therefore m_3 = 0.80$

$$= (4.4 - 3.98) / 0.10 \times 0.80$$

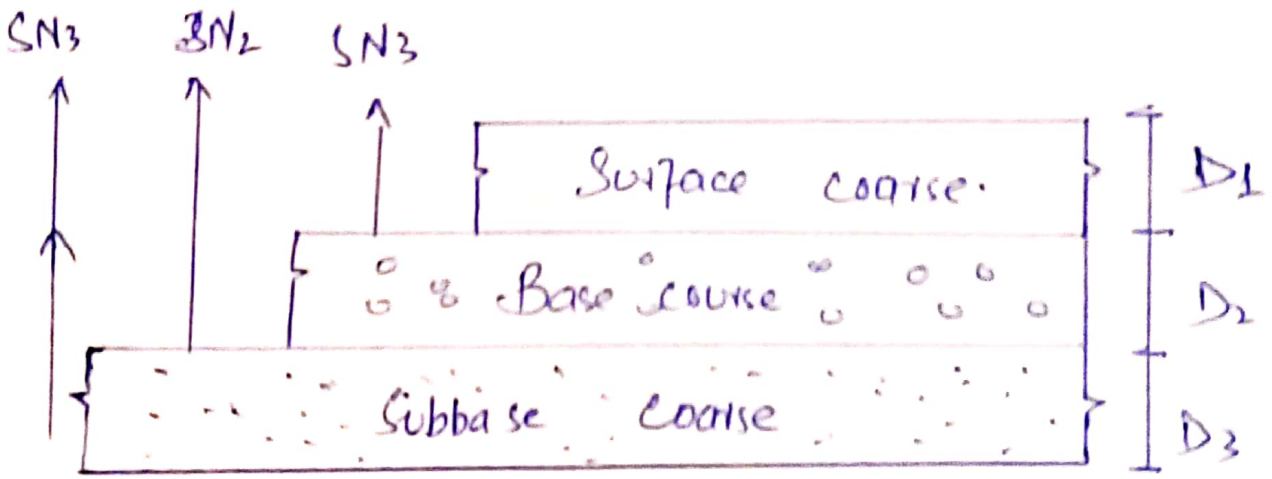
$D_3 = 5.25''$

We will use 6" as Sub base

$SN_3 = 2.64 + 1.34 + 6'' \times 0.10 \times 0.80$

$SN_3 = 4.46 > 4.4$ okay

final Design :-



AASHTO Design Equation for SN

$$\log_{10} W_{18} = Z_R S_o + 9.36 \log_{10} [SN+1] - 0.20$$

$$\log_{10} \left[\frac{\Delta PSI}{4.2 - 1.5}\right]$$

$$\frac{}{0.40 + \left[\frac{1094}{(SN+1)^{5.19}}\right]}$$

$$+ 2.32 \log_{10} M_R - 8.07$$

Question No (4) -

Pavement Distresses.

⇒ Distress is a condition of the pavement structure that reduces serviceability or leads to a reduction in service life.

=> Distresses could occur in a pavement due to:

- unstable mixes
- Higher wheel loads than those considered in design.

⇒ **ligator cracking :-**

⇒ **cause :**

overloading
Indemnate structure

Repair :-

- crack sealing in in effective
- Dig out and replace Area.

Block Cracking :

problem :- Allow moisture infiltration

possible cause :-

- HMA Shrinkage
- Asphalt binder aging

Repair :-

low Severity crack (< 1/2 inch wide). crack Seal to prevent entry of Moisture.

High Severity crack (< 1/2 inch wide) and crack with revealed edges.

Remove and replace the cracked pavement layer with an overlay.

Poth Holes :-

- Small bowl-shaped depression in the pavement Surface that penetrates all the way through HMA layer down to the to the base course.
- pothholes are most likely to occur on road with the HMA Surface (1 to 2 inch) and Seldom occur on road with 4 inch or deeper. HMA Surfaces.

Repair :-

patching techniques.

Rutting :-

=> Surface depression in the Wheel path, are particularly evident after a rain when they are filled with water.

=> surface depression in the Wheel path, are particularly evident.

possible cause :-

- In sufficient compaction of HMA layer during construction.
- Improper Mix design (e.g as a result of inadequate pavement structure.
- Subgrade rutting (as a result of inadequate pavement structure)

= Repair :- slight ruts (< 1/3 inch deep) can generally be left untreated

Bleeding :-

problem :

loss of skid resistance when wet

possible cause :-

excessive asphalt binder in the HMA.

low HMA air void

Raveling :- loose debris on the pavement which increase pavement roughness and loss of skid.

possible cause :-

Asphalt binder aging

Inadequate compaction during construction

Repair :- fog seal / slurry seal or remove the damaged pavement overlay.