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Section : (B)

Semister : 6th

Subject : Highway and Traffic Engineering

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Q.No1 Part(a)

What is the difference b/w flexible and Right pavement.

Answer:-

Flexible pavement	Rigid pavement
1) load is transferred by grain to grain contact.	1) No such phenomenon of grain to grain load transfer exists.
2) Flexible pavements have low inital construction costs but have high maintence cost.	2) Right pavements have low maintance cost but have high inital construction costs.
3) Have low life span usually 10-15 years.	3) life span is more as compare to flexible usally 30+ years.
4) Surfacing can not be laid directly on the sub grade but a sub base is needed.	4) Surfacing can be directly laid on the sub grade.

Q.no 2 part (b)

advantages

What are the of water bound over wet mix macadam?

Answer: The main advantage of wet-mix macadam over water-bound macadam is that it is composed of a well-graded mixture. this ensure good interlock and high stability.

2) the compaction is greatly facilitated by the moisture added which the individual particles.

3) the aggregates for wet mix macadam will have to be crusher-run whereas the aggregates for water bound macadam are generally hand-broken.

Q No1 Part (c)

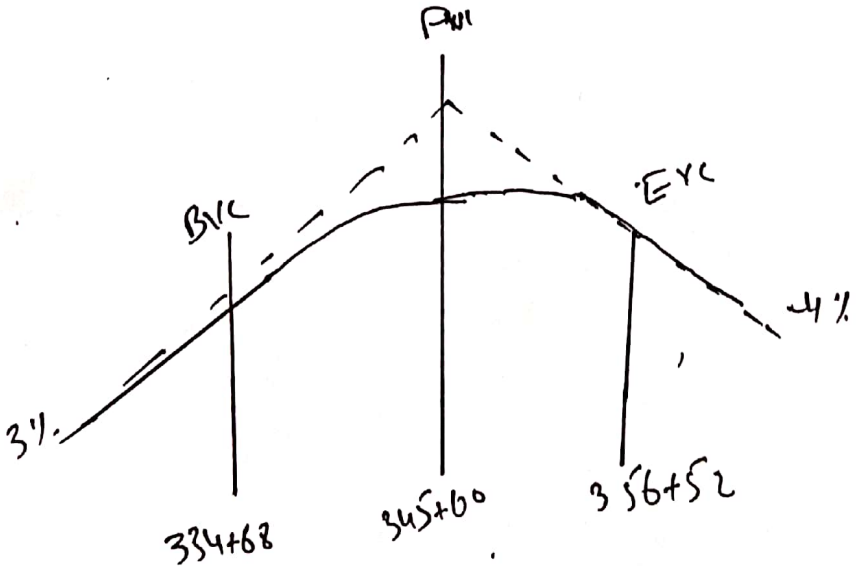
what is the difference b/w asphalt and bitumen.

Aswer:: Difference b/w Asphalt and Bitumen

Bitumen	Asphalt
1) A class of black or dark colored (Solid, semi-solid or viscous) cementitious substances, natural or manufactured, composed principally of high molecular weight hydrocarbons found in Asphalts, tars, pitches, and Asphaltites are typical.	a) A dark brown to black cementition material in which the constitents are bitumens which occur in nature or are obtained in fractional distillation of petroleum (crude oil) along with certain mineral matter.
2) In some literature bitumen is actually the liquid bineder that holds asphalt together.	3). Asphalt is generally used as a term to refer to be combination of bitumen and gravel specifically for road construction.

3 No 3 part (a):-

A crest vertical curve joining +3 percent and a -4 percent grade is to be designed for 75 mi/h - If the tangent (345+00.00) at an elevation 2507 ft. determine the station and elevation of the BVC. Also calculate the intermediate point on curve.



Solution:-

For design speed of 75 mi/h

Value of K from table

K = 312

Minimum Length $= K \times (3 - (-4))$

$= 312 \times (3 - (-4))$ $\quad K = 312$

$= 2184 ft$

Station of BVC = tangent intersection Station $- \left(\frac{21+84}{2}\right)$

tangent intersection Station = (345+60)

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

Station of EVC $= (334+68) + (21+84) = 356+52$

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

Q No3 A flexible pavement for an urban interstate highway is to designed using 1993.

Assn Resilient modulus of Asphalt concrete at 68°F 456,000 lb/in²

CBR value of base course material, 100 mr 31,000 lb/in²

CBR value of Subgrade material 6 mr of Subgrade 6x 1500 lb/in²

= 9000 lb/in²

Flexible Pavement Design.

Reliability level (R) = 99.0

Standard deviation S_o = 0.49

Inial Serviceability index, p_i = 4.5

Terminal Serviceability Index p_t = 2.5

$\Delta PSI = p_i - \Delta t =$

$4.5 - 2.5 = 2.0$

Step-1

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

Finding the value of ~~Sto~~ SNi or Di

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 :-3

Draw a line joining point B and resilient modulus (MI) of base course and extend this line to intsect the design serviceability loss chart at point C.

At thickness of surface coarse D1:

$$D1 = SN1 / a1$$

$$SN1 = 2.6$$

$$a1 = 0.44$$

$$= \frac{2.6}{0.4}$$

$$= 5.9''$$

thickness should be Taken to the nearst 0.5 inch

So, thickness of surface coarse in 6"

$$SN1 = D1'' \times a1$$

$$= 6 \times 0.44$$

$$SN1 = 2.64$$

finding SN_2 and D_2 (Base Course)

$\therefore$ SN_2 from table $= 3.8$

$D_2 = (SN_2 - SN_1)\,(a_2 m_2$

$= a_2 = 0.14$

$= m_2 = 0.80$

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

$D_2 = 10.36''$

we $12''$

So thickness of base course $12''$

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

$SN_2 = 1.34 + 2.64$

$= 3.98$

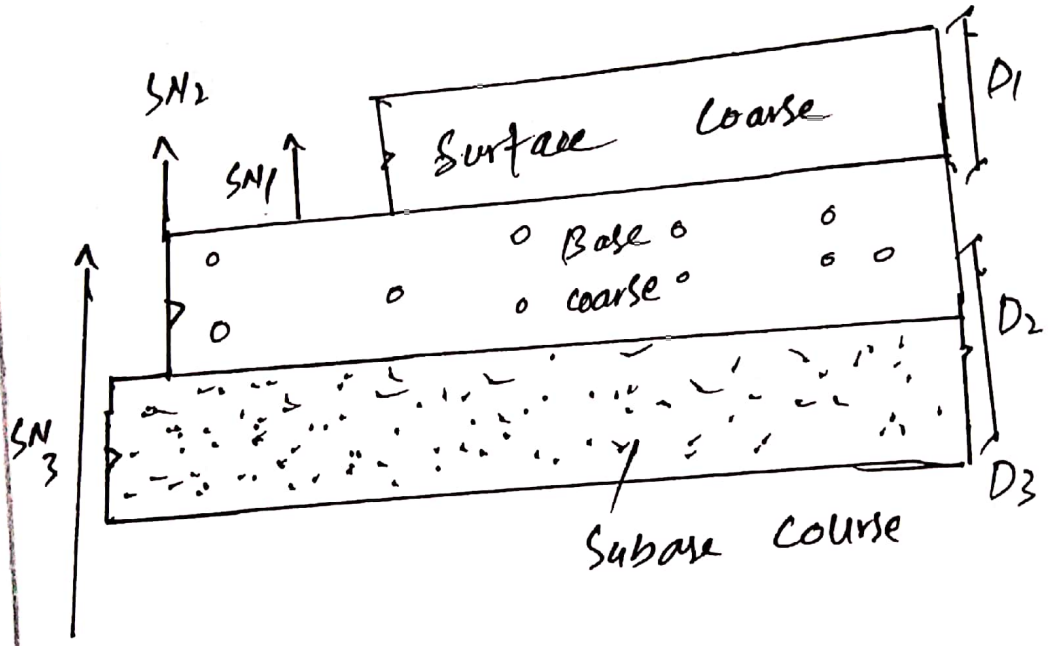
finding SN_3 and D_3

$\therefore SN_3 = 4.4$

$D_3 = (SN_3 - SN_2)\,(a_3 m_3$ $a_3 = 0.10$ $m_3 = 0.80$

$= (4.4 - 3.98)\ 10.10 \times 0.80$

Final Design:



Ashto Design equation for SN

11)

$$\log_{10} W_{18} = Z_R S_0 + 9.36 \log_{10} (SN+1) - 0.20$$

$$+ \frac{\log_{10}\left[\frac{\Delta PSI}{4.1-1.5}\right]}{0.40 + \frac{10.94}{(SN+1)^{5.19}}}$$

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

$D_3 = 5^{\wedge}.25''$

we will use 6" as sub base

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

$SN_3 = 4.467$ 4.4 okay

Q(NO4) What are the different pavement distresses? 12)

Pavement Distresses:: (a)

Distress in 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.

Alligator (Fatigue) cracking:: (b)

Possible causes::

- over loading

Inadequate structural design

Poor construction

Repair

- crack sealing is a effective
- Dig out and replace areas
- of poor subgrade.

Block Cracking:

Problem: Allows moisture infiltration

Possible causes:

HMA Shrinkage

Asphalt binder in the mix design

Repair

low severity cracks (1/2 inch wide) crack seal to prevent entry of moisture

high severity cracks (1/2 inch wide and cracks with raveled edges).

Potholes:

1) Small bowl-shaped depression in the pavement surface that penetrate all the way through the HMA layer down to the base course.

2) potholes are most likely to occur on roads with HMA surface (1 to 2 inches) and seldom occur on roads with 4 inch or deeper HMA surface.

3) potholes are most likely to occurs on roads with this HMA surfaces (1 to 2 inches) and seldom occur on roads with 4 inch or deeper HMA surface.

Problem: Roughness & Serious vehicular damage can result from driving across potholes at higher speeds) moisture infiltration.

Possible cause: generally potholes are the are and result of fatigue cracking. As fatigue cracking becomes severe.

Repair:

Patching technique.

Rutting:

Surface depression in the wheel path, are particulary evident after a rain when they are filled with water.

Possible causes:

Insufficient compaction of HMA layers during construction.

⇒ Surface depression in the wheel path, are particularly evident after a rain they are filled with water.

Possible causes:.

- Insufficient compaction of HMA layers during construction
- Subgrade Pavement settling (e.g as a result of Inadequate Structure)
- Improper mix design (eg excessively high asphalt content.

Repair:

- Slight ruts (1/3 inch deep) can generally be left untreated. Pavement with deeper rules should be leveled and overlayed.

Bleeding

Problem:.

loss of skid resistence when wet

Possible cause:.

- Excessive asphalt binder in the HMA
- Excessive application of asphalt binder during BST application.
- low HMA air vivd content.

Polished Aggregate.

Possible Causes: Repeated traffic application. - this can occur quiker if the aggregate is susceptible to abrasion.

~~Polish~~ possible causes: Repeated traffic application. this can occur quicker if the aggregate is susceptiable to abrsion.

Repair: Apply a skid-resistant slurry seal. BST or ~~non~~ non- to structural overlay.

Raveling: loose debris on the pavement with increase pavement roughness and loss of ~~skid~~ skid resistance.

Possible causes:.

- Asphalt binder aging
- Aggregate segregation. If the fine particles are missing from the aggregate matrix.
- Inadequate compaction ~~to~~ during ~~cons~~ construction.

Repair:.

Fog seal / slurry seal or Remove the damaged pavement and over lay.