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Semester : 10th
Subject : Highway & Transportation
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Day: M T W T F S S

Q1(a) Difference between flexible & Right Pavement.

- Flexible Pavement:

1) Bitumen used as binder in Pavements.
2) Road ready to use ~~after 24 hour~~ with in 24 hours.
3) Low life span usually 10-15 years.
4) Deformation in the subgrade is tranferred to the upper layers.
5) Flexible pavements have low Initial Construction costs but have high maintenance cost.

- Rigid Pavements:

1) Cement is used as a binder in rigid Pavement.
2) Road cannot be used until 14 days of curing.
3) life span is more as compared to flexible usually 30+ years.
4) ~~Roads cannot~~ Deformation in subgrade is not Transferred to subsequent layers.
5) Rigid Pavements have low maintenance cost but have high initial construction cost.

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Question no 1 (b): What are the advantages of water bound over wet min macadam?

Answer no 1(b):

→ The main advantage is that it is composed of well graded mixture. This ensures good interlock & high stability.

→ It is of superior inquality because materials are carefully graded and resulting mass is almost void less compacted mass.

→ Interlocking of aggregates particles imparts adequate strength of the materials selected for fillings the voids. These ensure non-entry of the plastic materials of sub-grade into the voids.

→ Watere bound macadam is less costly as compared to wet min macadam.

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

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Question no 1(c) : What is the difference between asphalt & bitumen?

Bitumen	Asphalt
→ A cite of black or dark coloured (solid, semisolid or viscous) ~~Cement~~ Cementitious substance natural or manufactured, compesed of high molecular weight.	→ A dark Brown to black cementitious material in which predominating constituents are bitumen which occur in nature or obtained by frictional distillation.

In American terminologies both are same

→ In some literature Bitumen is actually the liquid binder that hold asphalt together.	→ Asphalt is generally used as term refer to the combination and gravel specifically for road construction.

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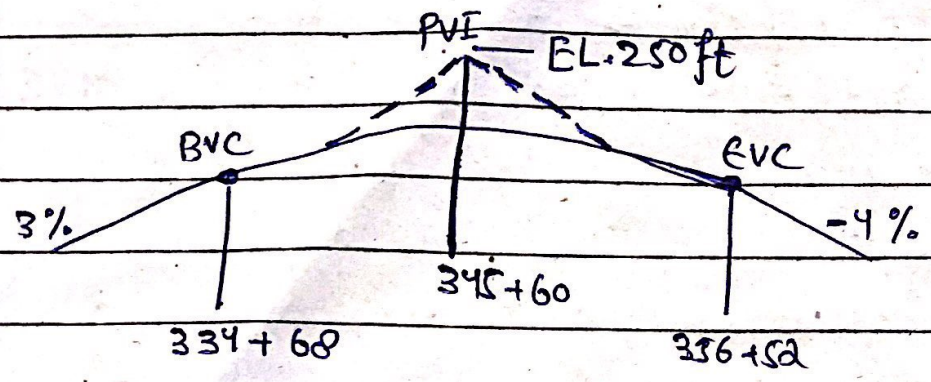
Question no 2

Q A crest vertical curre joining a +3 percent and a -4 percent ..... intermediate points on the curve at whole stations



Solution:

For design of speed of 75 mil/h value of K taken from table

$K = 312$

Minimum Length

$K \times (3-(-4))$ ∵ $K = 312$

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

$= 218 ft$

Stati

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Station of BVC : Tangent intersection station $-\left(\frac{21+84}{2}\right)$

$\because$ 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 $= 250 - \left(0.03 \times \frac{2184}{2}\right)$

$= 217.24\,ft$

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Question no 3

Answer Flexible Pavement design:

Reliability level CR = 99%

Standard deviation $S_o = 0.49$

Initial serviceability Index, $P_i = 4.5$

Terminal Servicability Index, $P_t = 2.5$

$\Delta PSI = 4.5 - 2.5 = 2.0$

Step 1

Draw line joining the reliability of 99% and the overall standard deviation S_o of 0.49, and extend this line to intersect the first T_L at point A.

Find value of SN_1 & D_1:

Step 2:

Draw line joining Point A to the ESAL 2×10^6, and the this line do intersect the sewnd T_L line at Point B.

Step 3: Draw a line joining Point B & resilient modulus (M_r) of base course & extend this line do intersect the design servicibility loss chart at Point C.

Step 4: Draw a horizontal line from Point C two intersect the design servical loss (PSI) curve at Point D

P.T.O

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

So the structure number required to Protect the base course and do find the thickness DT of surface coarse is 2.6

Step #5

Determine the appropriate structure layer co-fficient for each construction material. Resilient value of asphalt = 450,000 lb/in²

therefore $a_1 = 0.44$

Thicknes of surface coarse Di:

$Di = SNi / a_1$

$= \frac{2.6}{0.4}$

$= 5.9$

∴ $SN_1 = 2.6$

$a_1 = 0.44$

Thickness should be taken to the nearest 0.5inch

So, Thickness of surface coarse is 6"

$SN_1 = D_1'' \times a_1$

$= 6 \times 0.44$

$SN_1 = 2.64.$

Question no. 4

Q. what are the different pavement distresses? Explain in detail.

Answer: Pavement distress:

Distress is a condition of the pavement structure that reduces service ability or lead to reduction in service life

Distress in pavement occur due to

→ Unstable mines

→ Higher wheel loads than those considered in design

Alligator cracking:

→ Caused by overloading & Inadequate structure.

→ They are repaired by crack sealing as it act affective or dig out and replace poor area.

Block cracking:

→ It causes a problem of flow moisture infiltration.

→ Possible causes are "HMA shrinkage" & "Asphalt Binder aging"

→ It can be repaired by low severity crack seal to prevent entry of moisture high severity crack (>½ inch wide) and crack width revealed edges. Remove and replace the cracked pavements layer with an overlay.

Potholes:

Small bowl shapped depression in the pavement surface that Pendrates all the way through HMA layer down to the base coarse.

→ Potholes 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 surface.

→ Repairing is done by Patching techniques.

Rutting:

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

→ Causes are as follow

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

→ Repair is done by slight ruts (< ½ inch deep) can generally be left untreated

Bleeding :

→ Bleeding is loss of skid resistance when wet.

→ It is caused by "Execessive asphalt blinder in the HMA" & "low HMA our void"

● Raveling :

loose debris on the pavement which increase pavement roughness and loss of skid resistance.

→ It is caused by "Asphalt binder aging" & "In adequate compaction during construction"

→ It is repaired by ~~Fog~~ Fog seal / slurry seal or removal of damaged pavement overlay.