P:(1)

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Section : "B"

Subject : Highway & Traffic Engr

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Q NO I:

Part (a):

What is different b/w Flexiable & rigid Pavement?

Ans:

	Flexiable Pavement	Rigid Pavement
1:	Bitumen is used a binder in flexiable Pavement	⇒ Cement is used a binder in rigid Pavement.
2:	⇒ Deformation in the Sub grade is transferred to the upper layer.	⇒ Deformation in the Sub-grade is not transferred to sub-sequent layer
3:	Load is transfered by grain to grain contact.	⇒ No such Phenomenon of grain to grain load transfer exist.
4:	Flexiable Pavement have low initial construction cost but have high maintenance cost	⇒ Rigid Pavement have low maintenance cost but have high initial construction cost.

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5: It have low life span usally 10 to 15 year.	⇒ Life span is more as compare to flexiable usally cost.
6: Surfacing cannot be laid directly on the Subgrade but a Sub-base is needed.	⇒ Surfacing can be directly Life span laid on the subgrade.
7: Road can be used for traffic with in 24 hr.	⇒ Road cannot be used until 14 days of laying

1: Part "B"

What are the advantage of Water bound over Wet Mix Macadam?.

Ans: Following are the advantange of Water bound over Wet Mix Macadam.

1. Water bound Macadam is slightly cheaper then the Inlet-mix macadam the reason is (WBM) requires general labours while Inlet mix macadam requires Mixer Plant & Power.

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2: Aggregate of WBM can be broken by hand while the (WMM) need a crusher for the disintegration of Aggregates.

3: The inter locking of aggregate Particles impart adequate Strength of a material for filling the voids. These ensure non-entry of the Plastic material of the Subgrade into voids.

1 (Part: C)

Ans: Bitumen is actually the liquid binder that hold asphalt together.

* Asphalt is used as a term to refer to the combination of bitumen & gravel Specially for road construction.

P.T.O.

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* Bitumen is known for being strongly adhesive & resistance to damage from water & oil spills, this make bitumen the ideal binder for asphalt because asphalt is commonly used as a surface for road, car and parks etc.

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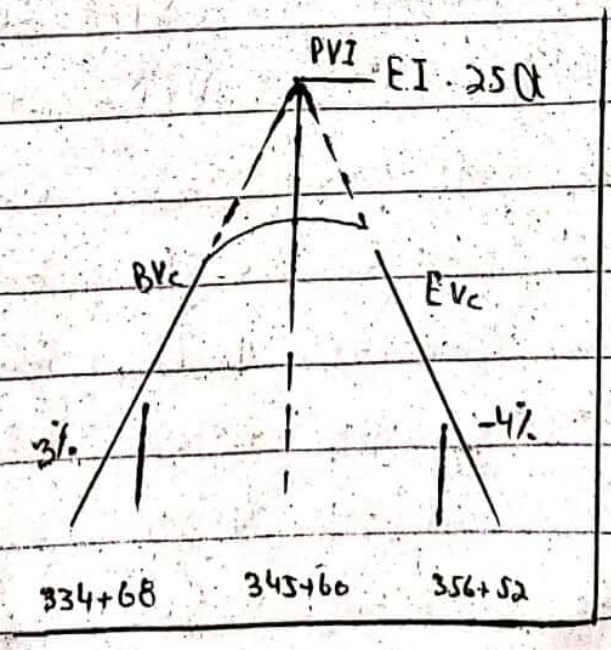
QNO: 2

A crest vertical curve joining a +3% Percent & a -4% grade is to be design for 75 mi/h .....?
Also calculate the elevation of intermediate Point on the curve .....?



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Solution:

For a design speed of 75 mph,

$K = 312$ [From table].

$\Rightarrow$ Minimum length $= 312 \times [3-(-4)] = 2184$ ft

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

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

$\Rightarrow$ Elevation of $BVc = 250 - \left[0.03 \times \frac{2184}{2}\right] = 217.24$ ft

The remainder of the computation is accordingly done using the format shown in table.

Station	Distance BVc in (ft)	Tangent Evelation (ft)	Offset $\left(y = \frac{Ax^2}{200L}\right)$ ft	curve evelation tangent offset (ft).
BVc 334+68	0	217.24	0.01	217.24
BVc 335+00	32	$217.24 + \frac{32}{100} \times 3$	0.02	218.18
BVc 336+00	132	221.20	0.22	220.92
BVc 337+00	232	224.20	0.86	223.34
BVc 338+00	332	227.20	1.77	225.43
BVc 339+00	432	230.20	2.99	227.21
BVc 340+00	532	233.20	4.54	228.66
BVc 341+00	632	236.20	6.40	229.86
BVc 342+00	732	239.20	8.59	230.61
BVc 343+00	832	242.20	11.09	231.11
BVc 344+00	932	245.20	13.92	231.25

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Buc 345+00	1032	248.20	17.07	231.13
Buc 346+00	1132	251.20	20.54	230.66
Buc 347+00	1232	254.20	24.32	229.88
Buc 348+00	1332	257.20	28.43	228.77
Buc 349+00	1432	260.20	32.86	227.34
Buc 350+00	1532	263.20	37.61	225.59
Buc 351+00	1632	266.20	42.68	223.052
Buc 352+00	1732	269.20	48.07	221.13
Buc 353+00	1832	272.20	53.79	218.41
Buc 354+00	1932	275.20	59.82	215.38
Buc 355+00	2032	278.20	66.17	212.03
Buc 356+00	2132	281.20	72.84	208.36
Buc 356+50	2184	282.70	76.44	206.32

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QNO # 3:

step 1: Answer:

⇒ Draw a line joing the reliability level of 99% & the overall standered divation so of 0.49 extend line to interseet the first (TL) Line at Point A.

step # 2:

⇒ Draw a line Joining Point A to the ESAL of 2×10^6 & extend this line to intersect the First "TL" Line at Point "B".

step # 3:

⇒ Draw a line Joining Point 'B' & resilient modulus (M_r) of base course & extend this line to intersed the design serviceability loss chart at Point 'C'.

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Step # 4:

⇒ Draw a Horizantal line from Point (C) to intersect the design serviceability loss (PSI) curve at Point 'D'.

So here

$$\Delta PSI = 4.5 - 2.5 = \boxed{2}$$

step # 5:

⇒ The structure number require to Protect the base course & to find the thickness D_1 of the surface course is 2.6.

step # 6:

⇒ Determine the appropriate structure layer co-efficient for each construction material Resilient value of asphalt = 450,000 lb/in^2.

Therefore:

$$a_1 = 0.44$$

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$D_1 = SN_1 / a_1$

$= 2.6 / 0.44$

$\boxed{D_1 = 5.9''}$

Thickness should be taken to the nearest .0.5 inches, so that the thickness of the surface course is .6".

$SN_1 = D_1 \times a_1$

$= 6 \times 0.44 = 2.64$

$\boxed{SN_1 = 2.64}$

⇒ NOW Find SN_2 & D_2 (Base course)

Find the value of a_2 from layer coefficient table & M_2 from drainage coefficient table.

⇒ Thickness of base course (D_2)

⇒ $D_2 = [SN_2 - SN_1] / a_2 m_2$

$D_2 = [3.8 - 2.64] \cdot 14 \times 0.80$

⇒ $\boxed{D_2 = 10.36''}$

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(P: II)

Use 12"

So the thickness of base course is 12".

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

$\Rightarrow SN_2 = 1.34 + 2.64$

$\boxed{SN_2 = 3.98}$

$\Rightarrow$

Finding SN_3 & D_3 (sub. base course) & also - layer coefficient a_3 & drainage coefficient m_2 from their respective table.

$\Rightarrow D_3 = [SN_3 - SN_2] / a_3 m_2$

$D_3 = \frac{[4.4 - 3.98]}{0.10 \times 0.80}$

$\boxed{D_3 = 5.24"}$

We will used 6" as a sub-base:

$SN_2 = 2.64 + 1.34 + 6" \times 0.10 \times 0.80$

$\boxed{SN_3 = 4.46}$

74.4 ok.

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Final design :

⇒ Surface course = 6"

⇒ Base couse = 12"

⇒ Sub-base = 6"

Total Pavement Thickness = 24"

Q NO: 4

What are the different Pavement distresses ?

Following are the different Pavement distresses.

1: Alligator cracking :

→ **Possible course :**

* Over load
* Inadequates structural design
* Poor construction

→ **Repair :**

* Crack Sealing is in effective.
* Dig out & replace area of Poor Sub grade.

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2: **Block cracking :**

→ **Problem :**

Allows moisture infiltration.

→ **Possible Cases:**

* HMA Shrinkage
* Asphalt binder aging
* Poor choice of asphalt binder in the Mix design.

⇒ **Repair :**

→ Low severity cracks (< ½ inch wide) cracks seal to Prevent entry of moisture.

→ High severity cracks (> ½ inch wide & crack with raveled edges) Remove and replace the cracks Pavement layer on overlay.

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3: Potholes:

⇒ Small bowl-shaped depression in the Pavement surface that Penetrate all the inlay Through the HMA layer down to the base course.

⇒ Potholes are mostly likely to occurs on road inlith the thin HMA surface.

→ **Problem:**

Roughness, moisture infiltration.

⇒ **Cases Problem:**

Generally Potholes are the end result of fatigue cracking. As Oatigues crackings creates small cracks on Pavement which can be dislodged as vehicles drive oven then.

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Repair:

Polishing techniques.

4: 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 particular evident after a rain then they are filled with water.

Possible cases:

→ In sufficient compaction of HML A layer during construction.

→ Sub-grade rutting [e.g a result of adequate pavement structure

⇒ improper mix design.

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Repair:

slight cracks (< 1/3 inch deep) can generally be left untreated - Pavement with deeper roots should be leveled and over layed.

5: Bleeding:

→ **Problem:**

Loss of skid resistance when wet.

→ **Possible causes:**

⇒ Excessive asphalt binder in the HMA.

→ Excessive application of asphalt binder during BST application.

→ Low HMA air void content.

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6: Polished Aggregate:

⇒ **Possiable causes:**

Repeated traffic application this can occur quicker if the aggregate is susceptible to abrasion.

⇒ **Repair:**

Apply a skid resistance slurry seal. BST or non structural overlay.

7: Reveling:

⇒ Loose debris on the Pavement which increase Pavement roughness and loss of skid resistance.

⇒ **Possible causes:**

⇒ Asphalt binder aging.

⇒ Aggregate segration. If fine Particles are missing from the

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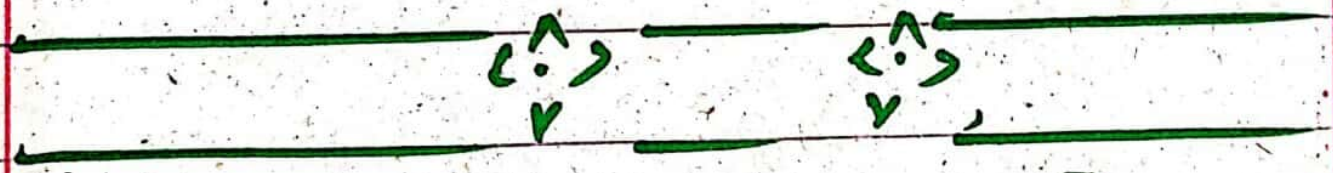
Aggregate matrix.

⇒ Inadequate compaction during construction.

⇒ **Repair:**

Fog seal / slurry seal or Remove the damaged Pavement & overlay.



The End!

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