FINAL EXAM

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SEC # A

Subject # Highway and Traffic Engg

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Q No : 01

Part : a

Flexible	Rigid Pavement
① Design is based on Load distributing Chasacteristics of the Commponent Layer.	① Design is based on flexural Strength or Slab action.
② Load is transfessed by grain to grain Contact.	② No Such phenomenon of grain to grain Load transferred exist.
③ It's Cause is Low Completion but Repeasing Cost is high.	③ It is Completion Cost is high but Low Repeasing Cost.
④ Bitumen is used as a binder in flexible pavement	④ Cement is used as a binder in Rigid Pavement.
⑤ The Strength of Road highly depend on Strength of Subgrade	⑤ Strength of Road Less dependent of Strength of Subgrade.

P-T-O →

Part : b : Advantages #

Ans: ① The Prime advantage of wet-mix macadam over water bound macadam is That it is Comprised of well graded mixture It will ensure a good interlocking power and high Stability

② → Addition of water will Faciliatate The handling of The mixture

③ The Method of Line is much easier Than That of water bound Macadam where The Screening and burning material have to be mixed in Stages and forced into voids If a Crusher is used, There is no possibility of plastic Fines entering into The mixture

④ The Road Constructed Thsough wet mix macadam process is durable

⑤ It get dry Sooner as Compared That of water bound Macadam.

P-T-O →

Part : C : Difference between asphalt and bitumen

In generally Bitumen is actually the Liquid binder that holds asphalt together/ Combine where is asphalt as generally used to refer the Combination of aggregates Like Bitumen, Sand and gravel Specifically For Road Construction.

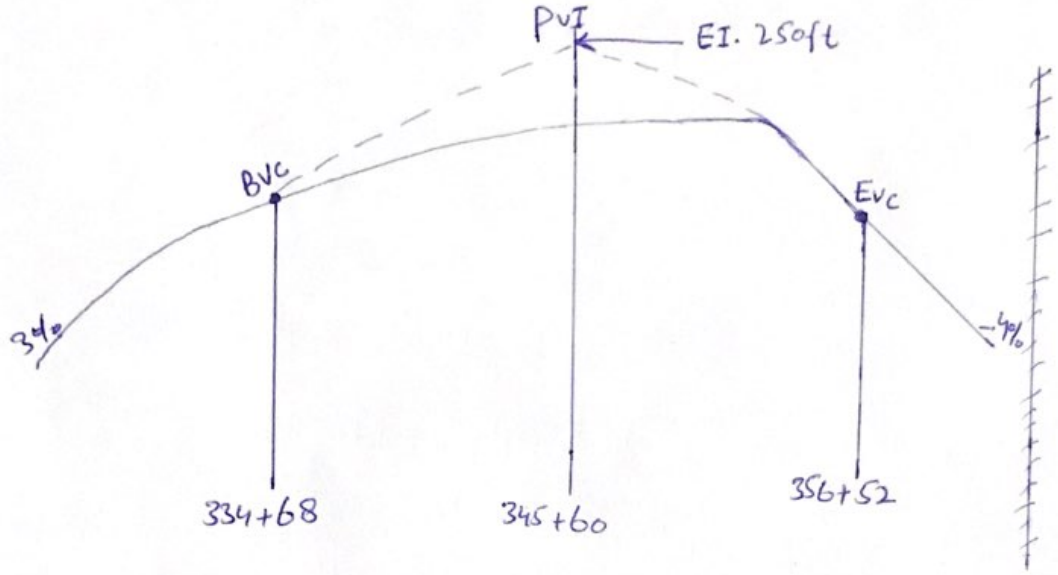
→ A bitumen - Sealed Road has a layer of bitumen Sprayed and Then Coverd with an aggregates

→ Asphalt is produced in a plant that heats, dries and Mixes aggregates.

P- T- O →

QN10: 02

Solution :



For design Speed of 75 mi/h

K = 312 from table

Minimum Length = $312 \times [3-(-4)]$

$= 2184 ft$

→ Station of Beginning vertical Curve (BVC)

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

→ Station of Ending vertical Curve (EVC)

$= (334+68) + (21+84) = 356+52$

Elevation of BVC $= 250 - \left(0.03 \times \frac{2184}{8}\right)$

$= 217.24$ ft

Q.NO: 03 :

Given Data:

→ Flexible Pavement
→ Urban Interstate Highway
→ ESAL $= 2 \times 10^6$
→ a week for water to be drain with in moisture Level = 30%
→ M_T of Ac at 68 f = 450000psi
→ CBR value of base = 100, M_T = 31000psi
→ CBR value of Sub base = 22, M_T = 13500psi
→ CBR of Sub grade = 6

Solution:

> Reliability (R) = 99% From table
> Standard Deviation (S_0) = 0.45 (0.4 - 0.5)
> P_i = 4.5
> P_t = 2.5

P-T-O →

APSI = 4.5 − 2.5 = 2.0

a_1 = 0.44 (M_T = 450000 psi, Ac)

a_2 = 0.14 (CBR = 100, Base)

a_3 = 0.1 (CBR = 22 Sub base)

By using figure

S_{N_3} = 4.4 (M_T = 9000 psi)

S_{N_2} = 3.8 (M_T = 13500 psi)

S_{N_1} = 2.6 (M_T = 31000 psi)

- $D_1 = S_{N_1}/a_1 = 2.6/0.44 \Rightarrow 5.9''$ (Use 6")
- D_1 = 6"
- $S_{N_1}{}^* = a_1 D_1{}^* = 0.44 \times 6 = 2.64$
- $D_2 \geq (S_{N_2} - S_{N_1})/(a_2 m_2) \geq (3.8 - 2.64)(0.14 \times 0.8)$
  $\geq 10.36''$ (Use 12")

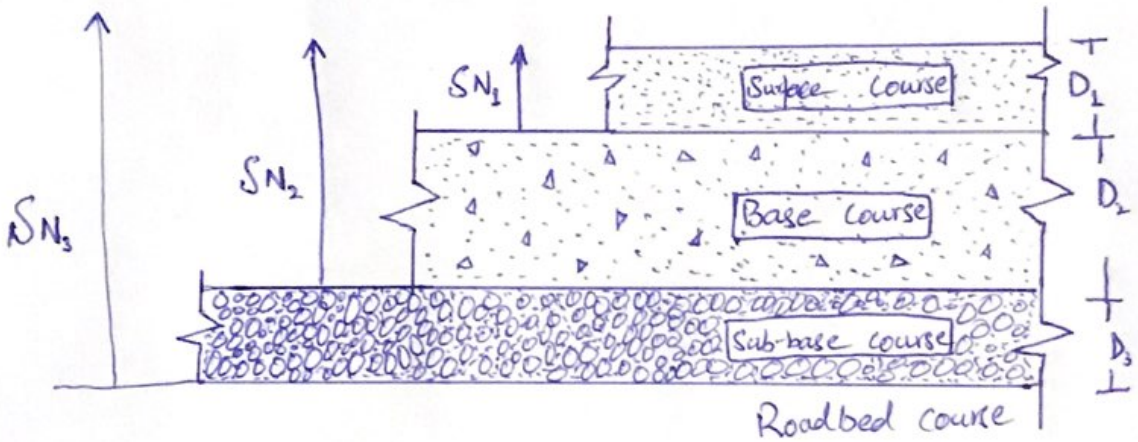
- $S_{N_2} = 0.14 \times 0.8 \times 12 + 2.64 = 1.34 + 2.64 = 3.98$
- $D_3 = (S_{N_3} - S_{N_2})/(a_3 m_3) = 4.4 - (2.64 + 1.34)/(0.1 \times 0.8)$
  $= 5.25''$ (Use 6")
- $S_{N_3} = 2.64 + 1.34 + 6 \times 0.8 \times 0.1 = 4.46$

P → T → D →

Final Design :

- Asphalt Concrete Surface = 6"
- Granular base = 12"
- Sub base = 6"

Total pavement Thickness = 24"



P-T-O→

Q.No: 04

Ans:

It is the Condition of pavement Structures That handrence/Reduce Serviceibility or intends to a Reduction in Service Life

→ Distresses Could be accured in pavement are as ~~there~~ ~~to~~ The following

1- Alligator (Fatigue) Cracking
2- Bleeding
3 Block Cracking
4 Depression
5 Longitudinal Cracking
6 Patching
7 Rutting
8 Polished Aggregate
9 Potholes
10 Ravelling

1- Alligator: (Causes) → Heavy Loads/over Loading on Road Surface

→ Improper Structual design of Road

→ Poor Construction

P-T-O →

→ Lack of Compaction

Repair :

It should be Repair by Crack Sealing as generally en-effective. Fatigue Crack Repair generally Falls into one of Two Categories

- Small Localized Fatigue Cracking
- Large to Fatigue Cracking area

② **Bleeding** : Causes :

→ Loss of Skid Resistance when wet

→ Excessive asphalt binder in the HMA (Hot Mix Asphalt)

→ Excessive application of asphalt binder during BST application

→ Low Hot Mix Asphalt (HMA) air void Content.

Repair :

Minor bleeding Repair Can be Rectified by applying Coarse Sand to blot up the excess asphalt binder

→ Major bleeding Can be Repeased cutting off excess asphalt with a Machine.

P-T-O→

(3) Block Cracking:

Problem: Allows moisture infiltration/ Roughness

Possible Causes: HMA Shrinkage and daily temperature Cycling. Asphalt binder aging. Poor Choice of asphalt binder in the mix design

Repair:

→ Low Severity Cracks (Less Than 1/2 inch wide)

Crack Seal to prevent entry of moisture and further Revealing of the Cracks edges

→ High Severity Cracks (greater than 1/2 inch wide)

Remove and Replace The Cracked pavement Layer with an overlay,

P.T.O →

(4) Depression: Causes:

→ Pavement Surface area Slightly Lower Than The Sossounding pavement.

→ Subgrade Settlement due to improper Compaction

Repair:

Depression Should be Repeared by Removing the affected pavement Than digging out and Replacing the area of poor Subgrade. Patch over the Repeared Subgrade.