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SECTION: A.

SEMESTER: 6TH.

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SUBJECT: HIGHWAY AND TRAFFIC ENGINEERING.

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Q#1 (a)

Answer:-

Flexible pavement	Rigid pavement.
• Bitumen is used as binder in pavement	• Cement is used as binder in pavement.
• Have low life span usually 10-15 years	• Life span is more compared to flexible 30+ years.
• Road can be used for traffic within 24hrs	• Roads can not be used until 14 days.
• Deformation in the subgrade is transfered to the upper layers	• Deformatio in subgroole is not transferred to subsequent layers
• Flexible pavements have low initial construction costs but have high maintainence cost	• Rigid pavments have low maintain-ence costs but high initial construction cost.

1 (b)

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

Addition of water while mixing facilitates the handling of the mixture. The operation of laying is much simpler that of water bound macadam. Where the screening and binding materials have to be added in stages and forced into voids. If crusher run material is used there is no possibility of plastic fines endearing into the mixture.

One disadvantage of the wet-mix macadam is that it is slightly costlier that water bound macadam because of the use of plant and paver. Water bound is traditionally a labour oriented specification.

The aggregates for wet are crusher-run where as for water bound are generally hand broken.

1 (c)

Answer :-

Bitumen	Asphalt
• Black or dark coloured (solid, semi-solid viscous) cementious material natural or manufactured, composed of high molecular weight	• A dark brown to black cementious material in which predominating constituent are bitumen which occur in nature or obtained by frictional distillation
• In some literature bitumen is actually the liquid binder that holds asphalt.	• Asphalt is generally used as term refer to the combination and gravel for road construction

Q # 2

Answer :-

For design speed of 75 mil/h value of k from table

$k = 312$

→ Minimum length

$K \times (3 - (-4))$ ∴ $K = 312$

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

$= 2184$ ft

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

∴ tangent intersection station = $(345 + 60)$

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

$= 334 + 68$

" " EVC = $(334 + 68) + (21 + 84)$

$= 356 + 52$

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

27.24 ft → Ans

Q#3

ANSWER:

Flexible Pavement Design.
Reliability level, CR = 99%
Standard deviation, So = 0.49
Initial Serviceability Index, Pi = 4.5
Terminal serviceability Index, Pt = 2.5
$\Delta PSI = 4.5 - 2.5 = 2.0$

STEP 1:

Draw a line joining the realibility of 99% and the overall standard deviation So of 0.49, and extend this line to intersect the first T_L at point A.
Find value of SN1 and D_1.

STEP 2:-

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

STEP 3:-

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

STEP 4:

Draw a horizontal line from point C to intersect the design serviced loss (PSI) curve at Point D.

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

STEP 5:

So the structure number required to protect the base course and to find the thickness D_I of surface course is 2.6.

STEP 6:-

Determine the appropriate structure layer co-efficient for each construction material

Resistant value of asphalt = 450,000 lb/in²

therefore $a_1 = 0.44$

Thickness of surface coarse D_1 =

$D_1 = SN_1 / a_i$

$\therefore SN_1 = 2.6$

$a_1 = 0.44$

$= \frac{2.6}{0.44} = 5.9''$

Thickness should be taken to the nearest 0.5 inch.

So, thickness of surface coarse is '6'

$SN_1 = D_1^{\circ} \times a_1$

$= 6 \times 0.44$

$SN_1 = 2.64$

Rizvi Notes

Finding SN_2 and D_2 (Base coarse)

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

$\therefore SN_2$ 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 coarse 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

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

$\therefore SN_3 = 4.4$

$\therefore a_3 = 0.10$

$\therefore m_3 = 0.80.$

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

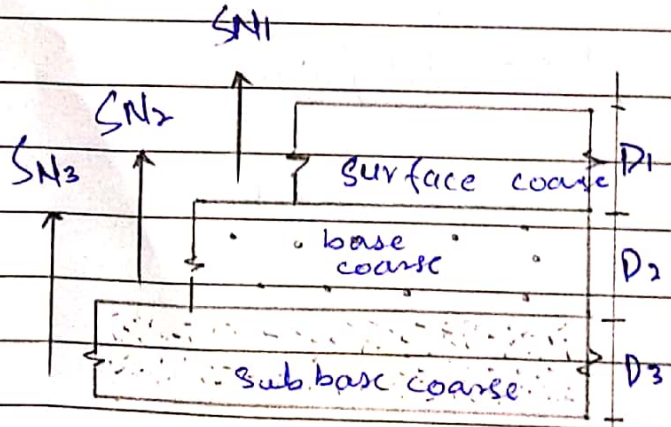
$D_3 = 5.25''$

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:



Q#4

Answer :- PAVEMENT DISTRESS

Distress is a condition of the pavement structure that leads to reduction in servic life.
Distress in parmenth occur due to

- Unstable mixes
- Higher wheel loads than those of design.

→ Alligator cracking
cause :

- over loading
- Inadequate structure

Repair :-

- Crack sealing is in effective
- Dig out and replace poor area.

→ Block cracking

Problem :- Allow moisture infiltration
Possible cause :-
• HMA shrinkage
• Asphalt binder aging.

Repair :-
Low severity crack (< 1/2 inch) crack seal to prevent entry of moisture, High severity crack (> 1/2 inch) and crack with revealed edges. Remove and replace the cracked pave-ment layer with an overlay.

Potholes :-
Small bowl shaped depression in the pavement surface that penetrates all the way through HMA layer down to base course.
• Potholes most likely occur on road with HMA surface 1 to 2 inch and seldom occur on road with 4 inch or deeper HMA surface.

→ Repair
Patching techniques.

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

→ Possible Coarse
In sufficient compaction of HMA layer during construction.
Improper Mix design (e.g as a result inadequate Pavement structure.
Subgrado rutting (as a result of inadequate Pavement structure).

→ Repair
Slight ruts ($< \frac{1}{2}$ inch deep) can generally be left untreated.

→ Bleeding
Problem:
loss of skid resistance when wet.
Possible cause:
Excessive asphalt blinder in the HMA.
Low HMA or void.

Rave ling:
loose debiris on the pavement which increase pavement roughness and loss of skin resistance.

Rizvi Notes

Possible Cause:
Asphalt binder aging.
Inadequate compaction during construction.

→ Repair
Fog seal / slurry seal or remove the damaged Pavement overlay.