NAME = Subhan Ullah Khan

ID# = 7861

Section = B

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Q NO 1

(a) what is different between flexible and rigid pavement?

Flexible pavement	Rigid pavement
(1) Bitumen is used as binder in flexible pavement	→ Cement is used as a binder in rigid pavement.
(2) Have Life Span of 10 - 15 years	→ Life Span is more as Compare to flexible usually 30+ years
(3) Road Can be used for Traffic within 24 hours	→ Road Cannot be used untill 14 days of Curing.
(4) Load is Transfered by grain to grain Contact	NO Such phenomena of grain to grain load transfer exists.

(b) What are the advantages of water bound over wet mix macadam?

⇒ The main advantages of wet-mix macadam over water-bound macadam is that it is composed of a well-graded mixture- this ensures good interlock and high stability-

→ The compaction is greatly facilited by the moisture added which lubricates the individual particles-

→ The aggregate for wet mix macadam will have to be crusher-run whereas the aggregate

QNO1 (c)

Asphalt	Bitumen
→ A dark to black Cementitious material in which the predominating constituents are bitumens which occur in nature or are obtained in fractional distillation of petroleum (crude oil) along with certain mineral matter	A class of black or dark-colored (solid - semi-solid or viscous) substance natural or manufactured composed principally of high molecular weight hydrocarbons found in asphalts tars, pitches, and Asphaltites are typical → in some literature Bitumen is actually the liquid binder that holds asphalt together → A mixture of hydrocarbons obtained naturally or as reduce from Petroleum
→ Asphalt is generally used as a term to refer to the combination of bitumen and gravel specifically for road construction	
→ Asphalt Combination → Carbon (70 - 85%) → Hydrogen (7 - 12%)	

QNO2:-

Solution:-

For design Speed of 75 mi/h K = 312

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

$= 2184$ ft

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.

Q.NO3:- Solution:-

Finding SN_1 and D_1

Step-1:- Draw a line finding the reliability level of 99% and the overall Standard deviation so of 0.49 and extend this line to ~~insert~~ intersect the First TL Line at point A.

Step-02:- Draw a line joining point A to the ESAL of 2×10^6 and extend this line to intersect the TL Line at point B

Step-03:- Draw a line joining point B and resilient modulus (MR) 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 Serviceability.

- Loss (psi) Curve at point D in this problem, $\Delta PSI = 4.5 - 2.5 = 2$

Step-5:- So the Structure required to protect the base Course and to find the thickness D1 of the Surface Course is 2.6

Step-6:- Determine the appropriate Structure layer Co-efficient for each Construction material

Resilient value of asphalt

Resilient value of asphalt = 450,000 lb/in²

therefore $a_1 = 0.44$

Thickness of Surface Coarse

$D_1 = SN_1 / a_1$ ∴ $SN_1 = 2.6$

$= \frac{2.6}{0.4} \Rightarrow 5.9''$ $a_1 = 0.44$

Thickness should be taken to the nearest 0.5 inch

So thickness of Surface Coarse is 6"

$SN_1 = D_1'' \times 2a_i$

$= 6 \times 0.44 \Rightarrow 2.64$

Finding SN_2 And D_2 (Base Corse

$D_2 = (SN_2 - SN_1 / a_2 m_2)$ ∴ SN_2 from Table

$= (3.8 - 2.64) 0.144 \times 0.8$ ∴ $a_2 = 0.14$

∴ $m = 0.8$

$D_2 = 10.36$

Use 12"

So thickness of base Cause 12"

$SN_2 = 0.14 \times 0.8 \times 12 + SN_1$

$= 1.34 + 2.64$

$= 3.98$

Finding SN_3 and D_3

$D_3 = (SN_3 - SN_2) / a_3 m_3$ ∴ $SN_3 = 4.4$

$= (4.4 - 3.98) / 0.1 \times 0.8$ ∴ $a_3 = 0.1$

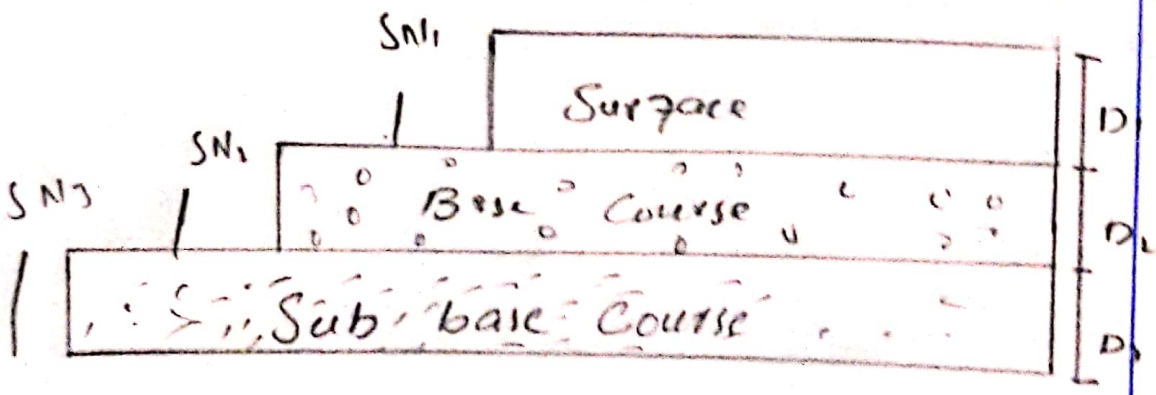
$D_3 = 5.25''$ ∴ $m_3 = 0.8$

We will use 6" as Sub base.

$SN_3 = 2.64 + 1.34 + 6'' \times 0.1 \times 0.8$

$SN_3 = 4.46 > 4.4$ is final

FINAL Design



QNO4:- What are the different Pavement distresses? Explain details?

Ans:- Distress is 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

* Un Stable Mixes.
* Higher Wheel Loads than those Considered in design.

⇒ possible Causes:- → Overloading.
→ Inadequate Structure design.
→ poor Construction.

⇒ Repair :-

→ Crack Sealing is in effective-

→ Dig out and replace area of poor Subgrade-

⇒ problem: ~~Ans~~ Allows moisture infiltration

⇒ possible Causes :-

→ HMA Shrinkage
→ Asphalt binder aging
→ poor choice of asphalt binder in the mix design-

⇒ Repair :-

→ Low Severity Cracks ($\geq < \frac{1}{2}$ inch wide) Crack Seal to prevent entry of moisture-

→ High Severity ($> \frac{1}{2}$ inch wide and Cracks with raveled edges) Remove and replace the cracked pavement layer with an Overlay-

⇒ potholes :-

→ Small, bowl-Shaped depression in the pavement Surface that penetrate all the way through the HMA Layer down to the base Course.

→ potholes are most Likely to occour on roads with thin HMA Surface (1 to 2 inches) and Seldon occur on roads with 4 inches or deeper HMA Surface.

⇒ problem :- Roughness (serious vehicular damage can result from driving across potholes at higher Speeds) moisture infiltration.

⇒ Possible Causes:-

Generally, potholes are the end result of fatigue Cracking. As fatigue Cracking

⇒ Repair:-

Patching Techniques-

⇒ Rutting:-

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

- Surface depression in the wheels path are particularly evident after a rain when they are filled with water.

⇒ possible Causes:- • insufficient Compaction of HMA layer during Construction.

- Subgrade rutting (e.g as a result of inadequate pavement structure.
- Inproper mix design (e.g excessiely high asphalt content, excessive mineral filler and insufficient amount of angular aggregate.

⇒ **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.

POLished aggregate.

⇒ possible Cause:- Repeated traffic application this Can occour quicker if the aggregate is Susceptible to abbrasion-

⇒ Repair:-

Apply a Skid resistance Slurry Seal BST or non-Structural overlay.

⇒ Raveling:- Loose debrise on the pavement which increase pavement roughness and Loss of Skid resistance.

⇒ possible Causes:-
- Asphalt binder aging.
- Aggregate Segregation of fine particales are missing from the aggregate matrix.
- inadequate Compaction during Construction.

For water bound macadam are generally hand broken-

→ On the other hand water bound macadam has been traditionally a ~~tooth~~ labour Oriented Specification.

→ Addition of water while making facilities the handling of the mixture the operation where the Screenings and binding materials have to be added in stages and forced into voids. If a Crusher-run materials is used there is no possibility of plastic fines entering Fines entering into the mixture.

⇒ Repair :-

Fog / Seal / Slurry seal or remove the damaged pavement and Overlay.