NAME :- MALIK Muhammad Afnan

ID :- 7839

Section :- "B"

Department :- Civil Engineering

Subject :- Highway And Traffic Engineering

Q.No1

(a)

Ans: Difference between flexible And Rigid pavement :-

1 Flexible Pavement :-

→ Bitumen is used a binder in flexible Pavement.

→ Deformation in the Sub grade is transferred to the upper layers.

→ Load is transferred by grain to grain Contact.

→ Flexible Pavements have low initial Construction Costs but have high maintence Cost.

→ Have low life Span usually 10-15 years.

→ Surfaceing Cannot be laid

directly on the Sub-grade but a Sub base is needed

→ In flexible Pavements Strength of Road highly depended on Strength of Sub-grade

→ Road Can be used for traffic within 24 hours.

Rigid Pavement:-

→ Cement is used as a binder in rigid Pavements.

→ Deformation in the Sub grade is not transferred to Subsequent layers.

→ No Such Phenomenon have low maintenance Cost but have high initial Construction Costs.

→ Life Span is more as Compare to flexible usually 30+ years.

→ Surface Can be directly laid

on the Sub grade..

→ Strength of road less dependent on Strength of Sub-grade in rigid pavements.

→ Road Cannot be used until 14 days of Curing.

Q NO1

(b)

Ans- **Advantages of Water bound over Wet mix macadam :-**

The advantages of water bound macadam is that it has been traditionally a labour oriented specification. While one disadvantage of the wet mix macadam is that it is a slightly costlier than water bound macadam. This is because the specification involves the use of plant and

Paver. The Second advantages is that the aggregate for wet mix macadam will have to be Crusher-run wheres the aggregates for water bound macadam are generally hand broken.

The main advantage of wet-mix macadam over water-bound macadam is that it is Composed of a well-graded mixture. This ensures good interlook and high Stability.

Q No 1

(c)

Ans:- **Difference between Asphalt And Bitumen :-**

Asphalt :-

Asphalt is the Combination of bitumen and gravel. And it is specifically use in road Construction.

→ A dark brown to black Cementon material in which the predominating Constituents are bitumens which occur in nature or are obtained in fractional distillation of Petroleum (crude oil) along with mineral matter.

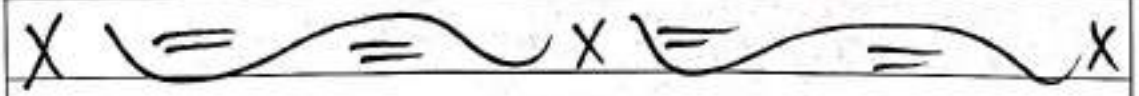
→ Both Asphalt and Bitumen are Same and are "Asphalt".

Bitumen :-

While bitumen is actually the liquid binder that hold together Construction material.

→ A class of black or dark-colored (solid, semi-solid or viscous) cementitious substance, natural or manufactured, composed principally of high molecular weight hydrocarbon found in Asphalt, Tars, pitches and Asphalties are typical.

→ Exposure to bitumen leaching may cause deterioration of Soil and ground water quality.



Q No 4

Ans:- **Pavement Distresses:-**

→ Distresses 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.

- unstable mixes
- Higher wheel loads than those considered in design.

Different Pavement Distresses:-

1) **Block Cracking:-**

Problem: Allows moisture infiltration.

→ Possible Cause.

- HMA Shrinkage.
- Asphalt binder aging.

- Poor choice of asphalt binder in the mix design.

→ Repair

- Low Severity Crack (< ½ inch wide) Crack Seal to Pavement entry of moisture.
- High Severity Cracks (< ½ inch wide and cracks with raveled edge) Re and replace the Cracked Pavement layer with an overlay

2) **Potholes:-**

→ Potholes are mostly likely to occur on road with thin HMA Surface (1 to 2 inches) and seldom occur with 4 inches are deeper HMA Surface.

→ Problem:- Roughness (Serious vehicular damage Can result from driving across Potholes at higher Speed) moisture infiltration.

→ Possible Cause:

Generally, Potholes are the end result of fatigue Cracking. As fatigue Cracking becomes severe, the interconnected Cracks created small chunks of Pavement, which can be dislodge as vehicles drive over them.

→ Repair: Patching techniques.

3) Alligator (Fatigue) Cracking.

→ Possible Causes.

- overloading
- Inadequate Structural design
- Poor construction.

→ Repair:

- Crack Sealing is in effective.
- Dig out and replace area of Poor Subgrade.

4) **Rutting :-**

-> Surface depression is the wheel path, are particulary evident after a rain when they are filled with water.

-> Possible Cause :-

- Insufficient Compaction of HMA layers during Construction
- Subgrade rutting (e.g, as a result of inadequate pavement structure).
- Improper mix design (e.g, excessively high asphalt content, excessive mineral filler, insufficient amount of angular aggregate particles)

-> Repair:

- Slight ruts (< 1/3 inch deep) can generally be left untreated Pavement with deeper ruts should be leveled and overlayed.

5) **Polished Aggregate:-**

→ Possible Cause: Repeated traffic application This can occur quicker if the aggregate to abrasion.

→ **Repair:**

Apply a skid-resistant slurry seal, BST or non-structural overlay.

6) **Rutting:-**

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

7) **Bleeding:-**

→ Problem:

Loss of skid resistance when wet.

→ Possible Cause:-

- Excessive asphalt binder in the HMA.
- Excessive application of asphalt binder during BST application
- Low HMA air void content.

8) Raveling:-

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

→ Possible Cause:-

- Asphalt binder aging.
- Aggregate Segregation if fine particles are missing from the aggregate matrix.
- Inadequate Compaction during Construction.
- Repair: Fog Seal/slurry or Remove the damaged Pavement and overlay.

x x x

Q No 2

Ans:

Required:-

Calculate the elevation of intermediate points on the Curve at the whole Stations.

Solution:-

For a 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 BVC $= 334+68$.

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

Station of EVC $= 356+52$

Elevation of BVC $= 250 - \left(0.03 \times \frac{2184}{2}\right) = 217.24$ ft

Elevation of BVC $= 217.24$ ft.

Table:-

Design Speed	stopping Sight Distance	Calculated	Design
15	80	9.4	10
20	115	16.5	17
25	155	25.5	26
30	200	36.4	37
35	250	49.0	49
40	305	63.4	64
45	360	77.1	79
50	425	95.7	96
55	495	114.9	115
60	570	135.7	136
65	645	156.5	157
70	730	180.3	181
75	820	205.6	206
80	910	231.0	231

Q No3

Ans:

As per mentained given data we can also find from Coorelation

The following Data:-

→ Initial Serviceability Index $P_i = 4.5$

→ Terminal Serviceability Index $P_t = 2.5$

→ $\Delta PSI = 4.5 - 2.5 = 2$

→ standard deviation $= 0.49$

→ Reliability $(R) = 99\%$.

→ So the structure number (SN) require to protect. The base Cource to find thickness D_1 of the surface Coursc is 2.6

As Per given data of Resilient modulus of asphalt Concrete at 68°F 450,000 lb/in^2. The structure layer Coefficient (a_1) will be 0.44

$a_1 = 0.44$

Now to find thickness $D_1 = \frac{SN_1}{a_1}$

As we know that.

$SN_1 = 2.6$ and $a_1 = 0.44$

$$D_1 = \frac{2.6}{0.44} = 5.9 = 6$$

So, the thickness of Surface Course is 6

$SN_1 = D_1 \times a_1$

$SN_1 = 6 \times 0.44$

$\boxed{SN_1 = 2.64}$

⇒ Now, we will find SN_2 and D_2 (Base Course)

Thickness of Base Course D_2

$$D_2 = \frac{(SN_2 - SN_1)}{a_2 m_2} - (A)$$

Now finding Coefficient layer a_2

$a_2 = 0.14$

No we can find drainage Coefficient from given table we can find $m_2 = 0.80$

Now Putting value in Eq (A)

$$\Rightarrow D_2 = \left(\frac{3.8 - 2.64}{0.14 \times 0.80}\right)$$

$D_2 = 10.36 = 1.2$

use thickness of base Course is 12".

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

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

$SN_2 = 1.34 + 2.64$

$SN_2 = 3.98$

=> Now we will find thickness of Subbase Course D_3

As we know that formula

$$D_3 = \frac{(SN_3 - SN_2)}{a_3 m_3}$$

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

$$D_3 = 5.25 = 6$$

So we will use "6" for Sub base

$$SN_3 = (2.64 + 1.34 + 6) \times 0.10 \times 0.80$$

$$SN_3 = (4.46 \cong 4.4)$$

So we calculated below

-> Surface Course = 6

-> Base Course = 12

-> Sub Base = 6