Name :- Malak Miraj Qadir

ID :- 7829

Semester : 6th

Section : A

Subject : Highway and Traffic Engineering

Instructors Name: Engr Farhan Khattak

Exam : Final Term

Q.No(01)

a): What is the difference between flexible and rigid pavement?

Ans:-

Flexible Pavement:-

1. Bitumen is used a binder in flexible Pavement
2. Deformation in the Subgrade is transferred to the upper layers.
3. Load is transferred by grain to grain contact.
4. Flexible pavements have low initial construction costs but have high maintenance costs.
5. Have low life span usually 10-15 years.
6. Surfacing cannot be laid directly on the Sub grade but a sub base is needed.

7. In flexible pavements strength of road highly dependant on strength of Subgrade.
8. Road can be used for traffic within 24 hours.

Rigid Pavement:

1. Cement is used as a binder in rigid pavements.
2. Deformation in the Subgrade is not transferred to subsequent layers.
3. No such phenomenon of grain to grain load transfer exists.
4. Rigid pavements have low maintenance cost but have high initial construction costs.
5. Life span is more as compare to flexible usually 30+ years.
6. Surfacing can be directly laid on the subgrade.
7. Strength of road less dependent on strength of Sub-grade in rigid pavements.

8. Road cannot be used until 14 days of curing.

Q.No(01) b.

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

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 mixing Plant and paver. The second advantages is that the aggregates for wet mix macadam will have to be crusher-run, whereas the aggregates for water bound macadam

are generaly hand-broken.

Q.No(01) c:

What is the difference between asphalt and bitumen?

Ans:-

Asphalt:

2. Asphalt is the combination of bitumen and graved. and it is specifically use in road construction.

2. And it is dark brown 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.

> Bitumen:-

While bitumen is actually the liquid binder that holds together the construction material.

2. Besides we can defined further bitumen. A class of black or dark-colored (solid, semi-solid or viscous) cementitious substances, natural or manufactured, composed principally of high molecular weight hydrocarbons found in Asphalts, Tars, pitches and Asphaltites are typical.

3. Bitumen pavements are less durable, with a layer depth of 10-20mm and life-span of 5-10 years.

4. Higher frictional resistance of a bitumen pavement means less efficiency in energy utilization.

5. Exposure to bitumen leaching may cause deterioration of soil and groundwater quality.

6. The loose fragments on bitumen pavement make the driving experience noisier and can wear down tires, consequently causing safety issues.

7. Cheap to Install Compared to asphalt.

Q.No(04)

What are the different pavement distresses? Explain in detail?

Ans:-

Pavement distresses:

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:

. Unstable mixes.

. Higher wheel loads than those considered in design.

1) Alligator (Fatigue) Cracking
2) Block Cracking
3) Rutting.
4) Bleeding
5) Polished Aggregate.
6) Raveling
7) Potholes

1. Alligator (Fatigue) Cracking):

> Possible Causes:

. Overloading
. Inadequate Structural design.
. Poor Construction.

> Repair:

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

Block Cracking:

> Problem:

To Allows moisture infiltration

> Possible Causes:

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

> Repair:

. Low Severity Cracks (<1/2 inch wide). Crack Seal to prevent entry of moisture.

. High Severity: Cracks (> 1/2 inch wide and cracks with raveled edges).
Remove and replace the cracked pavement layer with an overlay.

Rutting:

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

> Possible Causes:

. 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).
. Insufficient compaction of HMA layers during construction.

> Repair:

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

overlayed.

5) Bleeding:

>Problem:

Loss of skid resistance when wet.

>Possible Cause:

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

6) Polished Aggregate:

>Possible Causes:

Repeated traffic applications. This can occur quicker if the aggregate is susceptible to abrasion.

>Repair:

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

7. Pothdes:

> Small, bowl-shaped depressions in the pavement surface that penetrate all the way through the HMA layer down to the

base course.

> Potholes are most likely to occur on roads with HMA surfaces (1 to 2 inches) and seldom occur on roads with 4 inch or deeper HMA surfaces.

> 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 becomes severe, the interconnected cracks create small chunks of pavement, which can be dislodged as vehicles drive over them.

> Repair:

Patching techniques.

Q. No (02)

Ans. 02:-

Solution:-

For a design speed of 75 mi/h

K = 312 from table 15.5

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

$= 312 \times [3+4]$

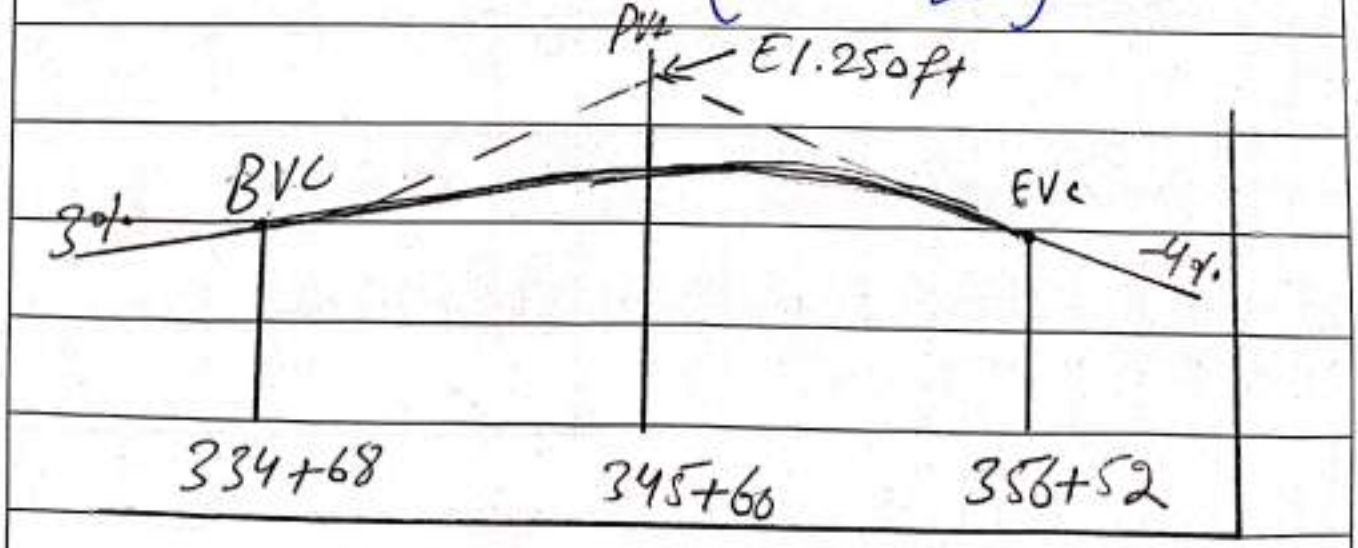
$= 312 \times [7]$

$= 2184$ ft

Station of BVC = $(345+66) - \left(\frac{21+84}{2}\right) = 334+68$

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

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



Station	Distance from BVC (x) (ft)	Tangent Elevation (ft)	offset $\left[y = \frac{Ax^2}{200L}\right]$ (ft)	Curve Elevation Tangent elevation offset, (ft)
BVC 334+68	0	217.24	0.01	217.24
BVC 335+00	32	$217.24 + \frac{32}{100} \times 3 = 218.$	0.02	218.18
BVC 336+00	132	221.20	0.28	220.92
BVC 337+00	232	224.20	0.86	223.34
BVC 338+00	332	227.20	1.77	225.48
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	229.80
BVC 342+00	732	239.20	8.59	230.61
BVC 343+00	832	242.20	11.09	231.28
BVC 344+00	932	245.20	13.92	231.13
BVC 345+00	1032	248.20	17.07	230.66
BVC 346+00	1132	251.20	20.54	229.88
BVC 347+00	1232	254.20	24.32	228.77
BVC 348+00	1332	257.20	28.43	227.34
BVC 349+00	1432	260.20	32.86	225.57
EVC 356+00	2184	282.76	76.44	206.32

Q.No. 03:-

Ans:-

As per mentioned 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 course to find thickness D_1 of the surface course is 2.6.

As per given data of Resilient modulus of asphalt concrete at 68°F 450,000 lb/in². The structural layer coeffficient (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

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

Now finding Coefficient layer a_2

$a_2 = 0.14$

Now we can find drainage coefficient(m_2)

From given table we can find $m_2 = 0.80$

Now putting value in eq (A)

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

$D_2 = 10.36 = 12$

Use thickness of base course is 12

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

$SN_2 = 1.34 + 2.64$

$\boxed{SN_2 = 3.98}$

$\Rightarrow$ Now we will find thickness of subbase course D_3.

As we know the 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

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

$SN_3 = 4.46 \simeq 4.4$

So as we calculated below:

→ Surface course = 6

→ Base Course = 12

→ Sub base = 6