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Name

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ID

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Section

'A'

Semester

'6th'

Subject

Highway and Traffic

Final Term

Date 1/20

Question: 1

Q1 (a)

Difference b/w flexible and rigid pavement.

Flexible pavement:

Flexible pavement typically distribute wheel loads to lower layer of the pavement section and consists generally of bituminous meterial.

Rigid pavement:

Rigid pavement are typically distribute wheel loads over a wide area of the

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subgrade and consists generally of cement concrete and may be reinforced with steel.

Flexible pavement	Rigid pavement
Bitumen is used as binder in flexible pavement.	Cement is used as binder in rigid pavement.
Deformation is the subgrade is transferred to the upper layer.	Deformation in subgrade is not transferred to subsequent layer.
Load is tranferred by grain to grain contact.	No such phenomena of grain to grain load transfer exist.
Flexible pavement have low initial	Rigid pavement have low

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construction costs but have high maintanance cost	maintenance cost but have high initial construction cost.
Have Low life span usually 10-15 years.	Life span is more as compare to flexible usually 30+ year.
Road can be used for traffic with in 24 hours	Road cannot be used until 14 days of curing.

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Q1 (b)

Advantages of water bound over wet mix macadam:

The main advantage of wet-mix macadam over water bound macadam is that it is composed of a well-graded mixture. This is ensured good inter lock and high stability.

Addition of water while mixing facalitates the handing of the mixture. The operation of layering is much simpler than that of water-bound macadem where the screening and binding meterial have to be added in stages and forced into voids. if a crusher-run meterial is

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used. There is no possibility of plastic fines entering into the mixture.

The compaction is greatly facilitated by the moisture added which lubricates the individual particles.

The aggregates of wet mix macadam will have to be crusher-run, whereas the aggregates for water-bound macadam are generally hand-broken.

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Q.1 (c)

Difference b/w bitumen and asphalt.

Bitumen:

- A class of black or dark-coloured (solid, semi-solid or viscous) cementitious substances, natural or manufactured, composed principally of high molecular weight hydrocarbon found in asphalts, Tars, Pitches, and Asphaltites are typical.

Asphalt:

- A dark brown to black cementitious material in which the predominating constituents are bitumens.

which occurs in nature or are obtained in fractional distillation of petroleum (crude oil) alongwith certain mineral matter.

- In American terminology
- Both Asphalt and bitumen are same and are "Asphalt".
- In some is generally literature bitumen is actually the Liquid binder that holds asphalt together.

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Question: 2

Solution:

Given Data:

speed = 75 mi/h

K = 312 from table 1

Min Length = $312 \times [3 + (-1)]$

= 2184 ft.

Station BVC = $(341 + 00) - \left(\frac{21 + 84}{2}\right)$

= 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

P.T.O

Table

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Station	Distance from BVC x (ft)	Tangent Elevation (ft)	Offset $\left[y=\frac{Ax^2}{200L}\right]$ ft	Curve Elevation (Tangent Elevation − offset)
BVC 334+00	0	217.24	0.01	217.24
BVC 335+00	32	$217.24+\frac{32}{100}\times 3=218.20$	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	225.43
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	231.11
BVC 344+00	932	245.20	13.92	231.28
BVC 345+00	1032	248.20	17.07	231.13
BVC 346+00	1132	251.20	20.54	230.66
BVC 347+00	1232	254.20	24.32	229.88
BVC 348+00	1332	257.20	28.43	228.77
BVC 349+00	1432	260.20	32.86	227.34
BVC 350+00	1532	263.20	37.43	225.59
BVC 351+00	1632	266.20	42.86	223.52
BVC 352+00	1732	269.20	48.07	221.13
BVC 353+00	1832	272.20	53.79	218.41
BVC 354+00	1932	275.20	59.82	215.38

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BV(355+00	2032	278.20	66.17	212.03
BV(356+00	2132	281.20	72.84	208.36
BV(356+52	2184	282.76	76.44	206.32

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Question: 3

Solution:

Reliability Level (R) = 99%

Standard deviation (So) = 0.49

Initial Serviceability index $P_i = 4.5$

Terminal Serviceability index P_t = 2.5

$\Delta PSI = 4.5 - 2.5 = 2.0$

Finding SN, or D_1 (Surface Course).

Step 1:

Draw the Line joining the reliability Level of 99% and the over all standard deviation So of 0.49

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Step 2:

Draw a line ejoining point A to the ESAL of 2×10^6

Step 3:

Draw a line ejoining point B and resilined modules (M_R) of Base Course and extent this Line.

Step 4:

Draw a horizontial line from the point 'C' to intersect the design serviciability

Loss (PSI) curve at point D

$\Delta PSI = 4.5 - 2.5$

$= 2$

D_1 of surface course is 26

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Step 5:

Resilind value of asphalt

$= 450,000 \text{ lb/in}^2$

$a_1 = 0.44$

Therefore

$a_1 = 0.44$

Thickness of surface coarce D_1

$D = SN_1/a_1$

$= 2.61/0.44$

$= 5.9''$

Thickness should be taken to the nearest $0.5''$

So Thickness of surface coarse is $6''$

$SN_1 = D_1'' \times a_1$

$SN_1 = 6 \times 0.44$

$= 2.64$

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Finding SN_2 and D_2 (Base coarse)

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

$$D_3 = (4.4 - 3.98) / 0.10 \times 0.80$$

$$D_3 = 5.25''$$

Use 6" as subBase

$$SN_3 = 2.64 + 1.34 + 6'' \times 0.10 \times 0.80$$

$$= 4.46 > 4.4$$

OKy

Now

Surface coarse = 6"

Base coarse = 12"

sub base = 6"

Total Pavement = 24"
Thickness

Question : 4

What are the different pavement distasses? Explain in detail?

Pavement Distress:

Distress is a condition of the pavement structure that reduces serverceability or leads to reduction in service Life.

Distress could occur in pavement due to:

Unstable mixes
Higher wheel Loads than those considerd in design.

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Aligator Craking:

Possible Causes

Over Loading

Inadequate structual design.

Poor construction.

Repair

Craking sealing is in effective.

Dig out and replace area of poor subgrade.

Block Craking:

Problem:

Allows moisture infiltration.

Possible Causes:

NCA shrinkage

Asphalt binder aging

Poor choice of asphalt binder in the mix design.

Repair:

Low severity cracks (< 1/2 inch wide). Crack seal to prevent entry of moisture.

High severity crack (> 1/2 inch wide and crack with raveled edges)

Remove and replace the cracked pavement layer with an overlay.

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Potholes:

Small bowl-Shaped depression in the pavement surface that penetrate all the way through the HMA Layer down to the base course.

Problem:

Roughness, moisture infiltration.

Problem Causes:

Generally, potholes are the end result of fatigue craking, As fatigue craking becomes severe, the interconnected cracks create small chunks of pavement which can be dislodged as

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vehicles drive over them.

Repair:

Patching techniques

Rutting:

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

Possible Causes:

Insufficient compaction of HMA layer during construction.

Subgrade rutting (eg: as a result of inadequate pavement structure).

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Repair:

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

Bleeding

Problem:

Loss of skid resistance when wet.

Problem Causes:

Excessive asphalt binder in the HMA.

Low HMA air void content.

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.

Raveling:

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

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Possible Causes:

Asphalt binder aging

Inadequate compaction during construction.

Repair:

Fog Seal / Slurry Seal or remove the damaged pavement and over lay.