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ID NO = 7823

SECTION = A

PAPER = HIGHWAY TRANSPORTATION ENGINEERING II

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QUESTION NO: 1 (Part = A)

	Flexible pavement	Rajid pavement
⇒	Load is transferred by grain to grain contact.	No such phenomenon of grain to grain load transfer.
⇒	Low completion cost but Repairing cost is high.	Having low Repairing cost but completion cost is high.
⇒	Have low life span.	Life span is more as compared to flexible Pavement.
⇒	Deformation in the sub grade is transferred to the upper layer.	Diformation in the sub grade is not transferred to subsequent layer.
⇒	Have low fluxral strenght.	Have high flexural strenght

⇒ Joints are not Required.	Joints are Required.
⇒ Required less curing time.	Required much curring time.
⇒ Damaged by oils and certain chemicals flexible Pavement are Workiable after 24 hours of construction.	No damage by oils and chemicals. It can't be used untill 14 days of curring.
⇒ No Thermal stresses are Required.	Thermal stress are Required.

QUESTION NO: 1 (Part: B)

Advantage of Water bound over Wet Mix Macadam:-

=) The construction cost of WBM Road is comparatively low.

=) Water bound Macadam is superior in quantity because Material are carefully graded and Resulting mass is almost void less compacted Mass.

=) In the construction of WBM Road no skilled labour are Required

=) They are constructed from locally available Material.

=) If the WBM Road are maintained properly and from time to time it can Resist

load of traffic of about 900 tonnes per lane per day.

=) The interlocking of aggregate particles imparts inadequate strenght of the material selected for filling the voids. These ensure non-entry of the plastic material of the sub-grade into voids.

QUESTION NO = 1 (Part = c)

Difference b/w bitumen And Asphalt:-

Bitumen:-

=) Bitumen is a binding Agent produced from Petroleum. Bitumen is known for being strongly adhesive and Resistant to damage from water and oil spills.

=) Bitumen is actually the liquid binder that holds alphalt together.

=) Bitumen is only used for commercial supplies as a binder or sealant for other products.

Asphalt:-

=) Asphalt is produced in a plant that heats, dries and mixes agregates.

Bitumen and sand into a composite mix.

It is a composite mixture that provides a durable and flexible surface for cars and heavy vechiels.

Asphalt is generally used as a term to refer to the combinatio of bitumen and gravel specifically for Road construction.

QUESTION # 02

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 FVC $= (334+68) + (21+84)$

$= 356+52$

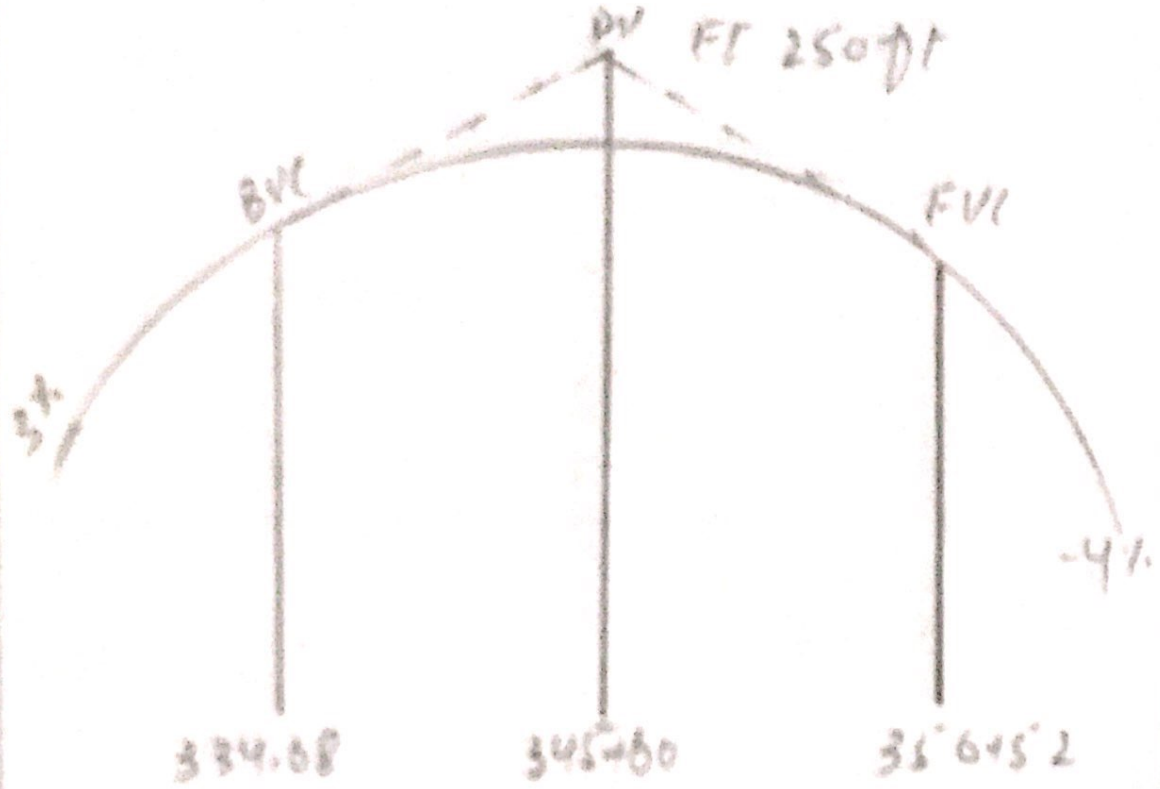
Elevation of BVC $= 250 - \left(0.03 \times \frac{2184}{2}\right)$

$= 217.24$ ft.

Station	Distance from BVC (x) ft)	Tangent Elevation	offset $y=\left(\frac{Ax^2}{200L}\right)$ ft	Elevation tangent − Elevation offset
BVC 334+68	0	217.24	0.01	217.24
BVC 335+00	32	217.24 32/100x3=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

DRIGT # 09

Station	Distance from BVC (x) (ft)	Tangent Elevation	offset $Y=\left[\frac{Ax^2}{200L}\right]$ ft	Elevation tangent − Elevation offset
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	37.51	225.59
BVC 351+00	1632	266.20	42.68	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
BVC 355+00	2032	278.20	66.17	212.03
BVC 356+00	2132	281.20	72.84	208.36
EVC 356+52	2184	282.76	76.44	206.32



QUESTION NO=3

GIVEN DATA:-

Residental Module at 68°F 450000 lb/in²

CBR value of base coarse Material 100, 31000 lb/in²

CBR value of sub-base coarse Material 22 Mr, 13500 lb/in²

CBR value of sub-grade Material 6

Mr of sub-grade 6 x 1500 lb/in²

9000 lb/in²

Moisture Content = 30%

Solution:

Reliability level (R) = 99%

Standard deviation (So) = 0.49

Initial servicability index $p_i = 4.5$

Teminal serviceability index $p_t = 2.5$

$$PSI = 4.5 - 2.5 = 2.0$$

Step#1

Finding SN1 and D1 (surface coarse) Draw the line joining the Realiability level of 99% and overall standard deviation (So) of 0.49

Step#2

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

Step#3

Draw a line joining point B and Residental Module (MR) of base coarse and Extend this line.

Step#4

Draw a horizontal line from point C to intersect design serviceability loss (PSI) curve at point D

$\Delta PSI = 4.5 - 2.5 = 2$

D1 of surface coarse is 2.6

Step# 5

Finding SN_1 and D_1 (Surface coarse) So the structure member Required to protect the base coarse and to find the thickness D_1 of the surface coarse is 2.6

Step# 6

As the percentage of time pavement structure exposed to moisture level approaching saturation. is 30% (i.e:- greater than 2.5%)

So

Drainage co-efficient $m_2 = 0.8$

From chart

layer co-efficient $a_2 = 0.14$

Thickness of Surface coarse:-

$$D_1 = SN_1 / a_1$$

$$= 2.6 / 0.44$$

$$D_1 = 5.9''$$

DAGIFA #14

Thickness should be taken to the nearest 0.5"

So thickness of surface is 6".

$SN_1 = D_1 \times a_1$

$SN_1 = 6 \times 0.44 = 2.64$

Finding SN_2 and D_2 (Base coarse)

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

$= 3.8 - 2.64 / 0.14 \times 80$

$D_2 = 10.36"$

use 12"

So thickness of base coarse is 12"

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

$SN_2 = 1.34 + 2.64$

$SN_2 = 3.98$

Finding = $(SN_3$ and $SN_2) / a_2 m_3$

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

$D_3 = 5.25"$

We will use 6" as a sub-base.

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

$SN_3 = 4.46$ okey

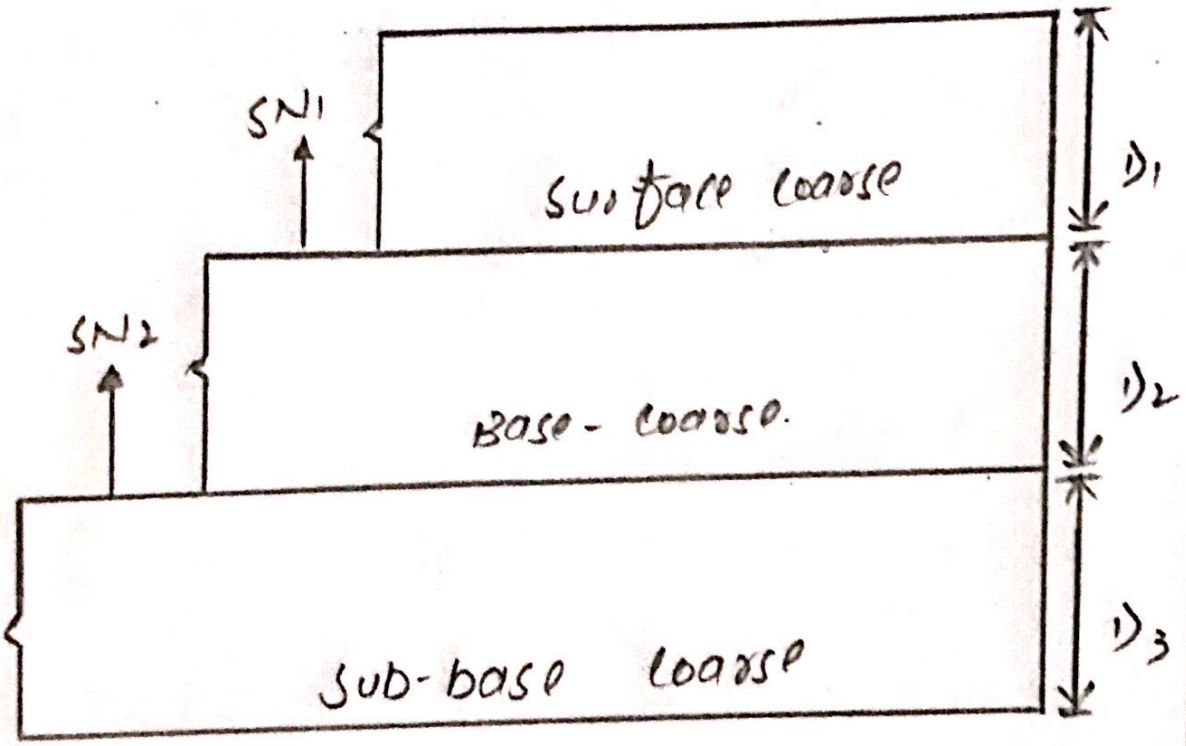
Final design

Surface coarse = 6"

Base coarse = 12"

Sub-base = 6"

Total pavement thickness = 24"



QUESTION NO = 04

Pavement Distress::

Distress is the condition of pavement structure that Reduces serviceability or leads to a Reduction in service life.

Distress could occure in a pavement due to

=) unstable mix

=) Higher wheel loads than those considered in design.

Different Pavement Distress

=) **Alligator Cracking:-**

It is also known as map or Fatigue failure.

since it appear similar as alligator skin so, it is called alligator cracking.

The failure can be due to weakness in surface base or sub-grade, a surface that is too-thin, poor drainage or the combination of all three.
The main Reason of this type of failure is the Repetative application of heavy movement of traffic.

Block cracking:-

Large cracking looks like large interconnected Rectangulars (Roughly).

Cause of block cracking:-

Asphalt binder Aging.
HMA shrinkage
Poor choice of asphalt binder in mix design.

Method of Repairing:-

low Sereoity cracks (half inch wide (to Prevent entry of Moisture.

High severity cracks half inch wide. Remove and Replace the cracks pavement layer with an overlap.

Rutting:-

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

Possible causes:-

Insufficient compaction of HMA layers during construction.
Sub-grade Rutting leg as a Result of inadequate pavement structure.

Repairs:-

Slight Ruts (< 1/3 inch deep can generally be left untreated.
Pavement with deeper Ruts should be levelled and overlap.

Longitudnal cracking:

It occuse parallel to the centre line of the pavement.

Cause :-

Poor constructed Joints
shrinkage of asphalt layes.
cracks Reflecting from underlying layes.

Transverse cracking:-

It is an unconnected "la" cracks that Run accross a Road pavement Perpendicular to direction of Road.

cause :-

Shrinkage of Asphalt layes.
Reflection from an existing crack.

Bleeding:-

loss of skid Resistance when wet.

Cause:-

Excessive asphalt binder in the HMA.

Low HMA Air void content.
Excessive application of Asphalt binder during BST application.

Raveling:-

losse debois on the pavement which increase pavement Roughness and loss of skid Resistance.

cause:-

Asphalt binder Aging.
Inadequate Compaction during construction.

Repair:-

Fog seal / slurry seal or Remove the damaged pavement and overlap.

polished Aggregate:-

Repeated traffic Application. This can occure Quicker if the aggregate is susceptible to abrasion.

Method of Repairing:-

Apply a skid Resistance slurry seal.
BST on non structuring overlaping.

Potholes:-

Small bowl shaped depression in the pavement surface that penetrate all the way through the HMA layer down to the base course.

Cause:-

Generally potholes are the end Result of fatigue cracking.

Repairing:-

patching techniques.