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ROLL NO: 7399
SUBJECT: HIGHWAY AND TRAFFIC ENGINEERING
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Q NO.1 (A) What is the difference between flexible and rigid pavement?

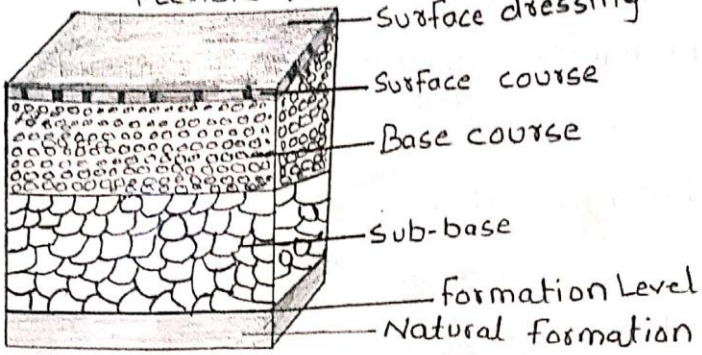
Ans Differences between Flexible and rigid Pavement are as follow

	FLEXIBLE PAVEMENT	RIGID PAVEMENT
1	In flexible pavement bitumen is used as binder	1) In rigid pavement cement is used as binder
2	Road can be used for traffic with in 24 hours.	2) Road cannot be used until 14 days of curing.
3	Have low Life span usually 10-15 years	3) Life span is more as campare to flexible usually 30 plus years.
4	Surface cannot be Laid directly on the subgrade but a sub base is needed.	4) Surface can be laid directly on the subgrad
5	Strenght of road is ~~less~~ highly dependent of strenght of sub grade grade	5) Strenght of road is Less dependent on Strenght of sub-grade
6	Load is transfered by grain to grain contact	6) NO such phenomena of grain to grain Load transfer exist.
7	Deformation in the sub-grade is transfered to the upper Layer	7) Deformation in the subgrade is not transfered to sub. sequent Layer.

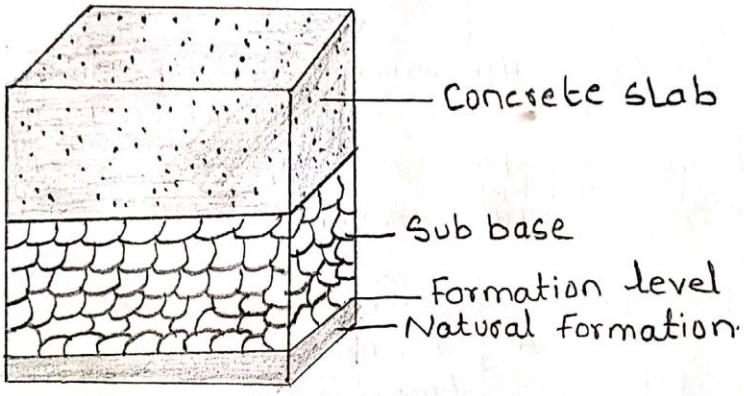
P. T. O

Diagram for Q1 (a)

Flexible Pavement:



Rigid pavement:



Q No 1 (b) What are the advantages of water bound over wet mix macdam?

Ans The advantages of WBM are as follow

1 The construction cost of WBM road is comparatively Low

2 The interlocking of agregate particles impart adequate strenght of material selected for filling the voids. These ensure no-entry of plastic materials of the subgrade into voids.

3 They are constructed from Locally availble material

4 If the WBM roads are maintained properly and from time to time it can resist Load

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of traffic of about 900 tonnes per lane per day

5 In the construction of WBM road no skilled labour are required.

6 WBM is superior in quality because the material are carefully graded and the resulting mass is almost void Less compacted.

Q.No 2 (c) What is diffrence between asphalt and bitumen?

Ans **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 Asphalt, Tars, Pitches and Asphatites are typicaly bitumen.

Bitumen is a binding agent produced from petroleum. Bitumen is known for being strongly adhesive and resistance to damage from water and oil spills. Bitumen is actually the liquid Binded that hold asphalt togather.

A bitumen sealed road has a Layer of bitumen sprayed and then covered with an agregate. this is than repeated to give two-coat seal.

Asphalt:

A dark brown to black cementitious material in which the predominating constituent are bitumens which occurs in natural or are obtained in fractional distillation of petroleum (crude oil) along with certain mineral matter

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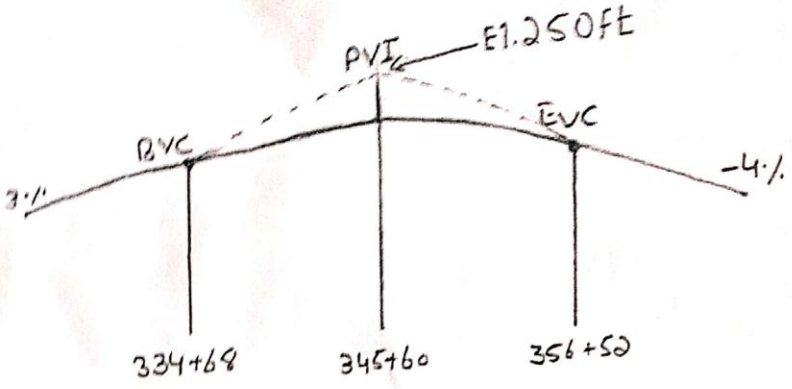
Asphalt is produced in a plant that heats dries and mixes agregates, bitumen and sand into a composite mix. It is than applied through a paving machine on site as a solid material at a nomimated or requvired thickness relative to the end use. Asphalt results in a smother and more durable asphalt road surface than a bitumen-sealed road. Asphalt is commonly used as surface of roads, car parks and driveway.

In american Teominology both asphalt and bitumen are same and are asplalt.

Q No 9



Solution For a design speed of 75 mi/h. K = 312

Minimum Lenght = 312 × [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 - (0.03 × $\frac{2184}{2}$)

= 217.24 ft.

Table is on another page.

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STATION	Distance From BVC (x) (Ft)	Tangent Elevation (Ft)	offset $\left[\text{Y} = \frac{Ax^2}{200L}\right]$ (Ft)	Curve Elevation (Tangent elevation − Ofset) (Ft)
BVC 334+68	0	217.24	0.01	217.24
BVC 335+00	32	217.24 + $\frac{32}{100}$ x3 = 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	37.61	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
BVC 357+00		282.20	76.44	206.32

Q NO :- 3

Given Data:-

Resilient Modulus at 68°F 450000 lb/in²
CBR value of Base coarse material 100 · Mr
CBR value of subbase coarse material 22 · Mr
CBR value of subgrade material 6 31000 lb/in² 13500 lb/in²
MR of subgrade 6 × 1500 lb/in² = 9000 lb/in²
moisture content = 30%

Solution:-

Reliability level (R) = 99%.
standard deviation (S_o) = 0.49
Initial Servicability Index P_i = 4.5
Terminal Servicability Index P_t = 2.5
ΔPSI = 4.5 − 2.5 = 2.0

Step # 1 :-

Finding SN_1 & D_1 (Surface coarse)

Draw the Line joining the reliability level of 99% and over all standard deviation S_o of 0.49

step # 2 :-

Draw the Line joining point A to the ESAL of 2×10^6

Step # 3 :-

Draw a Line joining point B and resilient modulus (Mr) of base coarse and extent this Line

Step # 4 :-

Draw a horizantal Line from point C to intersect design servicability.

→ loss (PSI) curve at point D

$\Delta PSI = 4.5 - 2.5 = 2$

↳ D_1 of surface coarse is 2.6

Step # 5 :-
Finding SN_1 & D_1 (Surface coarce) so the structure number required to protect the base coarse and to the find the thickness D_1 of the surface coarce is 2.6

Step # 6 :-
As the percentage of Time pavement structure exposed the 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.

$D_1 = SN_1 / a_1$
$2.6 / 0.44$
$= 5.9"$

Thickness should be taken to the nearest 0.5".
So thickness of Surface is 6"
$SN'' = D_1 \times a_1$
$SN_1 = 6 \times 0.44 = 2.64$

Finding SN_2 & D_2 (Base Course)

$$D_2 = (SN_1 - SN_1^*) / a_2 m_2$$

$$= 3.8 - 2.64 / 0.14 \times 0.80$$

$$D_2 = 10.36''$$

Use 12"

So thickness of base Course 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 & D_3 (Sub base Course)

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

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

$$D_3 = 5.25''$$

We will use 6" as a Sub base

SN_3 = 2.64 + 1.34 + 6" × 0.10 × 0.80

SN_3 = 4.467 4.4 Okey.

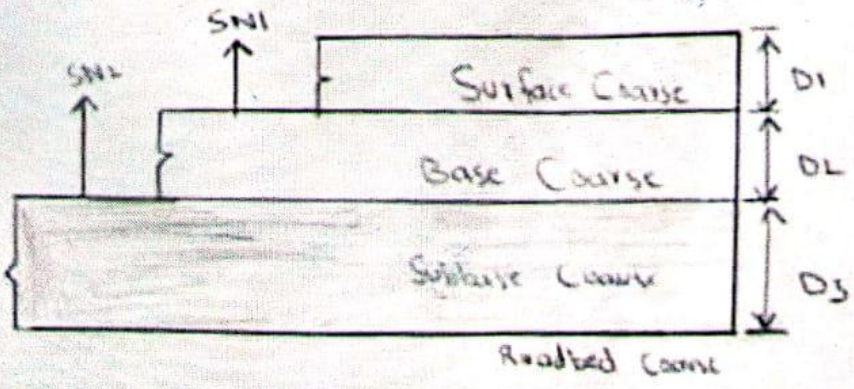
Final Design

Surface Coarse = 6"

Base Coarse = 12"

Subbase = 6"

Total Pavement thickness = 24"



Q No.4 What are the diffrent pavement distresses? Explain in detail?

Ans following are the diffrent types of road pavement distresses.

1) ALLIGATOR CRACKING:

* It is also known as map cracking or fatigue failure.
* It is also similar as alligator skin so that why it is called alligator cracking.

REASON OF ALLIGATOR CRACKING:

The main reason are

1) over loading
2) Poor construction
3) Inadequate structral design.

METHOD OF REPAIRING:

* Crack sealing is affective.
* Dig out and replace area of poor subgrade

2 Block Cracking

Block cracking looks like large Interconnected rectangulars (roughly)

→ Causes of block cracking.

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

Method of repairing:-

- Low severity crackes < half inch wide, crack seal to prevent entry of moisture.
- High severity crackes ≥ Half inch wide

Remove and replace the covered pavement Layer with an over Lay

3 RUTTING

Suface depression in the wheel Path are particularly evident after a rain when they are filled with water

REASON OF RUTTING:

- Insufficient compaction of HMA Layer during construction
- Sub grade rutting.
- Improper mix design

METHOD OF REPAIRING.

Sligts ruts (< 1/3" deep) can generally be left untreated pavement with deeper ruts should be leveled and over layed

4 Bleeding

Bleeding or flushing is shiny black surface film of asphalt on the road surface caused by upward movement of asphalt in pavement surface

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Causes of bleeding:

- Excessive asphalt binder in the HMA.
- Low HMA air void content.

THE

END