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Paper Highway and Frafic Engineering

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Exam: Final - term (Spring 2020)

Q No #(01) (a)

What is the difference between flexible and rigid pavement?

Answer

Flexible pavement	Rigid Pavement
1) Grain to grain load transfer	1) Slab action take place
2) Intial case is low	2) Intial cost is high
3) Joints are not requir	3) joint are required
4) Durability is less	4) Durability is high
5) good subgrade is required	5) Good subgrade is not required
6) ~~From~~ temperature varaition has no any effect on the stress variation	6) Temperature variation effect the Stress variation
7) life spain is short - 15 year	7) long high spain 30 year
8) repair work in easy	8) Repair work in todgh
9) Maintainance cost is high	9) Maintanance cost is low

10) Required less Curing time.	10) Required much Curing time.
11) Poor high night visibility due to use of bitumen	11) Good night variability 12) high glare due to sunlight
12) No glare due to sunlight	13) Different to do the underground works.
13) Easy to locate the underground works like Pipe location etc	14) thickness is less
14) ~~udesigned~~ tickness is move	15) Design not depends on subgrade
15) Design depends upon the subgrade strength	16) Stability depends upon the points between the slabs of Concrete
16) Stability depends upon the aggregate inter locking portiele friction and Cosheson	17) IRC 58.
17) IRC 37	

Q No (01) (b)

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

Answer

Advantage of water Bound Macado

1) water bound macadam is superior in quality because the materials are carefully graded and the resulting mass is almost void les Compacted mass.

2) The . Interlocking of aggregate particle impacts adequate strength of the materials selected for filling the voids. These ensure non entry of the plastic material of the sub-grade into the void.

3) water bound macadam is less costly as compared to bituminous base course.

Q No (a1) (c)

What is the differente between aspact and bitumen?

Answer

Aspatt	Bitumen
=> Aspatt paroements are durable with a layer depth of 25-40 mm and life span of 20+ year	=> Bitimen paroments are less durables with a layer depth of 10-20 mm and life span of 5-10 year
=> Surface made of asphalt is smothed and more skid resistant ensuring the driver's safely and minimal noise	-> the loose fragments on bitumen parement make the driving experience noiser and can wear down tires, consequently causing safety issues

=> Reduce friction b/w tires and car meaning better fuel economy and minimization of Carbon dioxide emission	=> Higher Frictonial ~~resis~~ resistance of a bitumen Pavement. means less effiency in energy utilization.
=> Asphalt is an Impermeable material thus the pavement do not leach. Therefore they have a lesser Chances of intiltrating and polluting the ground water	=> Exposure to bitumen leaching may cause deterorotion of soil and ground water quality
=> less Sensitive to temperature Compared to bitumen Pavement Negative impacts are Seen only in extremely high or low temperatur	=> Pavement are Susciptible to high temperature which can make it sticle and soft

Q No (04)

What are the different pavement distresses? Explain in detail?

P.T.O

Page :- ~~(37)~~ (05)

Answer

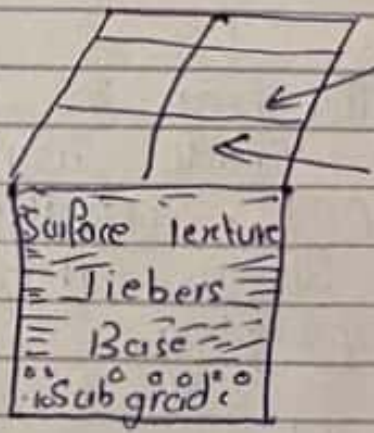
Dif parement Distresses:-

Introduction:-

A highway parement a structure of Consisting super Imposed layer of Processed materials the parement structure should be able of provide a surface of acceptable raining quality adequate skid resistence farourable light reflecting charactoristic and low noise pollution.

Rigid Parement:-

Rigid parement have sufficient flexural strength of transmit the wheel load stresses to a winder area below in right parement load is distributed by slab action.



P.T.O

Factored Affecting Parement Perfor mance

-> Traffic Contact pressure wheel loading Axle Configuration moving load.

=> Structural model layer elastic model.
-> Materials characterization
=> Enivermental factor temperature Mositure

Common Rigid Parement Distresses

1)=> Spalling at the joint :-
Cracking breaking or chipping of joints / crack edges. Usually occures within about 0.6m (2ft) of joint / crack edges.
=> at caused by Intiltration of incompressib material and subsequent expension / can also cause blowsups).

2) Faulting :-
A difference in elevation across a joint or crack usually associated with undowled JPCP. usually the approach slab is higher then the leave slab due to pumping.

3) Longitudinal Cracking :-
Longitudinal Crack not associated with corner breaks or blows ups the exlend across the entire slab into two or four Pieces.

4) Corner Cracking :→

A slab that intersec the pcc slab joint near the corner with in about 2m (6ft) or so. A corner extends through the entire slab and caused by high Corner Stresses.

5) Rutting :-

Surface depression in wheel path are particulary evident after a rain when they are fuailled with water.

Causes :-

1) → Insufficient Compaction
2) → Subgrade routing
3) Improper mix design

Repair :-

1) slight put (1/3 inch deep)

6) → Bleeding :-

→ loss of skid ressistence whe wet.

Cause :-

→ Excessive asphalt binder in the Hma
→ Excessive application of Asphal binour during BST aplicatio

7) → Polished Aggregate :-

Causes :→

Repeated traffic aplicatio this can be occure quicker if the aggregate is susceptible to abrasion.

Q20(02)

Answer Solution

for a design of 75 mi/h. K = 312

Minimum length = $312 \times [3-(-4)] = 2184$ ft

Station of BVC = $(345+60) - \left(\frac{21+84}{2}\right) = 334+68$

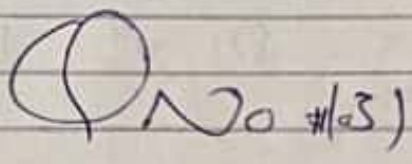
Station of EVC = $(334+68) + (21+84) = 356+52$

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

The remainder of the computation is efficiently done using the form of shown in the table

Station	Distance BVC (in) (ft)	Tanget elevation (ft)	off set $(Y = \frac{Ax^2}{200})$ ft	Curve elevation tangent elevation off set (ft)
BVC 334+68	0	217.24	0.01	217.24
BVC 335+00	32	217.24	0.02	218.18
BVC 336+00	132	221.20	0.28	220.92
BVC 337+00	232	224.20	0.80	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	231.25
BVC 345+00	1032	248.20	17.07	231.13
BVC 346+00	1132	251.20	20.54	230.61
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	32.80	227.34
BVC 350+00	1532	263.20	37.60	225.52

BVC 351+00	1632	206.20	92.68	223.052
BVC 352+00	1732	209.20	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 356152	2184	282.76	76.47	206.32



Answer Solution

(Steps) Draw a line joining the reliability level of 99% and the over all standered diviation So of 0.49 and extand line, to intersect the first T.L line at point A.

(⇔ Step (02) →

Draw a line joining point to the ESAL of 2×10^6 and extend this line to intersect the first TL line at point B.

Step = (03) →

Draw a line joining point B and resistient modulus (M_1) of base course and extend this line to intersect the design Serviceability loss chart at point C.

Step (04) :->

Draw a horizental line from point c to intersect the design serviceability.

=> Loss (PSI) curve at point D. So here

$\Delta PSI = 4.5 - 2.5 = 2$

Step :-> (05] :->

The structure number Require to protect the base course and to find the thick D of the surface course is 2.6

Step: (06) :->

Determine the appropiate structure layer to efficient each construction material Resilient value of asphalt = 450,000 lb/in

=> There fore

$$D_1 = \frac{SN_1}{a_1}$$

$= 2.6 / 0.44 = 5.9''$

Thickness should be taken to the nearest 0.5 inches so the thickness of the surface course is 6'

$SN = D_1 \times a_1$

$= 6 \times 0.44 = 2.64$

=> Now find SN_2 and D_2 (Base course) find the value of D_2 from layer co-efficient table and M_2 from drainage co-efficient table

=> Thickness of base course (D_2)

$D_2 = (SN_2 - SN_1) / D_2 M_2$

$D_2 = (3.8 - 2.64)' \quad 14 \times 0.80$

$D_2 = 10.36''$

Use 12"

So the thickness of base course is 12"

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

$SN_2 = 1.34 + 2.04$

$SN_2 = 3.98$

$\Rightarrow$ Finding SN_3 and D_3 (sub base course) and also layer co-efficient a_3 and drainage co-efficient M_2 from their respective table.

$D_3 = (SN_3 - SN_1) \; / \; a_3 M_2$

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

$D_3 = 5.24''$

we will use 6" as a sub base

$SN_3 = 2.64 + 1.32 + 6^2 \times 0.10 \times 0.80$

$SN_3 = 4.46 \; 74.4$ okey

Final Design :-

=) Surface Course = 6"

=) Base Course = 12"

=) Sub base = 6"

=) total parement thickness = 24"