Name:→ Alla-ud-Din

I.D:→ 7353

Paper:→ Highway & Traffic Engineering.

Instructor:→ Engr, Dr. Nadeem Anwar Qureshi

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 Cost is low	2)→ Intial Cost is High.
3)→ Joints are not Required	3)→ Joint are Required
4)→ Durability is less	4)→ Durability is high.
5)→ Good Subgrade is Required	5)→ Good Subgrade is not Required.
6)→ Temperature Variation has no any effect on the Stress Variation.	6)→ Temperature Variation effects the Stress Variation.
7)→ Life Span is Short 15 year	7)→ Long life Span ~ 30 year.
8)→ Repair work is easy	8)→ Repair work is tough.
9)→ Maintenance Cost is high.	9)→ Maintenance Cost is low.
10)→ Required less Curing time.	10)→ Required much Curing time.

P.T.O

Flexible Pavement	Rigid Pavement
11)⇒ Poor night Visibility due to use of bitumen.	11)⇒ Good night Visibility.
12)⇒ No glare due to Sunlight	12)⇒ Highy glare due to Sunlight.
13)⇒ Easy to locate the Underground work like pipe location, etc.	13)⇒ Difficult to do the e underground works.
14)⇒ Thickness is more.	14)⇒ Thickness is less.
15)⇒ Design depends upon the Subgrade Strength.	15)⇒ Design not depends on Subgrade.
16)⇒ Stability depends upon the aggregate Interlocking, particle friction and Coshesion	16)⇒ Stability depends upon the joints between the Slabs of Concrete.
17)⇒ IRC 37	17)⇒ IRC 58.

*

Q NO:→ (01)(b)

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

Answer

Advantage of Water Bound Macadam

1)⇒ Water bound macadam is superior in quality because the materials are carefully graded and the resulting mass is almost void less compacted mass.

P.T.O

2)→ The Interlocking of aggregate particle impacts adequate Strength of the materials Selected for filling the Voids. These ensure non-entry of the plastic materials of the Sub-grade into the Voids.

3)→ Water bound macadam is less costly as Compared to bituminous base Course.

*

Q NO:→ (01) (C)

What is the difference between asphalt and bitumen?

Answer

Asphalt	Bitumen
⇒ Asphalt pavements are durable; with a layer depth of 25-40mm and life Span of 20+ year.	⇒ Bitumen pavements are less durables; with a layer depth of 10-20mm and life Span of 5-10 year.
⇒ Surface made of asphalt is Smoother and more Skid-Resistant, ensuring the driver's Safety and ~~min~~ minimal noise	⇒ the loose fragments on bitumen pavement make the driving experience noisier and can wear down tires, Consequently Causing Safety issues.

P.T.O

Asphalt	Bitumen
⇒ Reduce friction b/w tires and Car; meaning better fuel economy and minimization of Carbon dioxide emission	⇒ Higher frictional Resistance of a bitumen pavement means less efficiency in energy utilization.
⇒ Asphalt is an Impermeable material, thus the pavements do not Leach. Therefore, they have a lesser Chance of infiltrating and polluting the ground water.	⇒ Exposure to bitumen leaching may cause deterioration of Soil and ground water quality.
⇒ Less Sensitive to temperature Compared to bitumen pavements. Negative Impacts are Seen only in extremely high or low temperature	⇒ Pavement are Susceptible to high temperature, which Can make it Slick and Soft.

*

Q NO:→ (04)

What are the different pavement distresses? Explain in detail?

P.T.O

Answer

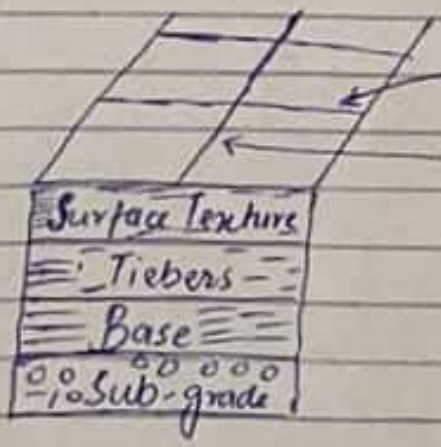
Different pavement Distresses:→

Introduction:→

A highway pavement a Structure of Consisting Super Imposed layer of processed materials the pavement Structure Should be able of provide a surface of acceptable Riding quality, adequate Skid Resistence favourable Light Reflecting Characteristic and low noise pollution.

Rigid Pavement:→

Rigid pavement have Sufficient flexural Strength of transmit the wheel load Stresses to a windw area below. In rigid pavement load is distributed by Slab Action.



P.T.O

Factored Affecting Pavement Performance

⇒ Traffic Contact pressure, wheel loading, Axle Configuratic moving load.

⇒ Structural model layer elastic model.

⇒ Materials Characterization

⇒ Environmental factor. Temperature, Mositure.

Common Rigid Pavement Distresses

1)⇒ Spalling at the Joint:→

Cracking, breaking or Chipping of joints/crack edges. Usually occures within about 0.6m (2ft) of joint/ Crack edge.

⇒ * al caused by Infiltration of incompressible 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 Cracks not associated with corner breaks or blowups that extend across the entire slab into two or four pieces.

4)⇒ Corner Cracking:→ A slab that intersect the pcc slab joint near the corner with in abow 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 particularly evident after a rain when they are filled with water.

Causes:→

1)⇒ Insufficient Compaction
2)⇒ Subgrade Routing
3)⇒ Improper mix-design.

Repair:→

1)⇒ Slight Ruts (<1/3 inch deep)

6)⇒ Bleeding ⇒ Loss of Skid Resistence when wet.

Causes:→

⇒ Excessive asphalt binder in the HMA.
⇒ Excessive application of Asphalt binder during BST aplication.

7)⇒ Polished Aggregate:→

Causes:→ Repeated traffic aplication this Can be occurse quicker if the aggregate is susceptible to abrasion.

P.I.O*

Q NO:→ (02)

Answer Solution

For a design speed of 75 M/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 = $250 - \left(0.03 \times \frac{2184}{2}\right) = 217.24$ ft

The Remainder of the Computation is efficiently done using the form of Shown in the table.

Station	Distance BVC (in) (ft)	Tangent Elevation (ft)	Offset $(Y = \frac{Ax^2}{200})$ ft	Curve elevation tangent elevation offset (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	0.86	223.34
BVC 338+00	332	227.20	1.77	225.43
BVC 339+00	432	230.20	2.99	227.21

D.I.O

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	225.59
BVC 351+00	1632	266.20	42.68	223.052
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

*

Q NO:→ (03)

Answer Solution

Draw a line joining the Reliability level of 99% and the overall standered divation so of 0.49 and extend line. to Intersect the first TL line at Point A.

P.T.O

Step:→(02):→ Draw a line joining point A 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 Resilient modulus (MR) of base course and extend this line to intersect the design Serviceability loss chart at point C.

Step:→ (04):→ Draw a horizontal 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 thickness D_1 of the Surface Course is 2.6.

Step:→ (06):→ Determine the appropriate Structure layer co-efficient each Construction material Resilient Value of asphalt = 450,000 lb/in

P.T.O

⇒ Therefore

a_1 0.44

$D_1 = SN_1 / a_1$

$= 2.6 / 0.44 = 5.9''$

Thickness should be taken to the nearest 0.5 inches So the thickness of the surface course is 6"

$SN_1 = D_1 \times a_1$

$= 6 \times 0.44 = 2.64$

⇒ 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)

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

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

$D_2 = 10.36''$

Use 12"

So the thickness of base course is 12"

P.I.O

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

$SN_2 = 1.34 + 2.64$

$SN_2 = 3.98$

⇒ Finding SN_3 and D_3 (Sub base Course) and also layer Co-efficient a_3 and drainage Co-efficient M_2 from their respective table.

$$D_3 = (SN_3 - SN_2) / 9\,SM_2$$

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

$D_3 = 5.24''$

We will use 6" as a ~~base~~ Sub base

$SN_3 = 2.64 + 1.321 + 6'' \times 0.10 \times 0.80$

$SN_3 = 4.46$ 74.4 OKey.

Final Design :→

⇒ Surface Course = 6"

⇒ Base Course = 12"

⇒ Sub base = 6"

⇒ Total pavement thickness = 24"