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Subject transportation 2

Q1 PART (a)

a: What is the difference between flexible and rigid pavement?

ANS :

FLEXIBLEPAVEMENT

1. Grain to grain load transfer
2. Initial cost is low
3.Joints are not required
4.Durability is less
5.Good subgrade is required
6.Temperature variation has no effect on the stress variation
7.Life span is short i.e: 15 years
8.Repair work is easy
9.Maintenance cost is high
10.Requires less curing time
11.Poor night visibility due to use of
Bitumen
12.No glare due to sunlight
13.Easy to locate the underground
Works like pipe location e.t.c
14.Thickness is more
15.Design depends upon the subgrade strength
16.Stability depends upon the aggregate
interlocking, particle friction and cohesion
17.IRC 37

RIGID PAVEMENT

1.Slab action takes place

2.Initial cost is high

3.Joints are required

4.Durability is high

5.Good subgrade is not required

6.Temperature variation effect the stres variation

7.Long life span~30 years

8.Repair work is tough

9.Maintenance cost is low

10.Requires much curing time

11.Good night visibility

12.High glare due to sunlight

13.Difficult to do the underground works

14.Thickness is less

15.Design not depends on subgrade

16.Stability depends upon the joints between the slab of concrete

17.IRC 58

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

1. The main advantage of wet-mix macadam over water-bound macadam is that it is composed of a **well-graded mixture**. This ensures good interlock and high stability.

2. Addition of water while mixing facilitates the handling of the mixture. The **operation of laying is much simpler** than that of water-bound macadam, where the screenings and binding material have to be added in stages and forced into voids. If a crusher-run material is used, there is no possibility of plastic fines entering into the mixture.
3. The **compaction is greatly facilitated by the moisture** added which lubricates the individual particles.

c: What is the difference between asphalt and bitumen?

ANS:

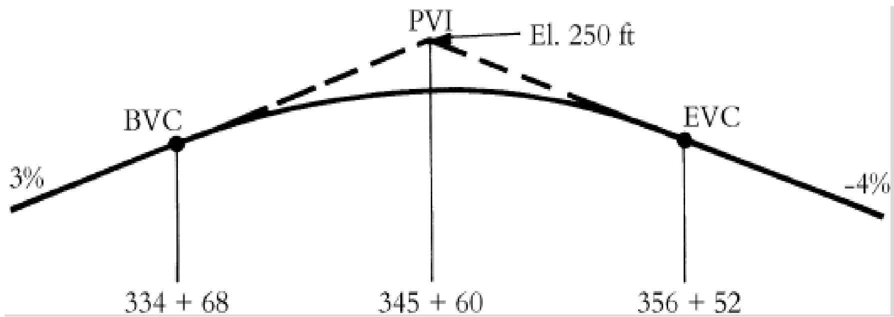
Bitumen is actualy the liqued binder that hold asphalt together.

Asphalt as used as a term to refer to combination of bitumen and gravel specifically for road construction .

Bitumen is known for being strongly adhesive and resistant to damage from water and oil spills , this make bitumen the ideal binder for asphalt becouse asphalt is commonly used as a surface for road, car parks, streets etc.

Q2:

A crest vertical curve joining a +3 percent and a -4 percent grade is to be designed for 75 mi/h. If the tangents intersect at station (345+60.00) at an elevation of 250 ft, determine the stations and elevations of the BVC and EVC. Also, calculate the elevations of intermediate points on the curve at the whole stations.



Solution

As we that :

For a design speed of 75 mi/h , k = 312 (frm table)

Minimum length = 312 *[3-(-4)] = 2184 ft

Station of BVC = 345 + 60)-(21+84 /2) =334 + 68

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

Elevation of BVC = 250 –(0.03 x 2184/2) = 217.24 ft

The reminder of the computation is efficency done using formate show in table :

station	Distance from bvc(x) ft	Tangent elevation (ft)	Offset [r= ax^2\200L] (FT)	Curve elevation(tangent elevation offset)
Bvc 334+68	0	217.24	0.01	217.24
Bvc 335+00	32	217.24+32/100x3 = 21820	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	238.20	8.59	230.61
Bvc 343+00	832	242.2-	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
Evc	2184	282.76	76.44	206.32

Q=3

A Flexible highway is to be designed to carry a design ESAL of 2×10ˆ6. It is estimated that it takes about a week for water to be drained from within the pavement and the pavement structure will be exposed to moisture levels approaching saturation for 30% of the time. The following additional information is available:

- **Resilient modulus of asphalt concrete at 68°F 450,000 lb/in2**
- **CBR value of base course material 100, Mr 31,000 lb/in2**
- **CBR value of subbase course material 22, Mr 13,500 lb/in2**
- **CBR value of subgrade material 6**

Mr of subgrade 6×1500 lb/in2 = 9000 lb/in2

Answer:

Step#01:- draw a joining the reliability level of 99% and the overall standard deviation so of 0.49 and extend line to insert the first TL line at point A

Step#02:- draw a line joining point A to the ESAL of 2*10^6 and extend tis 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 tis line to intersect the design serviceability loss cart at point C

Step#04;- draw a horizontal line from point C to intersect the design serviceability

Loss (psi) curve at point D so ere

PSI= 4.5- 2.5=2

Step#05:- the structure number require to protect the base course and find the thickness D1 of the surface course is 2.6

Step#06:- determine the appropriate structure layer co-efficient for each construction material resilient value of asphalt = 450000 lb./in2

Therefore a1 0.44

D1= SN1/a1

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

SN1=D1*a1

=6*0.44=2.64

Now find SN2 and D2 (base course) find the value of a2 from layers coefficient table and m2 from drain coefficient

Thickness of base course is D2

D2= (SN1-SN2)/a2m2

D2=(38-2.69)/14*0.80

D2=10.36inc

Use 12 inch

So the thickness of base course is 12 inch

SN2= 0.14*0.80*12+SN1

SN2= 3.98

Finding SN3 and D3 (sub base course) and also layer coefficient a3 and drainage coefficient m2 from their respective table.

D3= (SN1-SN2)/a3 m3

D3= (4.4-3.98)/ 0.10*0.80

D3= 5.24 inch

We will use 6 inch as a sub base

SN3=2.64+1.34+6*0.10*0.80

SN3= 4.46 >44 okay

Final design:-

Surface course= 6 inch

Base course= 12inc

Sub base= 6 inch

Total pavement thickness =24 inch

Q=4

What are the different pavement distresses? Explain in detail?

ANS:

Following are different pavement distresses

1.Alligator Cracking:-

-Possible causes:

- over loading
- Inadequate structural design
- Poor construction

-Repair:

- Crack sealing is ineffective
- Digout and replace area of poor subgrade

2.Block Cracking:-

-Problem:Allows moisture infiltration

-Possible causes:

- HMA 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 cracks(>1/2 inch wide){crack with raveled edges}Remove and replace the cracks pavement layer on overlay

3.Potholes:-

- Small bowl shaped depressionsin the pavement surface that penetrate all the way through the HMA layer down to the base course
- Potholesare mostly likely to occurs on road within the thin HMA surface and seldom occur with 4 inch or deeper HMA surfaces

-Problem:roughness,moisture,infiltration

-Problem causes:- Generally ,potholes are the end result of fatigue cracking .As fatigues cracking becomes severs,the interconnected cracks creates small chunks of pavement, which can be dislodged as vehicles drive over them

Repair:-Paching techniques

4.Rutting:-

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

Possible Causes:-

- Insufficent compaction of HMLA layer during construction
- Subgrade rutting e.g a result of adequate pavement structure
- Improper mix design

  Repair:
  Slight ruts can generally be left untreated.Pavement with deeper ruts should be leveled and overlayed.
  5)Bleeding:

Problem

Loss of skid resistance when wet

Possible causes

- Excessive asphalt binder in HMA
- Excessive application of asphalt binder during BST
- Low HMA air void content

6)Polished aggegate

Possible causes:

- Repeated traffic application .this can occur quicker if the aggregte is suspictable to abrashion.
  Repair :
  Apply a slcid resistance slurry seal .BST of non structural overlay.
  7)Reveling
  Loose debris on the pavement which increase pavement roughness and loss of slcid resistance
  Possible cause:
- Asphalt binden aging
- Aggregate segregation
- Inedaquate compaction during construction
  Repair :
  Fog seal or remove the damaged pavement and overlay.