Name : M. ABBAS

IDNO: 7852

SEC : B

Transportation - II

Semester 6th

Scanned with CamScanner

QNo1 Part (a)

What is the difference b/w flexible and Rigid Pavement.

ANSWER:

Flexible Pavement	Rigid Pavement
1 Bitumen is used as binder in flexible Pavement	1- Cement is used as a binder in rigid Pavement.
2. Load is transferred by grain to grain contact	2- No such phenomena of grain to grain load transfer exists.
3- Have life span of 10-15 years	3- Life span is more as compare to flexible usually 30+ years.
4. Road can be used for traffic within 24 hours	4- Road can't be used untill 14 days of curing

Scanned with CamScanner

Q No 1(b)

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

ANSWER:

ADVANTAGES OF WATER BOUND OVER WET MIX MACADAM:-

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

2- The compaction is greatly facilitated by moisture added which lubricates the individual particles

3- The aggregate for wet mix macadam will have to be crusher run, whereas the aggregates for water bound macadam are generally hand broken.

Scanned with CamScanner

Q No 1 (c)

What is the difference between asphalt and bitumen?

ANSWER:

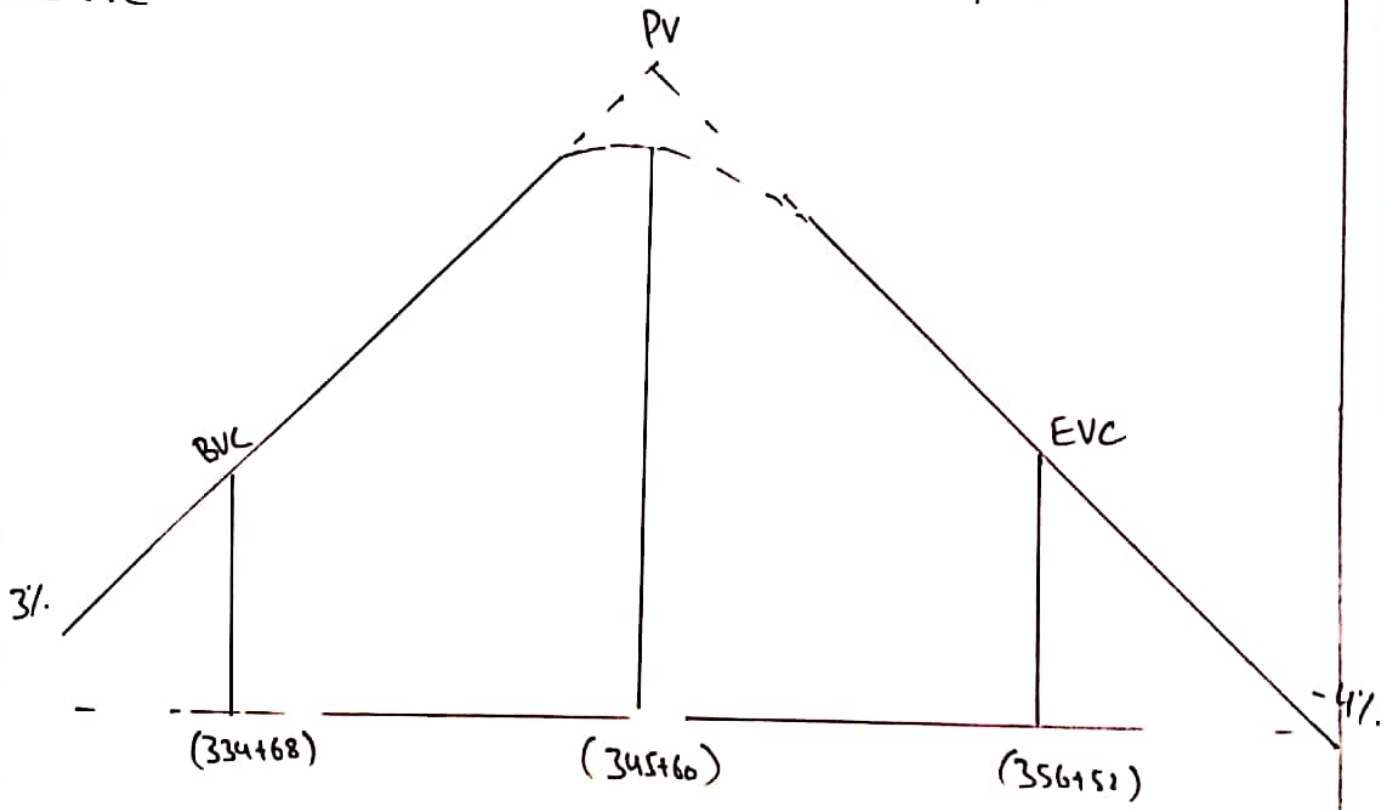
DIFFERENCE BETWEEN ASPHALT AND BITUMEN:

BITUMEN	ASPHALT:
1- A Class of black or dark colored (solid, semi solid or viscous) cementitious substance natural or manufactured, composed of highly molecular weight	1- A dark Brown to black cementitious material in which predomi-nating constituent are bitumen which occur in nature or obtained by frictional distillation
In American Terminology both asphalt and bitumen are same.	
2- In some literature Bitumen is actually the liquid binder that hold asphalt together	2- Asphalt is generally used as term refer to the combination and gravel specifically for road construction.

Scanned with CamScanner

Q No 2

A Crest Verticle curve joining +3 percent and a -4 percent grade is to be designed for 75 mi/h. If the tangent (345+60.00) at an elevation 250ft. determine the station and elevation of the BVC. Also calculate intermediate point on curve



Solution

For design speed of 75 mil/h value of k from table

$$K = 312$$

Scanned with CamScanner

Minimum Length = $K \times (3 - (-4))$

$= 312 \times (3 - (-4))$ $\quad K = 312$

$= 2184 ft$

Station of BVC = Tangent intersection station $- \left(\frac{21+84}{2}\right)$

$\because$ tangent intersection Station $= (345+60)$

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

$= 217.24 ft$

Scanned with CamScanner

Q No 3

A flexible pavement for an urban interstate highway is to be designed using 1993 - -

- - - - - - - - -

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 Sub base coarse material 22, Mr 13,500 lb/in²
- CBR value of Subgrade material 6
- Mr of subgrade 6x15,000 lb/in² = 9000 lb/in²

Flexible Pavement Design:

- Reliability level (R) = 99%.
- Standard deviation $S_o = 0.49$
- Initial Serviceability Index, $P_i = 4.5$

Terminal Serviceability Index, $P_t = 2.5$

$\Delta PSI = 4.5 - 2.5 = 2.0$

Step: 1

Draw a line joining the reliability level of 99% and the overall standard deviation S_o of 0.49, and extend this line to intersect the first TL at point A.

Find Value of SN_1 and D_1:

Step: 02

Draw a line joining point A to the ESAL 2×10^6, and the this line to intersect the Second TL line at point B.

Step: 03

Draw a line joining point B and resilient modulus (M_r) of base course and extend this line to intersect the design Servicability loss chart at point C

Step: 04

Draw a horizontal line from point C to intersect the design Serviceab.

Loss (PSI) curve at point D,

$$\Delta PSi = P_i - P_t = 4.5 - 2.5 = 2.0$$

Scanned with CamScanner

Step: 05

So the structure number required to protect the base course and to find the thickness DI, of surface course is 2.6.

Step: 06

Determine the appropriate structure layer coefficient for each construction material. Resilient value of asphalt = 450,000 lb/in², therefore $a_1 = 0.44$

Scanned with CamScanner

Thickness of Surface Coarse D_1:

$$D_1 = SN_1 / a_1$$

$\because SN_1 = 2.6$

$a_1 = 0.44$

$$= \frac{2.6}{0.4}$$

$$= 5.9''$$

Thickness should be taken to the nearest 0.5 inch

So, thickness of surface Coarse is 6"

$$SN_1 = D_1'' \times a_1$$

$$= 6 \times 0.44$$

$$SN_1 = 2.64$$

Scanned with CamScanner

Finding SN_2 and D_2 (Base Course)

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

$\because SN_2$ from table $= 3.8$

$\because a_2 = 0.14$

$\because m_2 = 0.80$

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

$$D_2 = 10.36''$$

Use $12''$

So thickness of base course $12''$

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

$$SN_2 = 1.34 + 2.64$$

$$= 3.98$$

Finding SN_3 and D_3

$\because SN_3 = 4.4$

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

$\because a_3 = 0.10$

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

$\because m_3 = 0.80$

Scanned with CamScanner

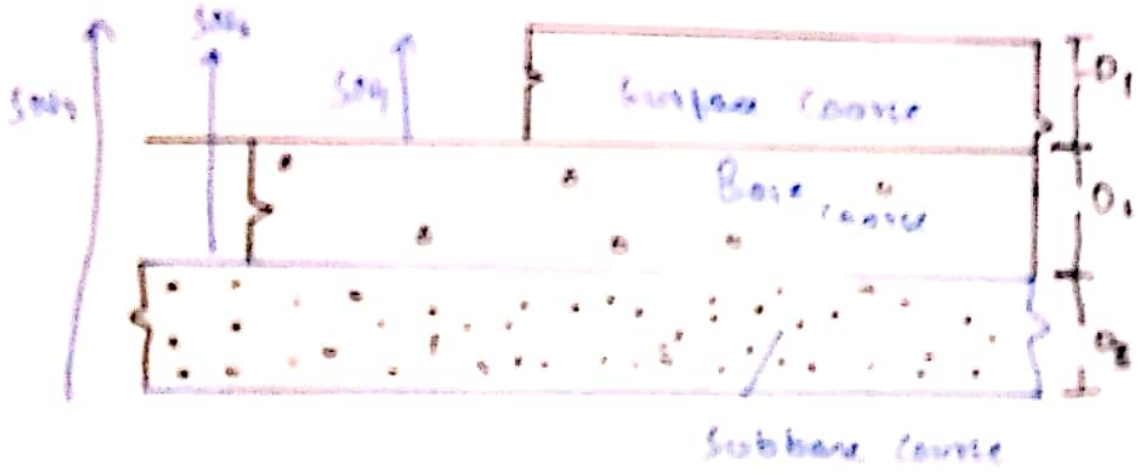
$D_3 = 5.25"$

We will use 6" as sub base

$SN_1 = 2.64 \times 1.34 \times 6" \times 0.10 \times 0.80$

$SN_2 = 4.46 > 4.44$ okay

Final Design.



Scanned with CamScanner

AASHTO DESIGN EQUATION FOR SN

$$\log_{10} W_{18} = Z_R S_o + 9.36 \log_{10}[SN+1] - 0.20 + \frac{\log_{10}[\Delta PSI / 4.2 - 1.5]}{0.40 + [1094/(SN+1)^{5.19}]} + 2.32 \log_{10} M_R - 8.07$$

QNO(4)

What are different Pavement distress? Explain in detail.

ANSWER:

PAVEMENT DISTRESS:

Distress is a condition of the pavement structure that reduces serviceability or lead to reduction in service life

Distress in pave occur due to

- Unstable mixes
- Higher wheel loads than those considered in design.

Aligator Cracking:

> Cause:

Overloading
Inadequate structure

Repair:

- crack sealing is in effective
- Dig out and replace poor area.

Scanned with CamScanner

BLOCK CRACKING:

Problem: Allow moisture infiltration

Possible Cause:

- HMA Shrinkage
- Asphalt binder aging

Repair

Low severity crack (< 1/2 inch wide). Crack seal to Prevent entry of moisture

High Severity crack (> 1/2 inch wide) and crack with revealed edges.

Remove and replace the cracked pavement layer with an overlay.

POTHOLES:

- Small bowl-shaped depression in the pavement surface that penetrates all the way through HMA layer down to the base course.
- Potholes are most likely to occur on road with the HMA surface (1 to 2 inch) and seldom occur on road with 4 inch or deeper. HMA surfaces.

Scanned with CamScanner

Repair:

Patching techniques

Rutting:

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

⇒ Surface depression in the wheel path, are Particularly evident after a rain when they are filled with water.

Possible Cause

- In sufficient compaction of HMA layer during construction.
- Improper mix design (e.g as a result of inadequate Pavement structure
- Subgrade rutting (as a result of inadequate Pavement structure)

Repair:

Slight ruts (< 1/3 inch deep) can generally be left untreated

Scanned with CamScanner

Bleeding:

Problem:

Loss of skid resistance when wet.

Possible Cause:

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

Raveling:

- Loose debris on the pavement which increase pavement roughness and loss of skid resistance

Possible Cause:

- Asphalt binder aging
- Inadvuate compaction during construction.

Repair:

Fog Seal/ Slurry Seal or Remove the damaged Pavement overlay.

Scanned with CamScanner