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Section	'A'
Subject	Highway and Traffic

age 1 | Q1. Name Shohaib maloor
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Section A.

Q1c | What is the difference between flexible and rigid pavement.

Flexible pavement:.

1) Bitumen is used a binder in flexible pavement.
2) Deformation in the subgrade is tranferred by to the upper layers.
3) load is transferred by grain to grain contact.
4) Flexible pavement have low initial construction costs but have high manintance cost.
5) have Low life Span usually 10-15 years
6) Surfacing cannot be laid directly on the sub grade but a sub base is needed needed.
7) In flexible pavement Strength of road highly dependent on strength of sub grade
8) Road can be used for traffic whin 24 hours.
9) Grain to grain load trafer
10) initial cost is low.
11) Joints are not required.

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Rigid pavement :.

1) Cement is used as a binder in rigid pavement.
2) Deformation in the Sub grad is not transferred Subsequent layers.
3) Rigid Pavement have low maintences cost but have high initial construction costs.
4) Life Span is more compare to flexible usually 30+ years.
5) Surfaceing can be directly laid on the Sub grade.
6) Strength of road less dependent on Strength of Subgrad in rigid pavement
7) Road connot be used until 14 day of curing.
8) Slab action takes place
9) initial cost is high
10) Durability is high
11) good Subgrad is not required.
12) Temperature variation effect the Stress variation.

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section A

1b What are the advatages of water bound over wet mix macadam?

Ans: Advatages of W.B.M over W.M.M

1) The water bound macadam construction of base course is less costly than the wet mix macadam as its Specification do not involve the use of mixing plant and power

2) water bound macadam requires more time fore Construction.

3) wet mix macadam road are Superior the water bound macadam in all aspects but the WBM is the old methed. of construction having low construction cost because it has been traditionally a labour oriented Specification.

4) Water bound is cheaper than wet mix macadam because of the Specification involves the use of.

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Q1c What is the difference between asphalt and bitumen.

Ans Asphalt:- Asphalt is mosture of Bitumen and coarse & fine aggregate.

2- Asphalt is a strong cement that is reading adhasive and highly water proof and durable making it particularly usueful in road construction.

3- It is applied through a paving machine on site as a solid material at required thickness relative to and more durable surface than a bitumen sealed road.

Bitumen

1) Bitumen is one of the derivatives of oil in black and pasty from which has many application in asphat road construction insulation and roof water proofing.

pages

Q1 c)

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1- Bitumen is actually the liquid binder that holds Asphalt together

2- A Bitumen sealed road has a layer of bitumen sprayed.

3- Bitumen is by product obtained from fractional Distillation of Crude oil.

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page6 | ①2 Name Shoaib Maroof
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Q2:: Solution:-

For a design speed of 75 mi/h
= 312 from

minimum length = 312 × (3 − (−4)] = 2184 ft

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

Station of EVC = (334 + 68) + (21 + 84)
= 386 + 52

Elevation of BVC = 250 − (0.03 × $\frac{2184}{2}$)
= 217.24 ft.

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Q2 Section A

Station	Distance from BVC (ft)	Tangent elevation (ft)	offset $\left[H = \frac{Ax^2}{200L}\right]$ ft	Curve elevation tangent elevation offset ft.
BVC + 334 + 68	0	212.24	0.01	217.24
BVC + 335 + 00	32	217.24 + 32/100 × 3	0.02	218.18
BVC + 336 + 00	132	= 218.20	0.86	220.92
BVC + 338 + 00	232	221.20	1.77	223.34
BVC + 339 + 00	332	224.20	2.99	225.43
BVC + 340 + 00	432	227.20	4.54	227.21
BVC + 341 + 00	532	230.20	6.40	228.66
BVC + 342 + 00	632	233.20	8.59	229.80
BVC + 343 + 00	732	236.20	11.09	230.61
BVC + 344 + 00	832	239.20	13.92	231.61
BVC + 345 + 00	930	242.20	17.07	231.28
BVC + 346 + 00	1032	245.20	20.54	231.13
BVC + 347 + 00	1132	251.20	24.32	230.66
BVC + 348 + 00	1232	254.20	28.43	229.88
BVC + 349 + 00	1332	260.20	32.86	228.77
BVC + 350 + 00	1432	263.20	37.61	227.34
BVC + 351 + 00	1532	266.20	42.68	225.59
BVC + 352 + 00	1632	269.20	48.07	223.52
BVC + 353 + 00	1732	272.20	53.79	221.13
BVC + 354 + 00	1832	275.20	60.17	218.41
BVC + 355 + 00	1932	278.20	66.17	215.38
BVC + 356 + 00	2032	281.20	72.84	212.03
	2132	282.20	76.44	208.36
	2284			206.32

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ye7 | (3) 1

Q No3 A. Flexible highway is to be design to carry a design ESAL of 2×10^{-6} 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 addition information of available.

-> Resilient modulas of asphalt concrete at 68°F 450000 lb/in²

-> CBR value of Sub base course material 22 mr 13500 lb/in²

-> CBR value of Subgrade material 6

-> mr of Subgrade 6 × 1500 lb/in²

-> Reliability Level (R) = 99% = 9001b/in².

-> Standard deviation (So) = 0.49

-> initial Serviceability index $P_i = 4.5$

-> Terminal Serviceability index $P_t = 2.5$

-> A PSi = 4.5 - 2.5 = 2.0

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Step 5:- Resilind value of Asphalt
= 450,000 lb/in²

Therefore a, 0.44

Thicknes of Surface Course D_1

$D_1 = SN_1/a_1$

$26/0.44$

$= 5.9''$

Thickness should be taken to the nearst 0.5

So thecknegs of Surface Coarse is 6"

$SN_1 = D_1 \times a_1$

$SN_1\ 6 \times 0.44 = 2.64.$

Finding SN_2 and D_2 (Base Coarse)

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

$= 38 - 264/0.14 \times 0.80$

$D_2 = 10.36''$

use 12.

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Section A

So thickness of base coarse 12"

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

$SN_2 = 134 + 264$

$SN_2 = 398$

Finding SN_3 and D_3 (subbase 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

$SN_3 = 2.84 + 1.34 + 6" \times 0.10 \times 0.80$

$SN_3 = 4.4674.4$ okey.

Final Design

Surface course = 6"
Base " = 12"
Subbase = 6
Total pavement Thickness = 24"

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Q4 What are the different pavement distresses explain in detail.

Ans Pavement Distresses.

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

→ Distresses could occur in a pavement due to
→ unstable mixes
→ Higher wheel loads than those considered in design.

Block cracking.

→ Problem: Allows moisture infiltration
→ possible cause.
→ HMA Shrinkage
→ Asphalt binder aging
→ poor choice of asphalt binder in the mix design.
→ Repair
→ Low Severity crack (<1/2 ind wide) crack Seal to prevent entry of moisture.

Sqvc.-

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Section A

→ High Severity Crack (>1/2 inch and Crack with ravely ravaled edges Remove and replace the cracked pavement layer with an overlay.

Potholes.

Small bowl-shaped depression in the pavement surface that penetrate all the way through the HMA layer down to the base course.

→ Potholes are most likely to occur on road with thin HMA surface (1 to 2 inches) and seldom occurs on road with 4 inch or deeper HMA surface.

→ Problem:- Roughness (serious vechecular damage can result from driving across potholes at higher speeds moisture infilitration.

→ Possible causes:- generally potholes are the end result of fatigue cracking As fatigue cracking become severe the interconnected cracks.

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Creat Small chunks of pavement which can be dislodged as vehicles drive over them.

Repair patching tecniques.

Rutting:- Surface depression in the wheel path are particularlary evident after a rain when they are filled with water.

-> Surface depression in the wheel path are particalary.

Possible cause:-

-> insufficuent compaction of HMA layery during construction.

-> Subgrad rutting (e.g as a rutting result of inadequate pavaments structure.

-> Improper mix design (e.g excessively high asphalt content excessive mineral filler insufficient amout angular aggregat particals)

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Section A

Repair

Slight ruts (⊘ < 1/3) inch deep) can generally be left untreated pavement with deeper rut should be levelled and overlayed.

Bleeding:

Problem:- loss of skid resistance when wet

Possible cause

→ Excessive asphalt binder in the HMA

→ Excessive application of asphalt binder during BST application

→ Low HMA air void content.

Polished Aggregate.

Polished causes:- Repeat traffic application this can occur quicker if the aggregate is susceptible to abrasion.

Repair; Apply a skid-resistant slurry seal BST or non structural overlay.

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section A.

Raveling:-

Loose debris on the pavement which increases pavement roughness and loss of skid resistance.

Possible causes.

→ Asphalt binder ageing.

→ aggregate segregating if fine particles are missing from the aggregate matrix.

→ Inadequate compaction during construction.

Repair:- Fog Seal or Remove the damaged pavement and overlay.