Final Term

Name: Rizwan ullah khan

ID: 7807

Section: "A"

Subject: Highway & Traffic Engg

Submitted To: Dr. Nadeem anwar.

Name : Rizwan ullah khan ①

ID = 7807

Q:1/a) Difference b/w flexible & Rigid Pavement

① Flexible Pavement:-

⇒ Deformation in the sub grades is transffered to the upper layers.

⇒ Flexible Pavement have low initial Construction Cost but have high maintanance cost.

⇒ Load is transffered by grain to grain contact

⇒ Repair work is easy.

⇒ Have low life span usually 10-15 year.

⇒ Bitumen is used binder in flexible Pavement.

② Rigid Pavement:-

⇒ Cement is used as a binder in rigid Pavement.

⇒ Deformation in the sub grade is not transfered to subsequent layers.

Name = Rizwan ullah khan

ID = 7807

⇒ Rigid pavement have low maintanance cost but have high initial construction cost.

⇒ Life span is more as campare to flexible usually 30 + year.

⇒ Strength of road less dependent on strength of subgrade in rigid pavement.

⇒ Surfacing can be directly laid on the subgrade.

⇒ Repair work is tough.

⇒ Road cannot be used until 14 days.

Name = Rizwan ullah khan
ID : 7807

Q:1 Part B:-

Advantage of water bound over Wet Mix Macadam:-

⇒ The water bound is constructed by ~~Spring~~ spreading loose metal which gives a consolidated thickness of 75-100 mm

⇒ water bound has been traditionally a Labour oriented Specifications.

⇒ Because of carefully graded material water bound is superior in quality and the resulting mass is almost ~~dense~~ void less compacted mass.

⇒ water bound is cheaper then wet mix macadam.

Name : Rizwan ullah khan (4)

ID : 7807

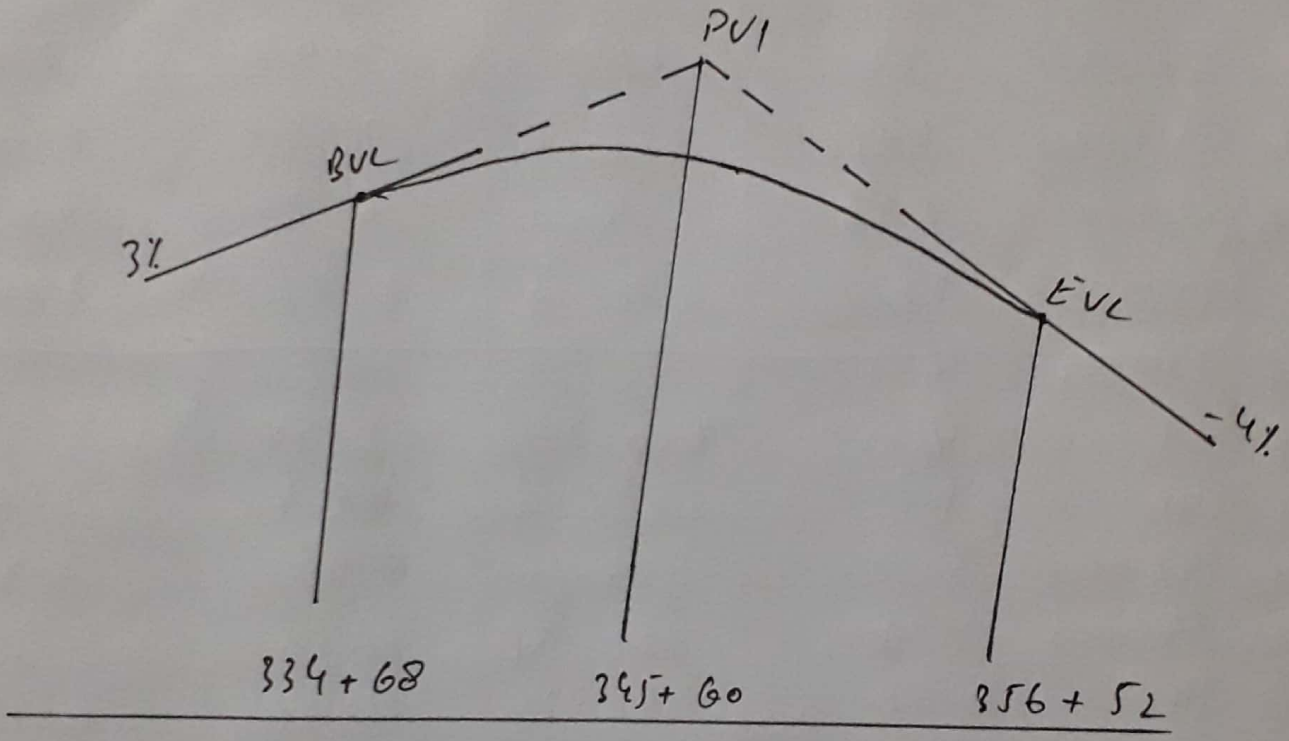
Q:1 Part "C"

Difference b/w Bitumen & Asphalt.

Bitumen	Asphalt.
⇒ Bitumen is actually the liquid binding material that hold asphalt together.	⇒ Asphalt is actually the mixture of Coarse and fine aggregate and Bitumen.
⇒ Bitumen is obtained by partial distillation of Crude oil.	⇒ Asphalt is a strong Cement that is readily adhesive and highly water proof.
⇒ Bitumen sealed road has a layer of bitumen sprayed and then covered with an aggregate.	⇒ It is applied through a paving machine on site as a solid material at required thickness, relative to end use.

Rizwan ullah khan
7807

Q: 021



Solution:-

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

Rizwan ullah khan

7807

Station	Distance from BVC (x) (ft)	Tangent Elevation	Offset $[r = \frac{Ax^2}{2 \times L}]$ ft	Curve Elevation (Tangent Elevation − offset) (ft)
BVC 334+68	0	217.24	0.01	217.24
BVC 335+00	32	218.20	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 338+00~~	432			
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	231.28
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
BVC 356+52	2184	282.76	76.44	206.32

Rizwan ullah khan
7807

Q: 31

Ans :-

Solution :-

Step # 01 :-

Draw a line joining the relaiability level of 99% & the overall standard diviation So of 0.49 and extend line to intersect the first TL at point A.

Step # 02 :-

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

Step # 03 :-

Draw a line joining point B and resilent modulus (M_r) of base course and extend this line to intersect the design Servicibility loss Chart at point C.

Step # 04

Draw a horizontal line from Point C to intersect the design Servicability loss (PSI) Curve at point D. In this Problem

$$\Delta PSI = 4.5 - 2.5 = 2.0$$

⇒ So structure number required to Protect the base course and to find the thickness D_1 of the Surface course is 2.6.

Step # 05:-

Determine the appropriate structure Layer co-effecient for each construction material. Risilient value of Asphalt = 450,000 lb/in² therefore a = 0.44.

Thickness of Surface Curve (D_1):

By formula $D_1 = SN_1 / a_1$

$2.6 / 0.44 = 5.9'' \approx 6''$

As thickness should be taken to nearset 0.5"
So the thickness of the surface course is 6"

$$SN_1 = D_1 \times a_1$$
$$= 6 \times 0.44$$
$$\boxed{SN_1^* = 2.64}$$

Thickness of Base Course (D_2) :-

We know that

$$D_2 = \frac{(SN_2 - SN_1^*)}{a_2 m_2}$$

$$= \frac{(3.8 - 2.64)}{0.14 \times 0.80} = \boxed{D_2 = 10.36"}$$

Rounding D_2 to nearest whole number, ie, 12".

So thickness is 12".

$$SN_2^* = 0.14 \times 0.80 \times 12 + SN_1^*$$
$$= 1.34 + 2.64$$
$$\boxed{SN_2^* = 3.98}$$

Rizwan ullah khan

7807

Thickness of Sub base Course :- (D_3) :-

$$\Rightarrow D_3 = \frac{(SN_3 - SN_2^*)}{a_3 m_3} = \frac{4.4 - 3.98}{0.10 \times 0.80}$$

$$\boxed{D_3 = 5.25} \Rightarrow \boxed{D_3 = 6''}$$

$$\Rightarrow SN_3^* = 2.64 + 1.34 + 6'' \times 0.10 \times 1.80$$

$$\boxed{SN_3^* = 4.46}$$

Now $4.46 > 4.4$ So 9ts OK!

Final Design :-

⇒ Surface Course = 6"

⇒ Base Course = 12"

⇒ Sub base = 6"

So

Total Pavement Thickness is 24" Ans.

Rizwan ullah khan
7807

Q No: 41:-

Different Pavement Distresses:-

Pavement Distresses:-

Distress is a Condition of the Pavement Structure that reduces serviciability or leads to a reduction in Service Life.

Distress could occure in a pavement due to:

* = Unstable mixes
* Higher wheel loads than those considered in design.

⇒ Alligator (Fatigue) Cracking:-

- Possible Causes:-

⇒ Overloading
→ Inadequate structural design
→ Poor Construction.

- Repair:-
  - → Crack Sealing is in effective
  - → Dig out and replace area of poor Subgrade.

⇒ Block Cracking:-

- Problem:- Allows moisture infilteration
- Possible causes:-
  - → HMA Shrinkage
  - → Asphalt binder aging
  - → Poor choice of asphalt binder in mix design
- Repair:-
  - → Low Severity Cracks ($< 1/2$ inch wide). Crack Seal to prevent entry of moisture.
  - → High Severity cracks ($> 1/2$ inch wide and Cracks 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 ~~to~~ course.

Causes :-

Generally, Potholes are the end result of fatigue Cracking. As fatigue Cracking becomes Severe, the interconnected Crackes Creat Small Chunks of Pavement, which Can be dislodged as vehicals drive over them.

Repair :-

Patching techniques.

⇒ Rutting :-

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

Causes :-

⇒ Insufficient Compaction of HMA layers during Construction.

→ Improper mix design.

→ Subgrade rutting.

Repairs :-

→ Slight ruts (< 1/3 inch deep) Can generally be left untreated.

Rizwan ullah khan
7807

⇒ Bleeding :-

Causes :-

→ Excessive asphalt binder in the HMA.
→ Excessive application of asphalt binder during BST application.
→ Low HMA air voids content.

⇒ Polished aggregate.

Causes :-

→ Repeated traffic application. This can occur quiker if the aggregate is susceptible to abrasion.

Repaire :-

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

⇒ Raveling :-

Causes :-

→ Asphalt binder aging
→ Aggregat Segregation.
→ Inadequate Compaction during Construction.

Repair :-

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