Homework # 6

ASSHO Method

Assume SN = 4.0 given P_t = 2.5

Axle Load (Kips)	Single Axle			Tandem Axle		
	Repletion (N)	EWLF (F)	F*N	Repletion (N)	EWLF (F)	F*N
2	249	0.0003	0.07			
6	525	0.02	10.50			
10	1051	0.12	126.12			
14	249	0.40	99.60			
18	182	1.00	182.00			
20	140	1.49	208.60			
22	90	2.17	195.30			
26	10	4.31	43.10			
10				156	0.01	1.56
16				168	0.07	11.76
22				177	0.23	40.71
28				292	0.55	160.60
32				103	0.89	91.67
34				111	1.11	123.21
38				21	1.69	35.49
42				4	2.49	9.96
Total			865.29			474.96

EAL_o = 865.29 + 474.96 = 1340.25 Axle/day

$$\sum_0^n EAL = \frac{EAL_o(365)}{\log_e(1+i)}\left[(1+i)^n - 1\right]$$

$$\sum EAL = \frac{1340.25 * 365}{0.04879}\left[(1.05)^{10} - 1\right] = 6{,}305{,}569.04$$

Total EAL_{10} for Pavement design lane = $0.6*0.6*6.31*10^6 = 2.3*10^6$

Assume: R = 95%, S_o = 4.5, P_o = 5.0, a and no loss due to forest

Then: ΔPSI = 5.0 – 2.5 = 2.5

Assume that bituminous treated layers will be used, therefore, for the three layers we can found M_R from Marshall Stability from Fig. 2.9. as follow:

Layer	Marshall Stability (lbs)	M_R (psi)
Wearing Course	1900	$4.4*10^5$
Base	1400	$3.0*10^5$
Subbase	1000	$1.9*10^5$

From figure 2.5 $\Rightarrow a_1 = 0.43$

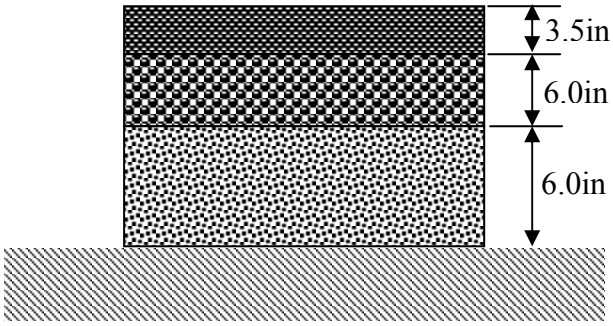
From figure 2.9 $\Rightarrow a_2 = 0.26$

From figure 2.5 $\Rightarrow a_3 = 0.19$

Subgrade M_R = 15000 psi $\Rightarrow SN = 3.0$ (fig. 3.1)

Assume D_{WC} = 3.5in (The Minimum), D_{base} = 6.0in (The Minimum), $D_{subbase}$ = 5.0in

Therefore $\Rightarrow SN = 3.5 * 0.43 + 6.0 * 0.26 + 6.0 * 0.19 = 4.21$



MOC Method

By calculating EWLF from fig. 1.09.2, the following table was obtained:

Axle Load (Ton)	Single Axle			Tandem Axle		
	Repletion (N)	EWLF (F)	F*N	Repletion (N)	EWLF (F)	F*N
0.9	249	0.0000	0.00			
2.7	525	0.03	15.75			
4.5	1051	0.09	94.59			
6.4	249	0.52	129.48			
8.2	182	1.10	200.20			
9.1	140	1.40	196.00			
10.0	90	2.24	201.60			
11.8	10	4.32	43.20			
4.5				156	0.01	1.56
7.3				168	0.04	5.88
10.0				177	0.18	31.86
12.7				292	0.43	125.56
14.5				103	0.81	83.43
15.4				111	1.10	122.10
17.2				21	1.50	31.50
19.1				4	2.20	8.80
Total			880.82			410.69

EAL_o = 880.82+410.69 = 1291.51

$$\text{G.F.} = \left(1+\frac{AG}{100}\right)^{10} = (1.05)^{10} = 1.63$$

$EAL_{10} = EAL_o * G.F = 1291.51*1.63 = 2103.73$

Total EAL_{10} =

$$\left(\frac{EAL_0 + EAL_{10}}{2}\right) * n * 365 = \frac{1291.51 + 2103.73}{2} * 10 * 365 = 6{,}196{,}319.75$$

Total EAL_{10} for Pavement design lane = $0.6*0.6*6.2*10^6 = 2.2*10^6$

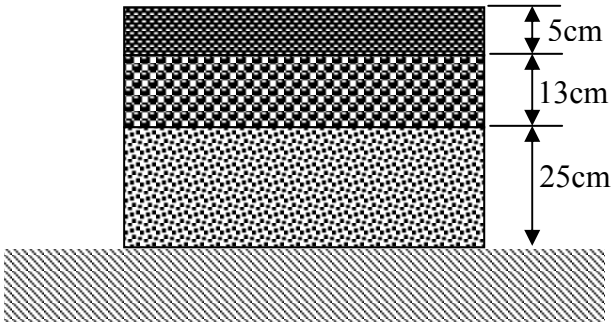
$M_R = 1500*CBR \Rightarrow$ CBR for the Subgrade = 15000/1500 = 10

Minimum cover depth require = 43 cm (from fig. 1.09.8)

Form Figure 1.09.5

AC base course thickness = 12.5 cm

Therefore, we can use 5cm AC surface + 13 cm AC base + 25 cm crushed aggregate subase. The total cover is 43 cm. OK.



Asphalt Institute method

From Table IV - 4

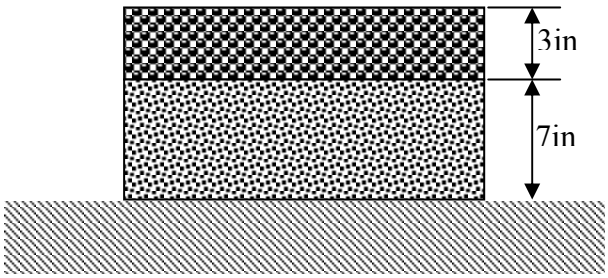
Axle Load (lb)	Single Axle			Tandem Axle		
	Repletion (N)	EWLF (F)	F*N	Repletion (N)	EWLF (F)	F*N
2000	249	0.0002	0.04			
6000	525	0.01	5.48			
10000	1051	0.09	92.17			
14000	249	0.36	89.64			
18000	182	1.00	182.00			
20000	140	1.51	211.40			
22000	90	2.18	196.20			
26000	10	4.09	40.90			
10000				156	0.00688	1.07
16000				168	0.05	7.93
22000				177	0.18	31.86
28000				292	0.50	144.54
32000				103	0.86	88.27
34000				111	1.10	121.55
38000				21	1.70	35.70
42000				4	2.51	10.04
Total			817.83			440.96

$EAL_o = 817.83 + 440.96 = 1258.78$

$$\sum EAL = \frac{1258.78 * 365}{0.04879}\left[(1.05)^{10} - 1\right] = 5{,}922{,}291.33$$

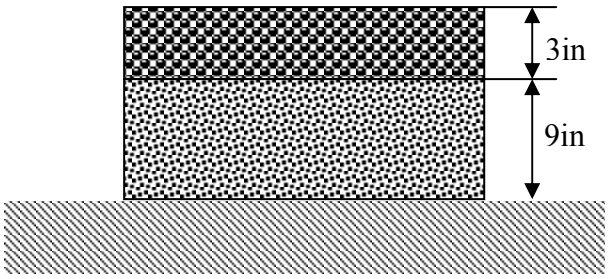
Total EAL_{10} for Pavement design lane = $0.6*0.6*5.92*10^6 = 2.1*10^6$

From Chart VI-11:
Full depth asphalt concrete = 9in
Assume AC surface = 3in (Minimum, Table VI-2)
Therefore, AC base = 6 in



From Chart VI-13:
Thickness of the asphalt surface and type II base = 11in

Assume AC surface = 3 in
Therefore, Emulsified asphalt base = 9in



From design chart VI-16
Thickness of asphalt surface and base = 9in
Plus 6.0in Granular Base