CE 441

DESIGN OF PAVEMENT

Fall 2002-2003

HOMEWORK # 6

DESIGN OF FLEXIBLE PAVEMENTS

Note: Assume any data needed and justify your assumptions

1) It is required to design a six-lane flexible highway pavement in a rural area. The primary investigation showed that an effective M_r or the subgrade soil is 15000 psi. Granular materials available in the area are good quality crushed stone aggregates.

   Mix Design for Asphaltic Materials gives Marshall stability of 1900 lbs for wearing courses, 1400 lbs for bases and 1000 lbs for subbases. The traffic summary is shown below:

	Single Axle		Tandem Axle	
Axle Load (kips)	No. Axles/day		Axle Load (kips)	No. Axles/day
2	249		10	156
6	525		16	168
10	1051		22	177
14	249		28	292
18	182		32	103
20	140		34	111
22	90		38	21
26	10		42	4

The directional split is 40-60 and lane split is 20-20-60%. Assume annual growth of 5% in traffic, and pavement is to be designed for 10 years.

A. Design the cross-section of the pavement using

   1) AASHO method (for P_t = 2.5, R = 1.5)
   2) The asphalt Institute Design method (Design two alternatives)
   3) MOC — Design method
   4) California method of design (CBR = 10)

B. Sketch your designs and check your design using limiting strain criteria for fatigue and rutting. (You may use BISAR Program to calculate your strains values assuming the standard 18-kips axle load for all alternatives). Compare your results to the limiting values suggested in Tables 15.5 and 15.6 of the textbook and state if your designs are safe or not.

2) A. A flexible taxiway for air carrier operations is to be designed by
    FAA procedures for 5000 annual equivalent departures of the design
    aircraft. The aircraft has a dual-wheel configuration having a main
    gear tire load of 40,000 pounds (per wheel), P_t = 160 psi, and a
    30 inch c-c spacing. The proposed subgrade is typified by a
    weathered soil profile having an 18-inch "B" horizon (E-9) overlying
    the parent material (E-6). Determine the flexible-pavement structure
    assuming unbound base and subbase may be used. Frost is no problem.

   B. A Full-Depth asphalt airfield pavement is to be analyzed for fatigue
    distress. The pavement thickness is 20 inches with a subgrade modulus
    of 7500 psi. If the design aircraft is the Asphalt Institute standard
    358,000 pound DC-8-63F and the mean annual air temperature is 60°F,
    determine the number of repetitions to failure by:

    a. The Asphalt Institute design curves;

    b. For the same no. of repetitions how much the thickness should
       be for rutting distress?