

**CEEN 174 - Pavement Design  
Homework No. 3 – Fall 2007  
Due Tuesday, October 23, 2006**

The load-induced responses of various flexible pavement systems will be investigated through the use of the supplied computer program KENLAYER and the estimated fatigue damage consumption will be calculated.

Using the KENLAYER program, compute the maximum surface deflection and critical tensile strain at the bottom of the HMA layer and the critical vertical compressive strain at the top of the subgrade layer for the pavement conditions shown in Table 1. The granular base and fine-grained subgrade layers will be treated as stress-dependent materials using parameters as shown. After completion of your KENLAYER runs, compute the total fatigue damage in the HMA layer and subgrade layer using equations 3.6 and 3.7 in your text (equation constants recommended by the Asphalt Institute) resulting from the passage of 1 million Class 9 trucks, each with the axle weights/configurations listed in Table 2.

To maintain consistency between all student runs, the following input parameters should be used:

$\mu = 0.35$  for HMA,  $\mu = 0.40$  for base, and  $\mu = 0.45$  for subgrade

For base layer,  $M_r = k_1 \theta^{k_2}$ ;  $k_2 = 2.577 - 0.55 \text{ Log } k_1$

Stress point in base 3.0 inches below top of base

Stress point in subgrade 0.1 inches below top of subgrade

Total Subgrade Thickness = 240 inches

Rigid Bottom Layer:  $E=1 \times 10^6$  psi,  $\mu=0.15$

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**Table 1: Pavement Properties for KENLAYER Analysis**

<b>Student Name</b>	<b>HMA Thickness/Modulus</b>	<b>Base Thickness/Modulus</b>	<b>Subgrade Type</b>
C. Dunlap	H <sub>1</sub> = 6 in, E <sub>1</sub> = 400 ksi	H <sub>2</sub> = 10 in, K <sub>1</sub> = 4 ksi	Very Soft
J. Griffin	H <sub>1</sub> = 6 in, E <sub>1</sub> = 400 ksi	H <sub>2</sub> = 10 in, K <sub>1</sub> = 4 ksi	Soft
D. Krueger	H <sub>1</sub> = 6 in, E <sub>1</sub> = 400 ksi	H <sub>2</sub> = 10 in, K <sub>1</sub> = 4 ksi	Medium
B. Kuhn	H <sub>1</sub> = 6 in, E <sub>1</sub> = 400 ksi	H <sub>2</sub> = 10 in, K <sub>1</sub> = 4 ksi	Stiff
M. Long	H <sub>1</sub> = 6 in, E <sub>1</sub> = 400 ksi	H <sub>2</sub> = 10 in, K <sub>1</sub> = 8 ksi	Very Soft
D. Mostyn	H <sub>1</sub> = 6 in, E <sub>1</sub> = 400 ksi	H <sub>2</sub> = 10 in, K <sub>1</sub> = 8 ksi	Soft
D. Murphy	H <sub>1</sub> = 6 in, E <sub>1</sub> = 400 ksi	H <sub>2</sub> = 10 in, K <sub>1</sub> = 8 ksi	Medium
A. Sharma	H <sub>1</sub> = 6 in, E <sub>1</sub> = 400 ksi	H <sub>2</sub> = 10 in, K <sub>1</sub> = 8 ksi	Stiff

**Table 2: Class 9 Truck Axle Load/Configuration Data**

<b>Axle Type</b>	<b>% of Total</b>	<b>Axle Load kips</b>	<b>Inflation Pressure psi</b>	<b>Dual Spacing inch</b>	<b>Tandem Spacing in</b>
Single	40	10	105	n.a.	n.a.
	55	12			
	5	16			
Dual-Tandem	35	30	90	18	48
	55	34			
	10	40			