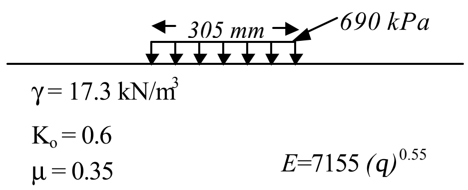
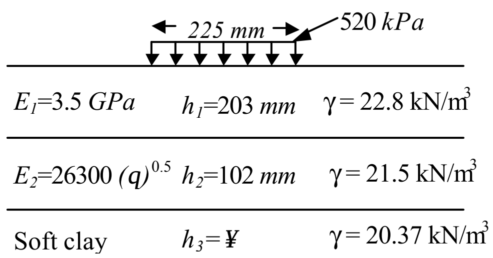
Assignment Sheet 3

1. Solve problems in assignments sheets 1 & 2 using KENLAYER program and compare the results.

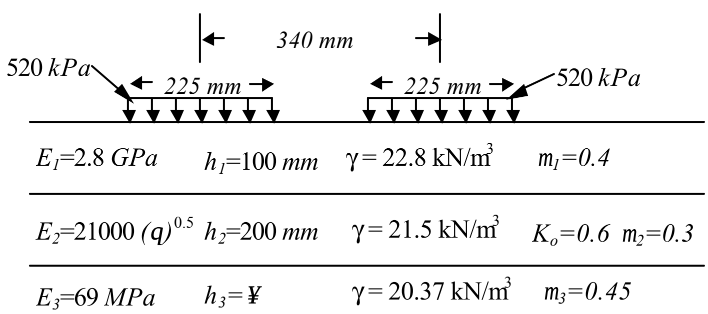
2. The elastic modulus of a homogeneous half space varies as shown in the figure. Assuming that stresses at a point 305 mm below the center of the loaded area is used to find the elastic modulus, determine the maximum surface deflection. Assuming Boussinesq stress distribution is valid solve the problem manually and also by using KENLAYER program.



3. Figure shows a three-layer system. Layer 1 is linear elastic, while layers 2 and 3 are nonlinear elastic with Poisson's ratios of 0.45, 0.3 and 0.4 respectively. The loading, thickness, and material properties are shown in the figure. With the use of KENLAYER, determine the maximum tensile strain at the bottom of layer 1 and the maximum compressive strain at the top of layer 3 by a) subdividing layer 2 into two layers of 50 mm thick each, and b) by considering layer 2 as one layer and considering the stress at upper quarter point of layer 2 for computing E_2.



4. Figure shows a three-layer system under a set of dual-wheel loads. Layer 1 and 3 are linear elastic, while layer 2 is non-linear elastic. The loading, thicknesses, and material properties are shown in the figure. The stresses at the upper quarter of layer 2 between the two wheels are used to evaluate E_2. The maximum tensile strain at the bottom of layer 1 and the maximum compressive strain at the top of layer 3 are determined by comparing the results at three locations: one under the center of one wheel, one under the edge of one wheel, and the other at the center between two wheels. If the actual number of repetitions is 100 per day, determine the life of the pavement by KENLAYER. What should be the number of repetitions per day for a design life of 20 years?



5. Solve problem 4 if layer 2 is subdivided into four layers each of 50 mm thick and the stresses at midheight of each layer are used to determine the modulus of each layer.

6. A two-layer system is subjected to a circular load with a radius of 152 mm and a contact pressure of 518 kPa. The thickness of layer 1 is 200 mm. Layer 1 is viscoelastic chracterised by a generalized model with parameters (E_o=3×10^6 kPa, T_o=0 s); (E_1=3×10^6, T_1=0.05); (E_2=1.8×10^7, T_2=0.5); (E_3=3×10^7, T_3=5); and layer 2 is elastic with E=6.9×10^4 kPa. Both layers are incompressible with poisons ratio of 0.5. If the load is stationary determine the maximum vertical displacement at times of 0, 0.01, 0.1, 1, 10, and 100 s by KENLAYER. Check the displacement at 100 s by using Burmisters deflection chart.

7. If the load in problem no. 6 is moving at 64 km/hr and the number of load repetitions per year is 100,000, determine the life of the pavement based on the Asphalt Institute’s failure criteria.