Assignment Sheet 1

1. Sketch and show the dimensions of the most realistic contact areas on flexible and rigid pavements for a standard axle load of 80 kN with a tyre pressure of 552 kPa. If the contact area on rigid pavement is assumed as rectangle, what should be the dimension of the rectangular area?

2. Determine the complete state of stress (σ_z, σ_r, σ_t) using one-layer theory under the centreline of a tyre having a 222.5 kN, 690 kPa pressure for the following depth-tyre radius ratios: 0, 0.2, 0.5, 1.0, 2.0, 4.0, 8.0. Assume the pavement is characterised by $\mu = 0.5$ and E = 20.7 MPa.

3. Repeat problem 1 for the case when $\mu = 0.2$ and comment on the effect of μ upon the computed stresses.

4. For the pavement and load conditions of problem 1, calculate the strains (ε_z, ε_r, ε_t) at depth-tyre radius ratio of 2.0 for $\mu = 0.2$ and $\mu = 0.5$. Comment on the effect of μ upon the strain values.

5. A dual wheel having a load per tyre of 22.25 kN, 483 kPa pressure, and a 356 mm centre to centre spacing is placed on a pavement 483 mm thick. The subgrade is characterised by E = 20.7 MPa and $\mu = 0.5$. Calculate the total pavement deflection due to the dual load by one layer theory at the following radial distances from the centre line of one tyre: r = 0, 89, 178, 267, and 356 mm.

6. Repeat problem 4 using two-layer interface theory. Assume that $E_1 = 10E_2$.

7. A plate bearing test using 750 mm diameter rigid plate was made on a subgrade as well as on 254 mm of gravel base course. The unit load required to cause settlement of 5 mm was 69 kPa and 276 kPa, respectively. Determine the required thickness of base course to sustain a 222.5 kN tyre, 690 kPa pressure and maintain a deflection of 5 mm.

8. A pavement structure is comprised of the following layers: 146 mm AC, E = 2.76 GPa; 584 mm of granular base, E = 138 MPa; and a subgrade having an E = 69 MPa. All layers are assumed to have $\mu = 0.5$. Calculate the horizontal tensile strain at the bottom of the AC layer and the vertical compressive strain at the top of the subgrade layer under the centre line of a 178 kN, 1035 kPa pressure.