**TD 1**

1. (a) A dry sand is tested in direct shear. The test procedure includes having a

normal (compressive) stress of 200 kPa imposed while the sample undergoes

shearing. The sample fails when the shear stress reaches 135 kPa. From this

data, determine the angle of internal friction φ for the soil.

(b) A second sample of the same sand is also to be tested in direct shear, but the

applied normal (compressive) stress will be 145 kPa. What shear stress is

expected to cause the sample to fail?

2. Samples of damp sand are tested in direct shear. The procedure involves two

separate tests, with different normal loads for each test. In test one, using a

normal loading which causes a compressive stress equal to 50 kPa, the sample is

failed at a shear stress equal to 33 kPa. For test two, the normal stress is 80 kPa,

and the sample shears at a stress of 51 kPa. Use this test data to determine the

angle of internal friction and the value of apparent cohesion for this sand.

3. A sample of dry sand is tested in direct shear. The shear box holding the sample

has a circular cross section with a diameter of 50 mm. The normal (compressive)

load imposed is 200 N. The sample shears when the shear force is 130 N.

(a) Determine the test normal stress and shear stress at failure.

(b) Determine the angle of internal friction φ for this soil.

(c) What is the probable condition of the tested sample (dense, loose, etc)?

4. (a) Samples taken from a uniform deposit of dry granular soil are found to have a

unit weight of 19.6 kN/m3 and an angle of friction of 35°. What is the

shearing strength of the soil on a horizontal plane at a point 4m below the

ground surface?

(b) A proposed structure will cause the vertical stress to increase by 60 kN/m2 at

the 4 m depth. Assume that the weight of the structure also causes the

shearing stress to increase by 52 kN/m2 on a horizontal plane at this depth.

Does this shearing stress exceed the shearing strength of the soil?

5. Describe the state of samples A to D when the Mohr’s Circles describing their

state of stresses are as follows:

(a) For A, the Mohr’s circle is a dot on the normal stress axis.

(b) For B, the Mohr’s circle is too small to touch the failure envelope.

(c) For C, the Mohr’s circle is just tangent to the failure envelope.

(d) For D, the Mohr’s circle is so large that part of the circle is above the failure

envelope.