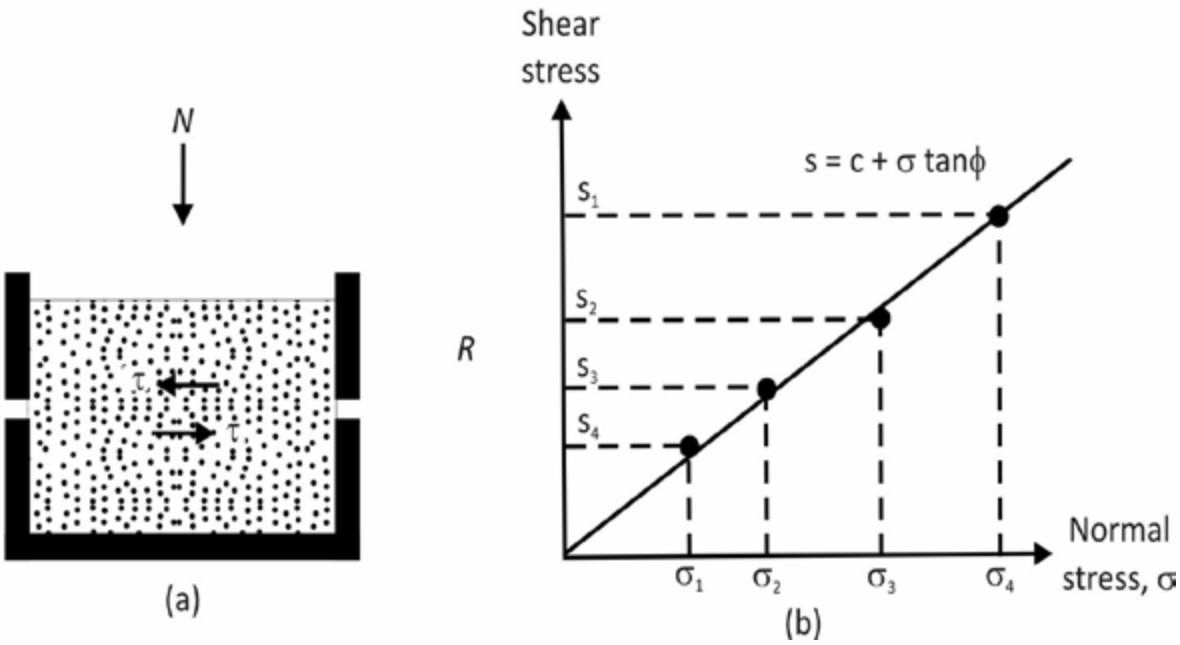
LECTURE 32

Direct Shear Test:

Dry sand can be conveniently tested by direct shear tests. The sand is placed in a shear box that is split into two halves . A normal load is first applied to the specimen. Then a shear force is applied to the top half of the shear box to cause failure in the sand. The normal and shear stresses at failure are



Direct shear test in sand: (a) schematic diagram of test equipment; (b) plot of test results to obtain the friction angle, ϕ

$$\sigma' = \frac{N}{A}$$

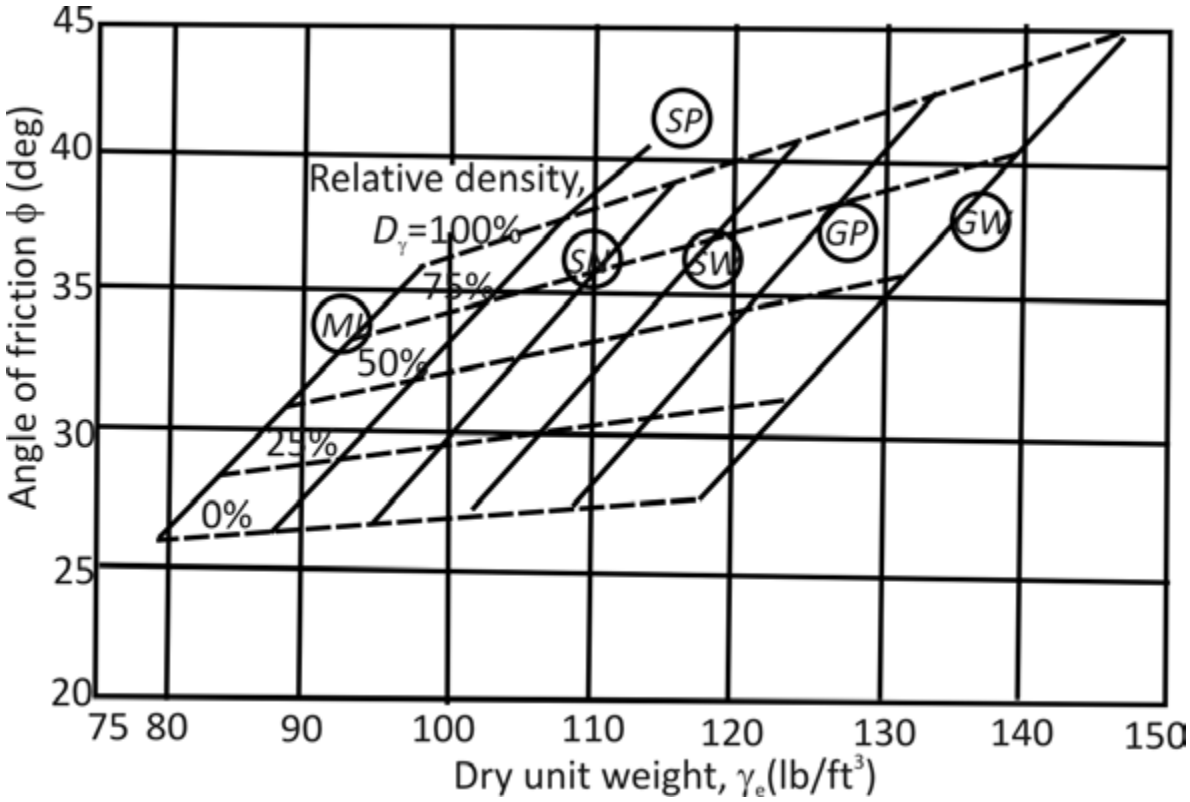
$$S = \frac{R}{A}$$

Where
A = Area of the failure plane in soil-that is, the area of cross section of the shear box

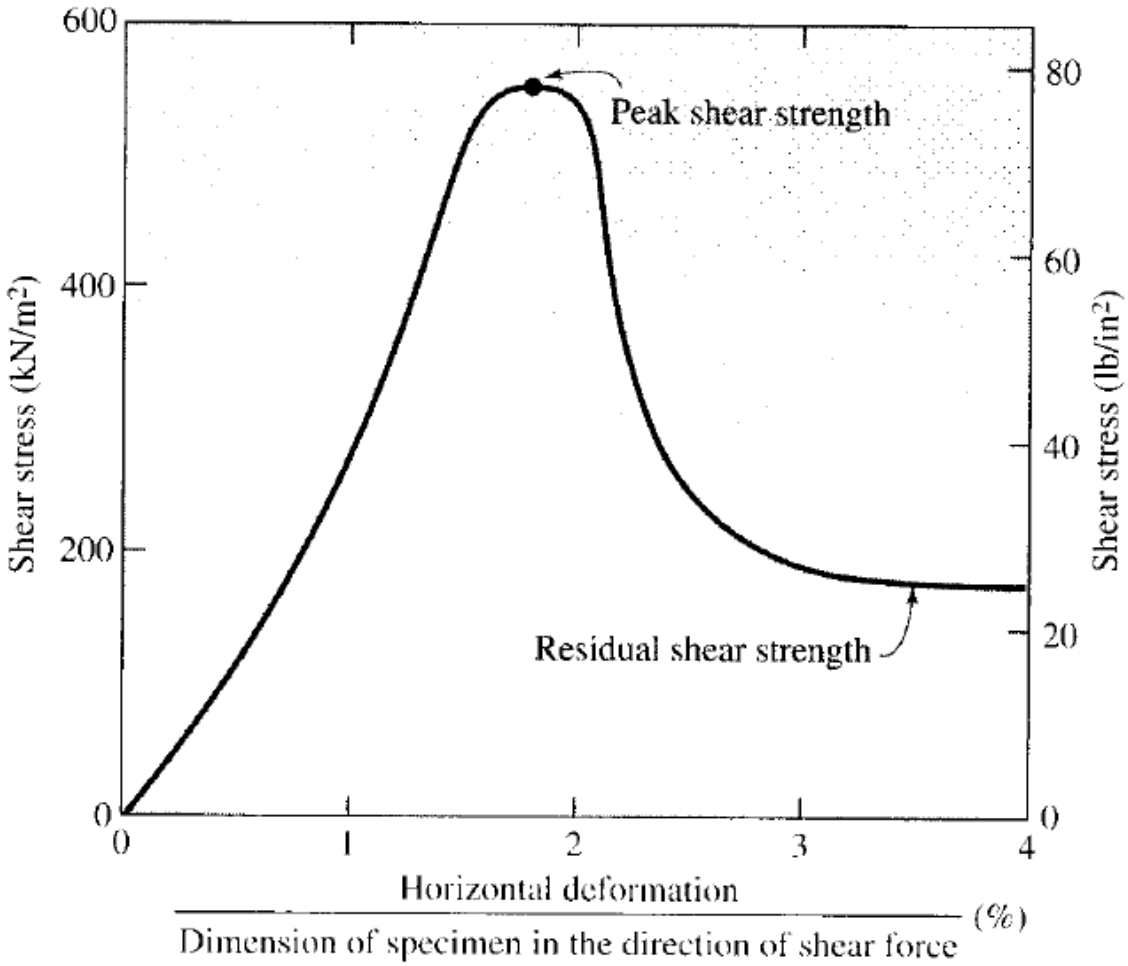
Several tests of this type can be conducted by varying the normal load. The angle of friction of the sand can be determined by plotting a graph of s against $\sigma'(=\sigma)$

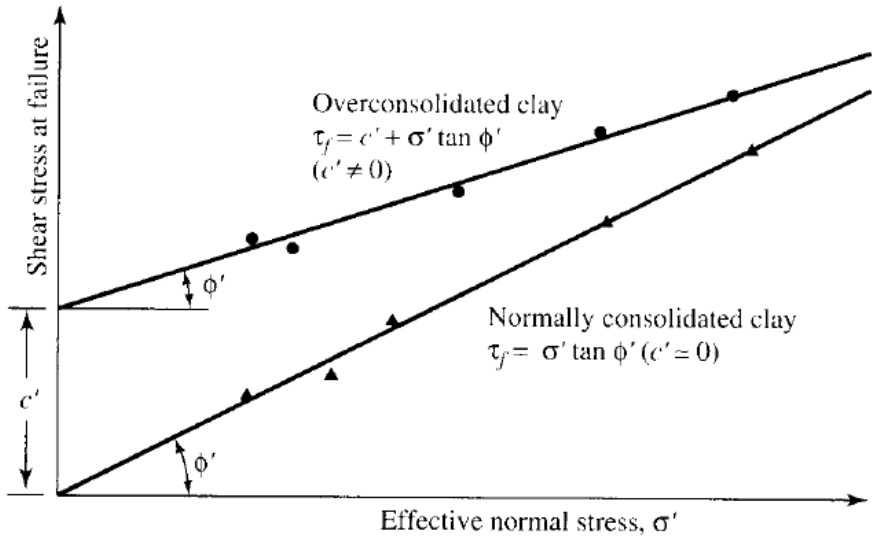
$$\phi = \tan^{-1}\left(\frac{s}{\sigma'}\right)$$

For sands, the angle of friction usually ranges from 26° to 45°, increasing with the relative density of compaction. The approximate range of the relative density of compaction and the corresponding range of the angle of friction for various coarse-grained soils is shown in **figure**



Range of relative density and corresponding range of angle of friction for coarse-grained soil





Failure envelope for clay obtained from drained direct shear tests