LECTURE 22

Terzaghi's Spring Mass Analogy-

Terzaghi's model consists of a cylindrical vessel with a series of piston separated by springs. The space between springs is filled with water the pistons are perforated to allow for passage of water. Piezometers are inserted at the centers of different compartment to measure the pressure head due to excess pore water pressure.

Terzaghi has correlated the spring mass compression process with the consolidation of saturated clay subjected to external load. The springs and the surrounding water represent the saturated soil. The springs represent the soil skeleton networks of soil grains and water in the vessels represents the water in the voids. In this arrangement the compression is one dimensional and flow will be in the vertical direction. When pressure is applied this will be borne by water surrounding the spring

$\Delta\sigma = \Delta u$ at time t =0

Δu is called excess hydrostatic pressure due to this water level in all the Piezometer reach the same height 'h' given by $h = \frac{\Delta u}{\gamma_w}$

$\Delta\sigma = \Delta u$ and $\Delta\sigma' = 0$ --------- t=0

There will be no volume change. After some time 't' there will be flow of water through perforation beginning from upper compartment. In the lower compartment the volume of water remains constant since the flow is in upward direction.

Due to flow of water in the upper segment there will be reduction in volume due to this spring's get compressed and they being to carry a portion of the applied load. This signifies a reduction in excess hydrostatic pressure or pore water pressure and increase in effective stress in the upper segments. Whereas there will be no dissipation of excess hydrostatic pressure in lower compartments. The isochrones indicate that with passage of time there is flow of water from the lower compartments leading to gradual dissipation of excess hydrostatic pressure. At time t = 0 when no more pore water flows out the excess hydrostatic pressure will be zero in all compartments and the entire load is carried by springs.

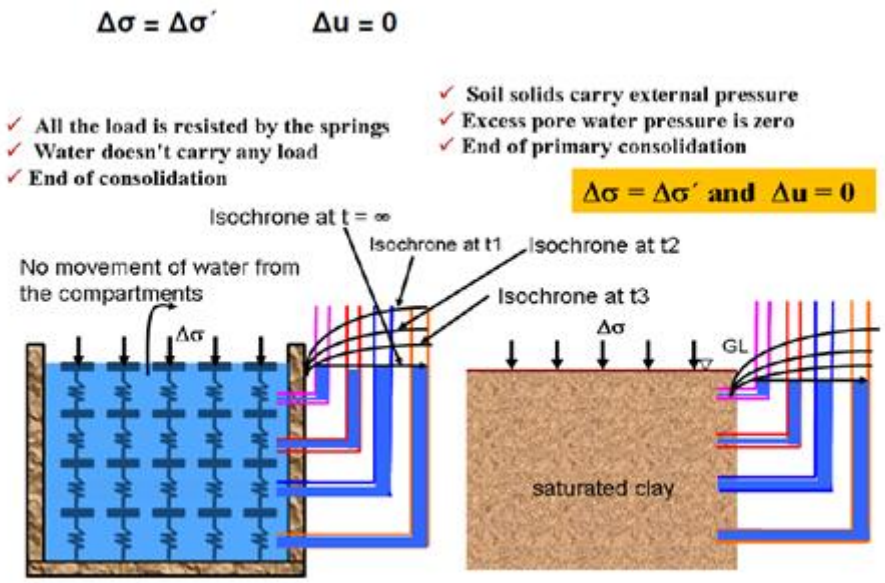

Figure Compression of Spring mass

The compression of a spring mass system is analogous to the consolidation of a saturated fine grained soil deposit subjected to external pressure.

Soil Compressibility

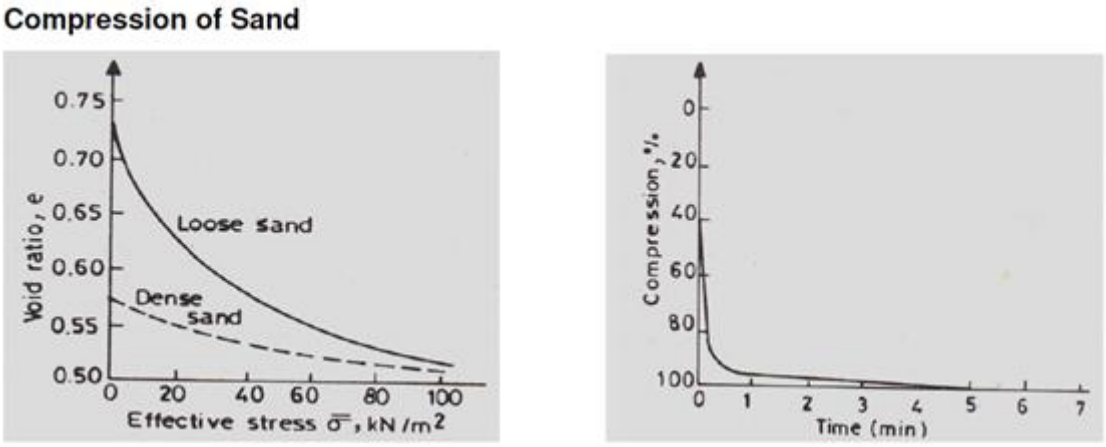

Figure Void ratio-effective stress and compression-time plots for sand

Sand deposit compresses immediately on load application. Loose sand compresses more than dense sand. Loose and dense sand deposits tend towards the same void ratio.

Compression of fine grained soil (clay)

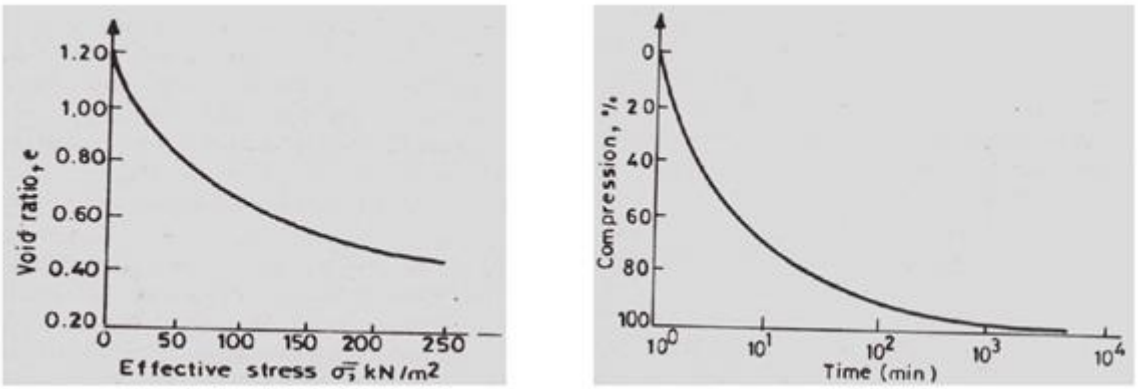

Figure Void ratio-effective stress and compression-time plots for clay

Time dependent compression takes longer time compared to sand. The magnitude of compression is also large.