Al-Mustaqbal University College

Building &Construction Technology Engineering Department

Soil mechanics

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Lecture 2

Plasticity of Fine-Grained Soils

Consistency and Atterberg's limits of fine-grained soils

Consistency of soil

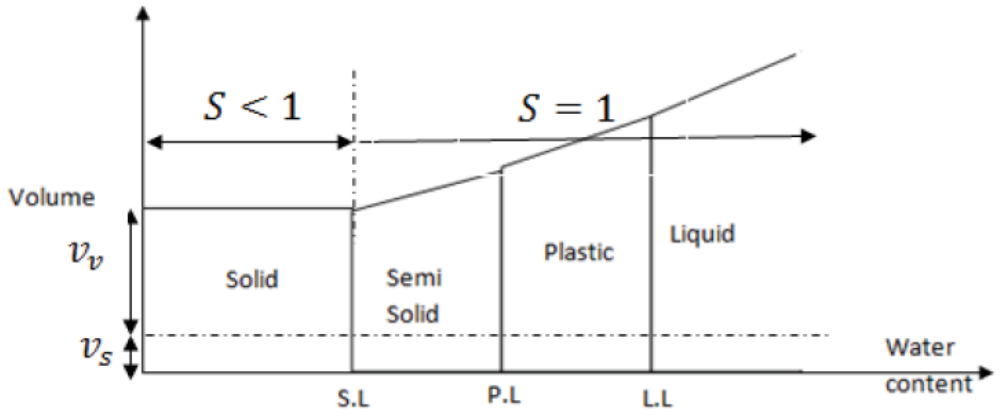
Soil consistency describes the degree and kind of cohesion and adhesion between the soil particles as related to the resistance of the soil to deform or rupture.

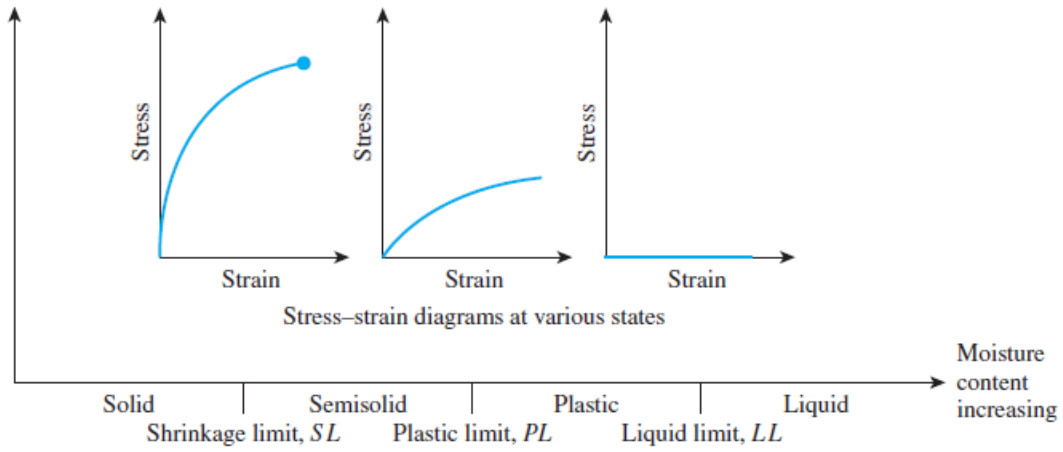
Atterberg's Limits

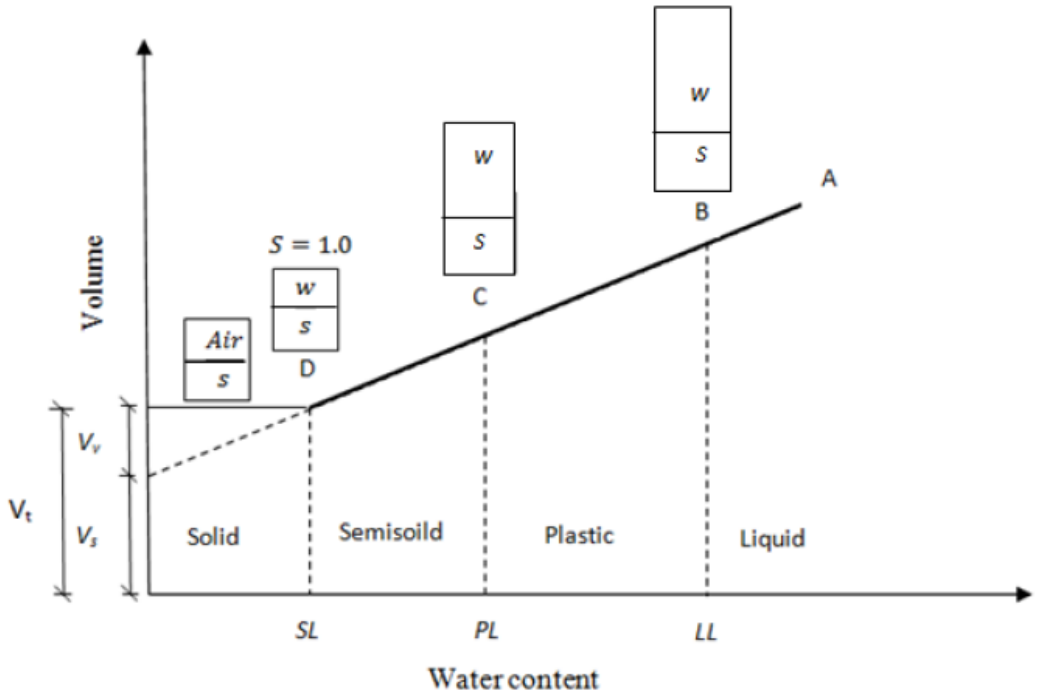
Atterberg's limits are the limits of water content and important to describe the consistency of fine-grained soils.

- At a very low moisture content, soil behaves more like a solid. When the moisture content is very high, the soil and water may flow like a liquid. Hence, on an arbitrary basis, depending on the moisture content, the behavior of soil can be divided into four basic states—solid, semisolid, plastic, and liquid—as shown in Figure.

Effect of moisture content







1- shrinkage limit

The moisture content, in percent, at which the transition from solid to semisolid state takes place

2- plastic limit

The moisture content at the point of transition from semisolid to plastic state

3- liquid limit

The moisture content at the point of transition from plastic to liquid state.

These parameters are also known as Atterberg limits.

- **Plasticity Index (P.I.):** it is the range in moisture content when the soil exhibited its plastic behavior.

$$P.I. = L.L - P.L.$$

- **Liquidity Index (L.I.) :** a relation between the natural moisture contents (ω_n and (L.L.) and (P.L.) in form:

$$L.I. = \frac{\omega_n - P.L}{L.L. - P.L.}$$

If LI > 1 Then the soil at Liquid state

If LI = 1 then the soil at L.L.

If $LI < 1$ then the soil below L.L.

Activity:

The degree of plasticity of the clay-size fraction of a soil is expressed by the ratio of the plasticity index to the percentage of clay-size particles in the soil.

$$Activity = \frac{P.I}{\%\ of\ clay\ size\ particles}$$

- Soils have an activity between 0.75 and 1.25. Activity below 0.75 is considered inactive, while soils with activity above 1.25 are considerd active.
- Soils of high activity have a greater change in volume when the water content is changed (greater swelling, when wetted and greater shrinkage when drying. Soils of high activity can be particularly damaged to geotechnical works.