2.6 Methods of Soil Sampling

- Disturbed sampling ⇒ Grain-size distribution, w_n, LL, PL, G_s, classification of soil, and shearing characteristics for cohesionless soils
- Undisturbed sampling (Tube sampling, Block sampling)
  ⇒ Consolidation and shearing characteristics for cohesive soils

1) Sample disturbance

- Sample disturbance can occur during boring (or drilling), during sampling, during transportation and storage, or during preparing for testing.
- The mechanisms associated with sample disturbance can be classified as
  1. Changes in stress conditions :
     - the reduction of total horizontal and vertical stresses from their in situ value.
  2. Mechanical deformation :
     - shear distortions applied to sample, for example by tube sampling.
  3. Changes in water content and void ratio :
     - can occur as an overall swelling or consolidation of the soil sample, or a redistribution of moisture in reponse to pore pressure gradients.
  4. Chemical change :
     - may result from contact with drilling fluid or with sampling tubes.

2) Type of sampling for undisturbed samples

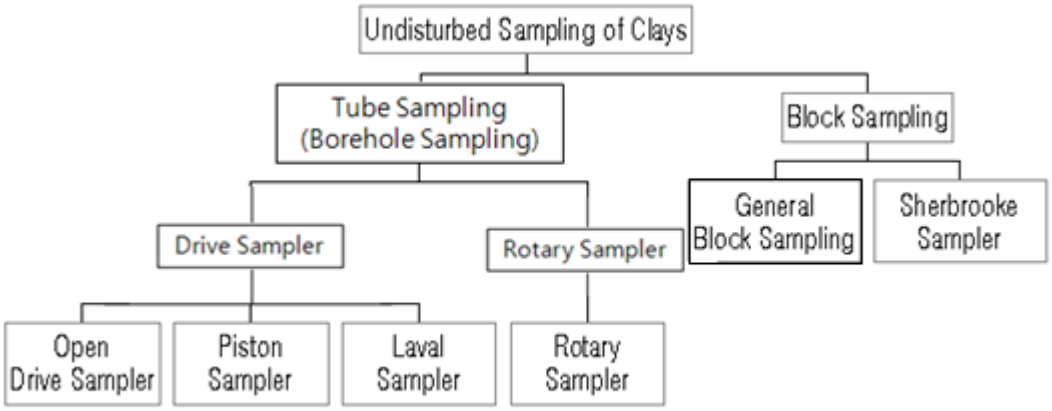

Fig. General classification of sampling techniques

1. Tube sampling

: Effective to obtain soil samples from deep soil deposits.

1) Sample Disturbance

- Disturbance occurs due to stress release + mechanical deformation.
- Design parameters for tube samplers; Area ratio, Cutting edge tapered angle, Inside clearance and L/D ratio

a) Area ratio

$$A_R(\%) = \frac{D_0^2 - D_i^2}{D_i^2} \times 100$$

$\Rightarrow$ Undisturbed state can be defined with $A_R \leq$ 10%.

where D_o = outside diameter of sampler,

D_i = inside diameter of sampler

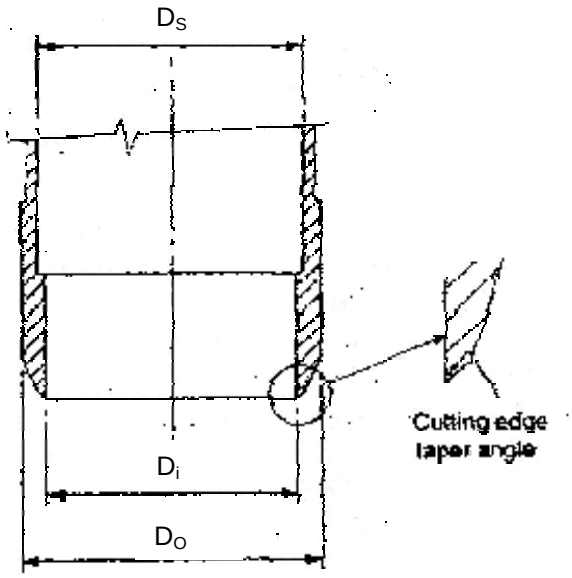

Fig. Sampler with screw-on cutting shoe

b) Cutting Edge Tapered Angle

- Enable to use thick tubes with minimizing sample disturbance in order to preventing their bending or buckling during driving the sampler into the soil.
- ISSMFE suggested the combinations of area ratio and cutting edge tapered for samplers of about 75mm dia. as given below.

Area ratio (%)	Cutting edge taper (deg.)
5	15
10	12
20	9
40	5
80	4

c) Inside clearance and *L/D* ratio

- To prevent sample jamming due to the friction or a adhesion of the

soils inside of the sampler tube. (The soil beneath the bottom will be severely remolded due to induced bearing capacity failure.)

- The less *L/D* ratio, the easier the penetration of the sampler tube. In an ultimate condition, a maximum permissible *L/D* of 2.5 is considered.
- Inside clearance (= $(D_s - D_i)/D_i$) reduces or eliminates wall friction but gives the room for some swelling and lateral strain. It is usually less than 4%. Hvoslev recommends inside clearance 0.75 – 1.5%.

2) Types of Tube sampler

a) Open – drive sampler

- Consist of a tube which is open at its lower end.
- Advantage : Cheapness and simplicity of operation.
- Disadvantage : Poor cleaning of borehole, problem of sample retension during withdrawal.
- Can be divided into two types based on thickness of tube or area ratio:
  - Thick-wall open drive sampler (A_R >20%)
  - Thin-wall open drive sampler (A_R<20% with a suitable cutting shoe angle)