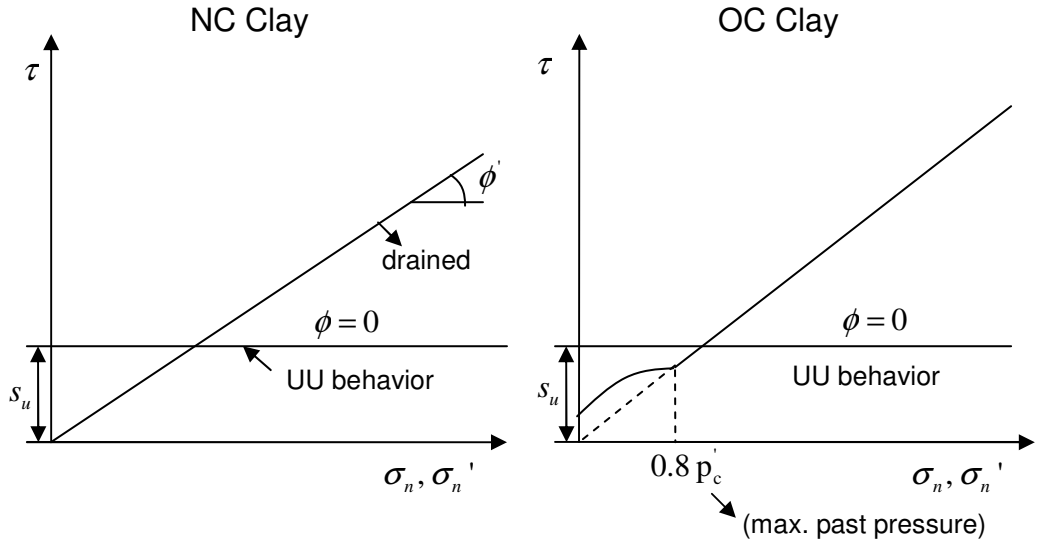
1.3 Shear Strength of Clays.

(1) Drained Strength.



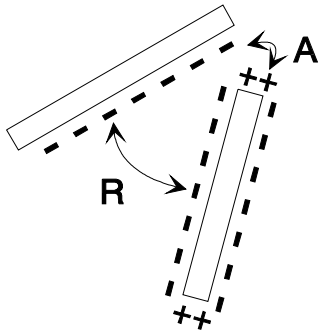
"Fundamental Sear Strength Parameters"

- Hvoslev Parameter.

c_e, ϕ_e

- Work based on lab tests of saturated remolded clays.

Physico-chemical Forces (Intrinsic Forces)



Attractive Forces, A.

1) Electrostatic attraction.

2) Van der Waal's Force.

Repulsive Forces, R.

1) Electrostatic repulsion.

- Factors affecting intrinsic forces.

1. Type of clay.

2. Particle spacing.

3. Geometric arrangement of particles.

4. Specific surface.

- Effective stress equations.

$$\sigma' = \sigma - u + A - R$$

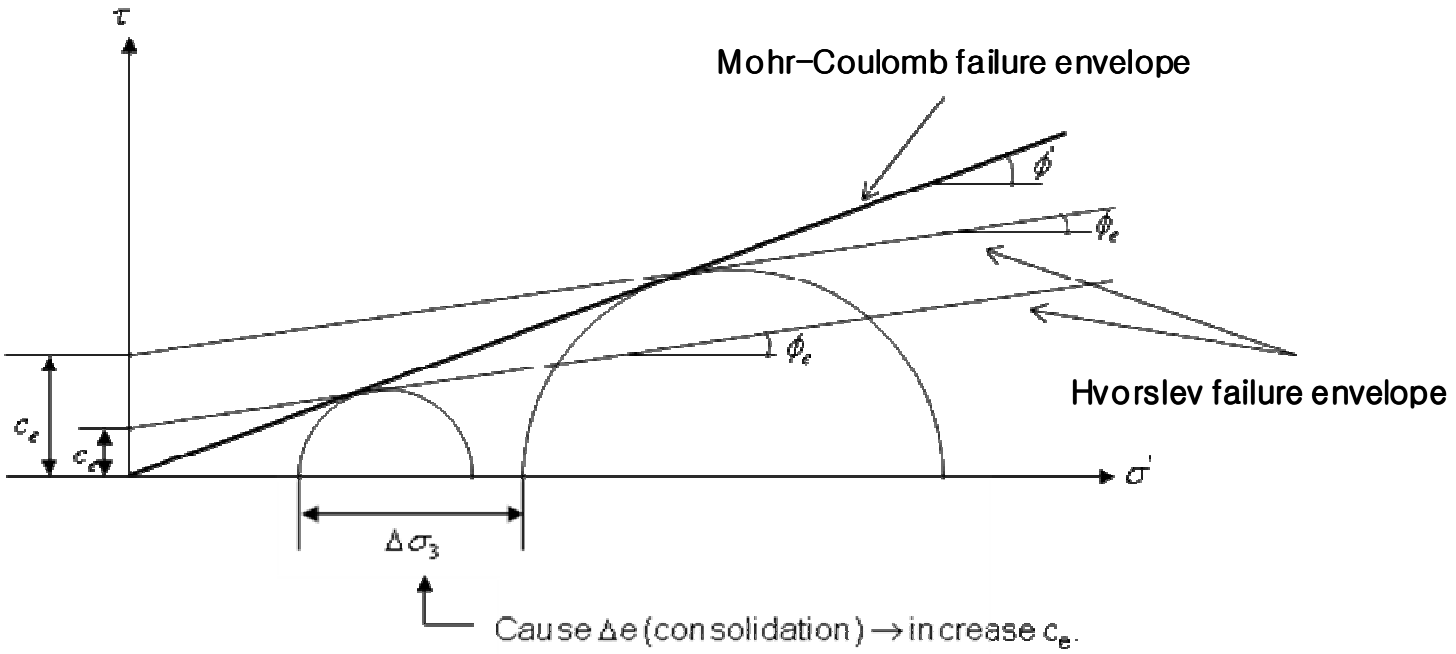
S ≡ shear strength = $S_{granular} + S_{cohesive}$

$$\begin{aligned} S = S_g + S_c &= (\sigma - u)K_g + (\sigma - u + A - R)K_c \\ &= (\sigma - u)(K_g + K_c) + (A - R)K_c \\ &= (\sigma - u)\tan\phi_e + c_e \end{aligned}$$

Equivalent friction angle.
→material constant.

Equivalent cohesion.

For NC Clay. (drained test)



→ No longer 1 failure envelope, but a series of envelope for Hvorslev theory.

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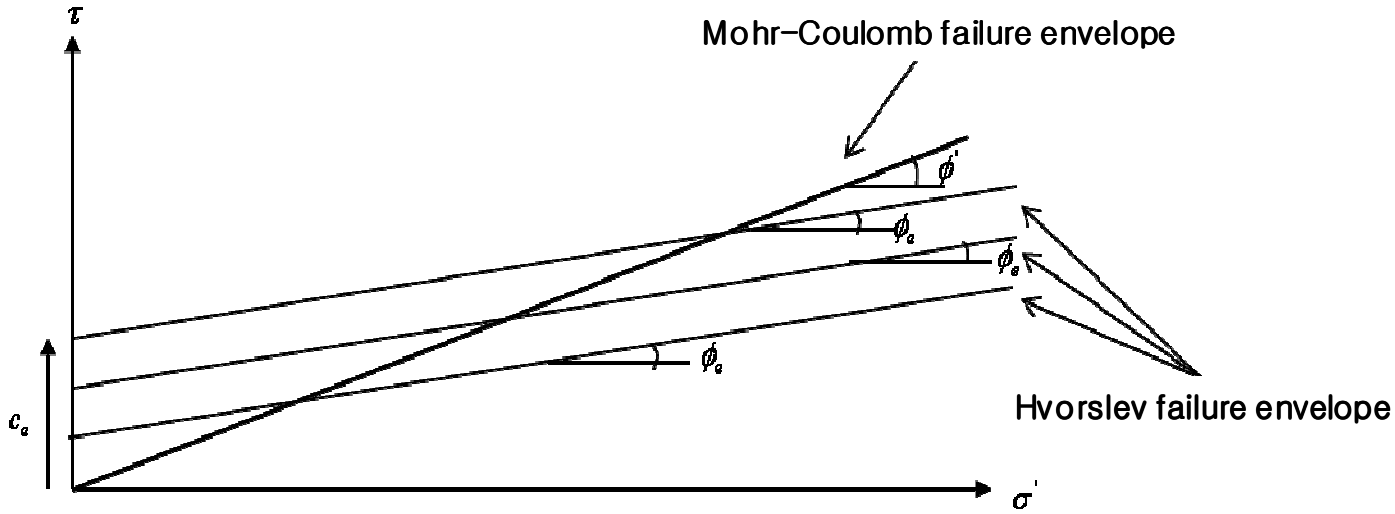
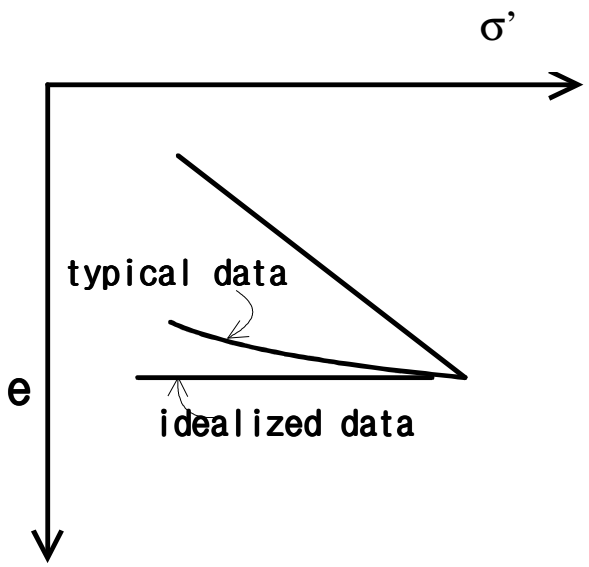


For O.C. Clay.

Ideal Soils → No Δe during unloading.

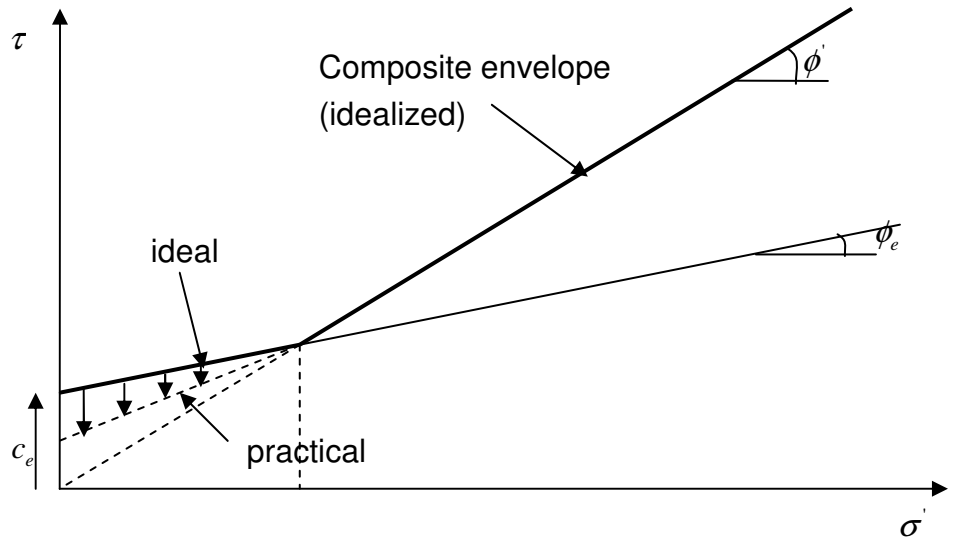


In terms of Hvorslev parameters;

For any unloading (OCR > 1).

$$\phi_e = \text{constant}$$

$$c_e = \text{constant}$$



Practical decrease in strength due to increase in e during 'actual' unloading

→ So, Hvorslev ideal envelope (O.C. Clay) → upper bound strength.

- **Summary**

An increase in effective stress has two effects on strength of clays.

1. Increase particle to particle contact forces.

   → increase in frictional resistance. → $S = (\sigma - u)\tan\phi_e$

   ($\sigma - u$: increase)

2. Decrease volume and void ratio, and increase (A-R) and c_e.