(2) Shear Behavior of Sands (also clays)

- Most important factors in determining shear strength itself (for given soils).

  i) Initial void ratio (density)

  ii) Confining stress

- Critical State $\{\frac{dq}{d\varepsilon_a}=0,$ and $\frac{d\varepsilon_v}{d\varepsilon_a}=0$ or $\frac{dp'}{d\varepsilon_a}=0\}$

  for drained conditions;

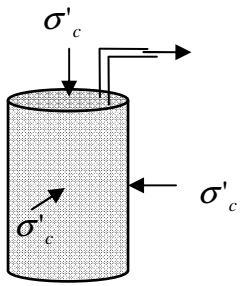
  e_{cr} = critical void ratio ≡ void ratio at which no volume change occurs as shearing progresses.

  for undrained conditions;

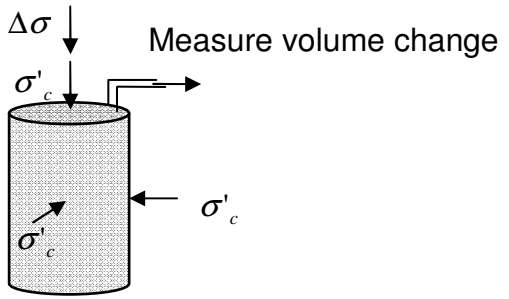
  σ'_{3cr} = critical confining stress ≡ confining stress at which no excess pore water pressure change occurs as shearing progresses.

1) CID TXC tests

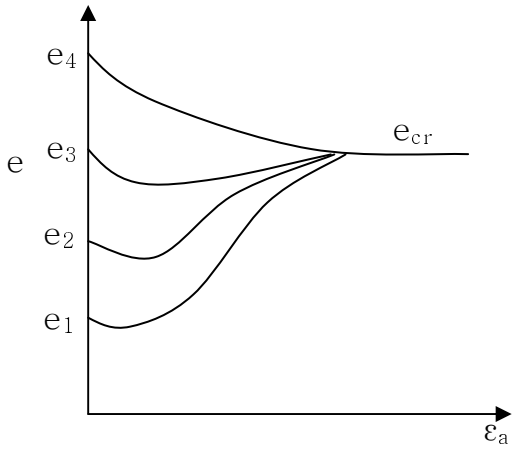
consolidation



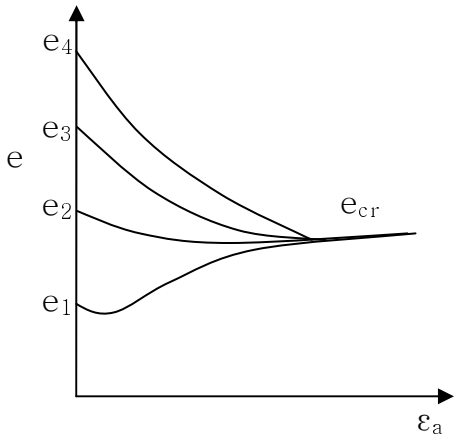
shearing



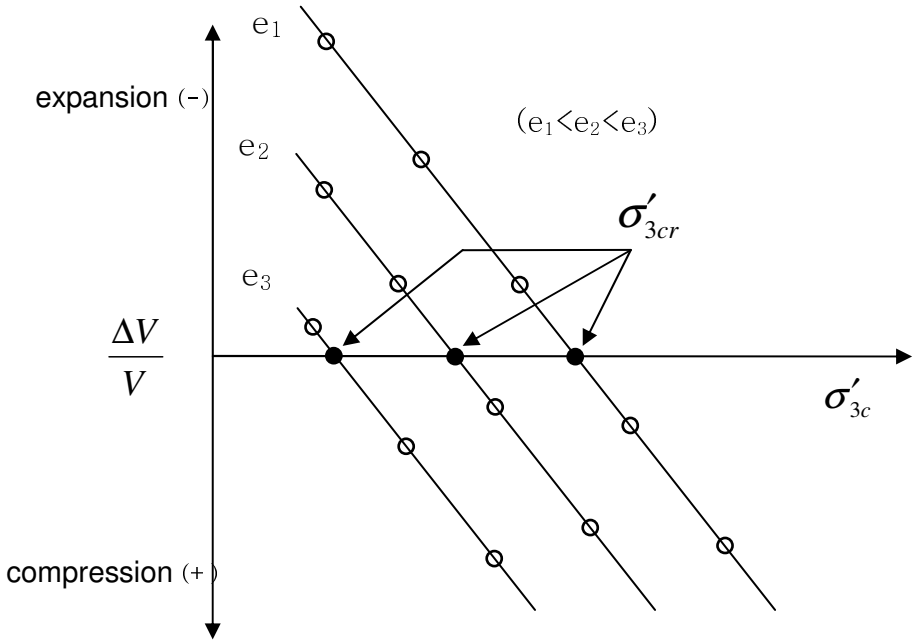
- varying e_0 and <u>low</u> σ'_3

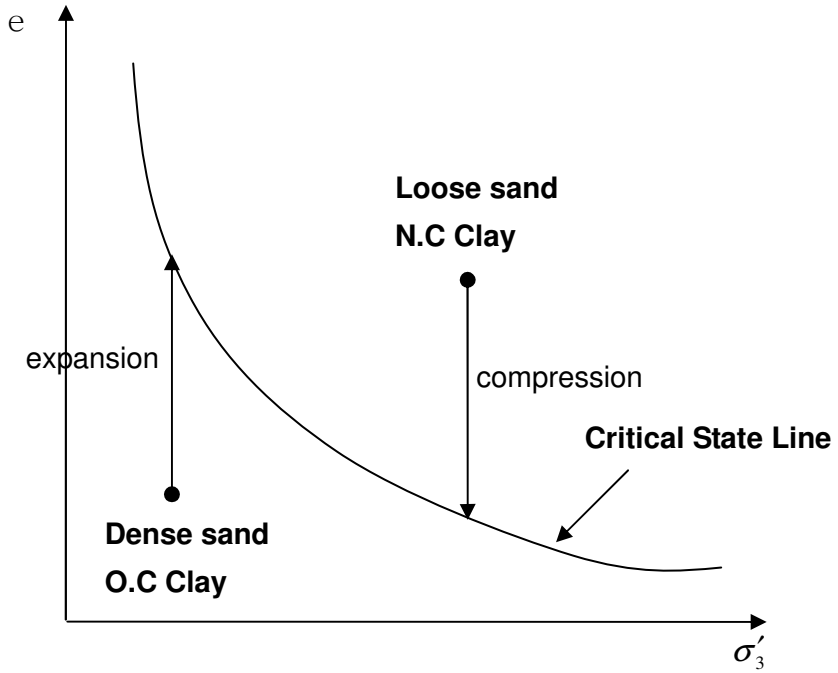


- varying e_0 and <u>high</u> σ'_3



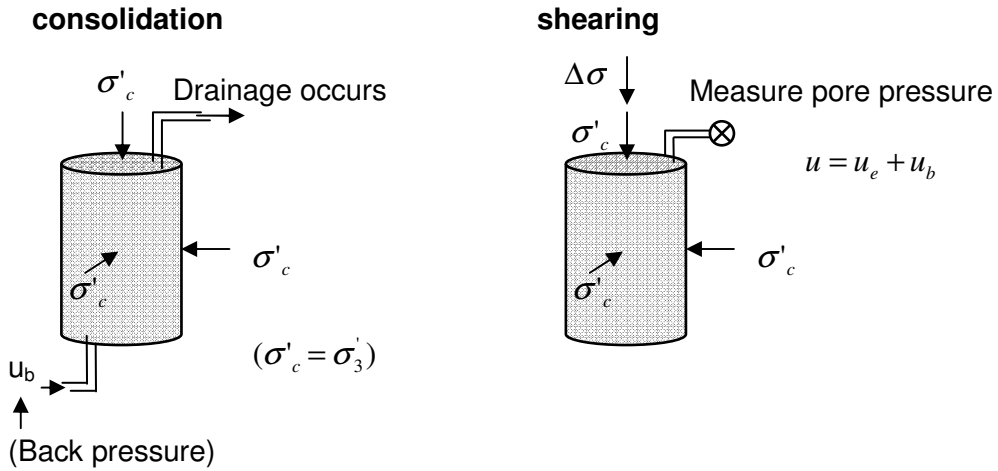
- Series of CID TXC tests with varying σ'_3, e_0.





$\Rightarrow$ The denser the sample, the higher the σ'_{cr}.

2) CIU TXC



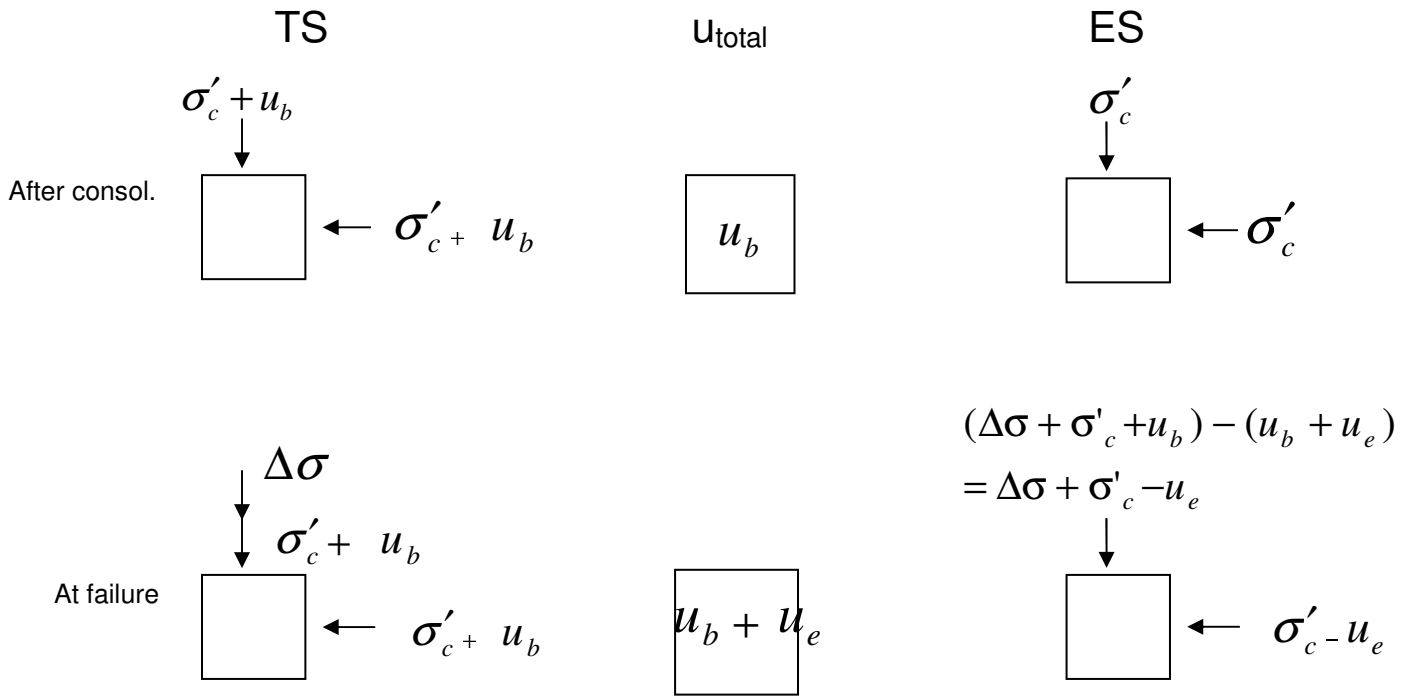
Practically,

$$\sigma_c = \sigma'_c + u_b$$

- Why back pressure?

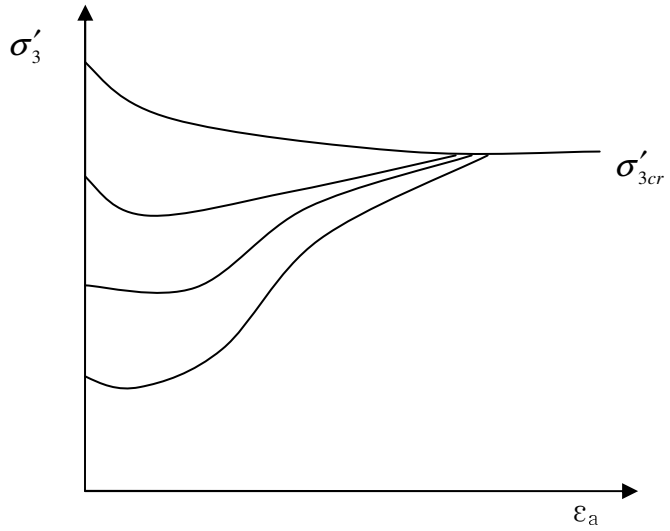
(1) to saturate the sample.

(2) to prevent cavitation in sample during shearing in heavily O. C. samples.


TS
u_{total}
ES
$\sigma'_c + u_b$
After consol.
$\sigma'_c + u_b$
u_b
σ'_c
σ'_c
$\Delta\sigma$
$\sigma'_c + u_b$
At failure
$\sigma'_c + u_b$
$u_b + u_e$
$(\Delta\sigma + \sigma'_c + u_b) - (u_b + u_e)$
$= \Delta\sigma + \sigma'_c - u_e$
$\sigma'_c - u_e$

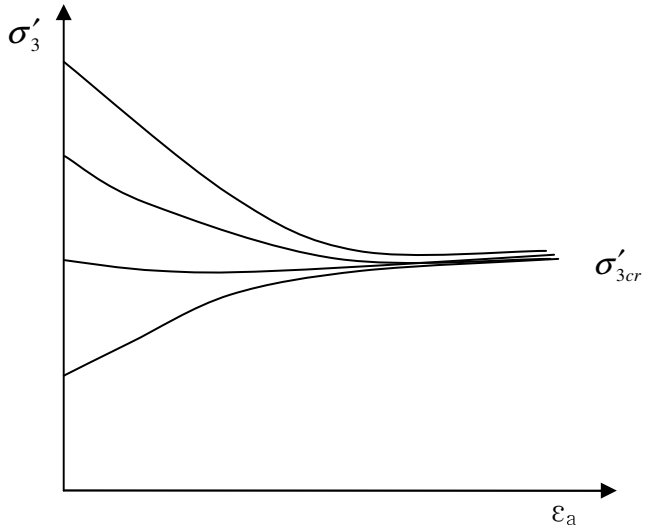
- Varying $\sigma_3^{'}(=\sigma_c^{'})$ with <u>low</u> e_0.

  (dense sand)

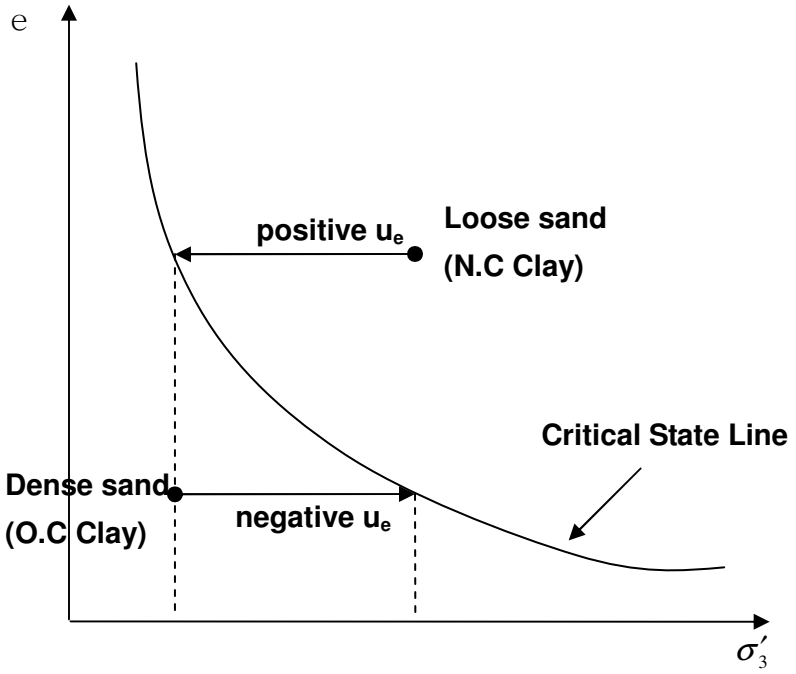


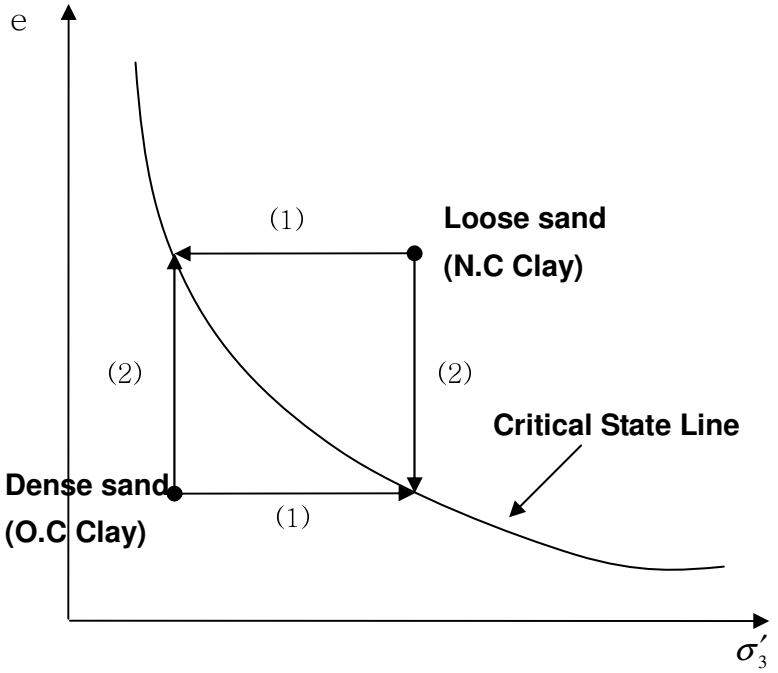
- Varying $\sigma_3^{'}(=\sigma_c^{'})$ with <u>high</u> e_0.

  (loose sand)



σ'_{3CR}(loose) < σ'_{3CR}(dense)





(1) u_e development(undrained loading)

(2) volume change (drained loading)