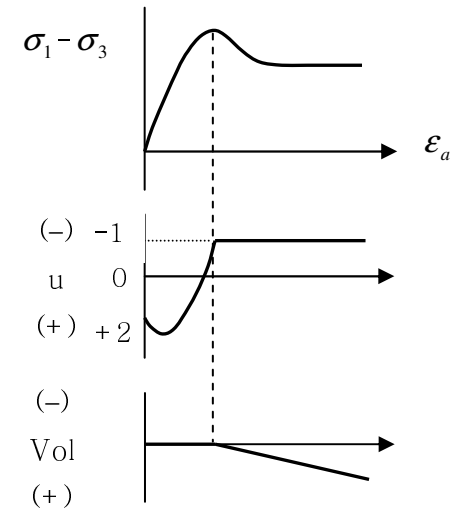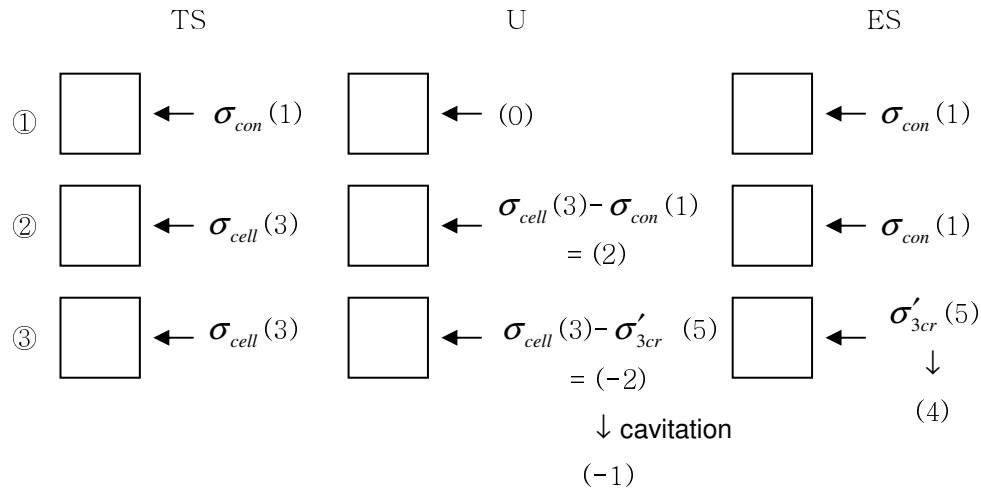## 3) UU behavior

To run test

    ① Apply a pressure to sample, σ_{con} (For example, 1 atmosphere pressure), so that sample

        can stand "self-supported" in TX cell.

    ② Close drainage lines and apply cell pressure, σ_{cell}.

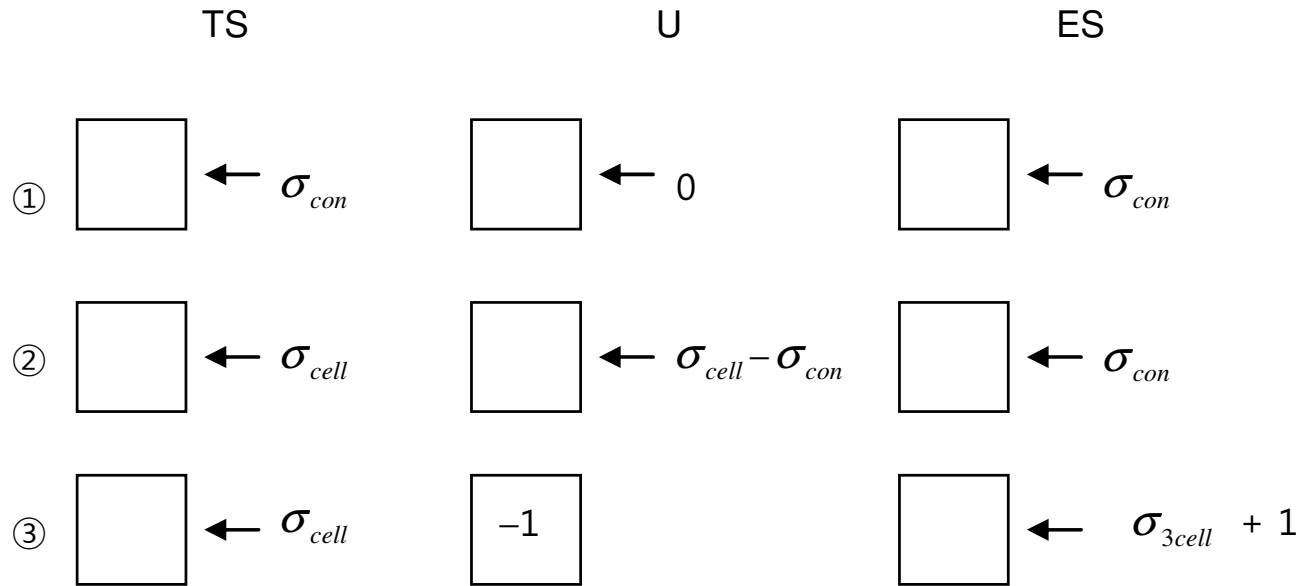   ③ Load sample to failure by increasing vertical stress.

Example

In case of σ'_{3cr} =5 atmosphere pressure, σ_{con} =1, σ_{cell} =3.
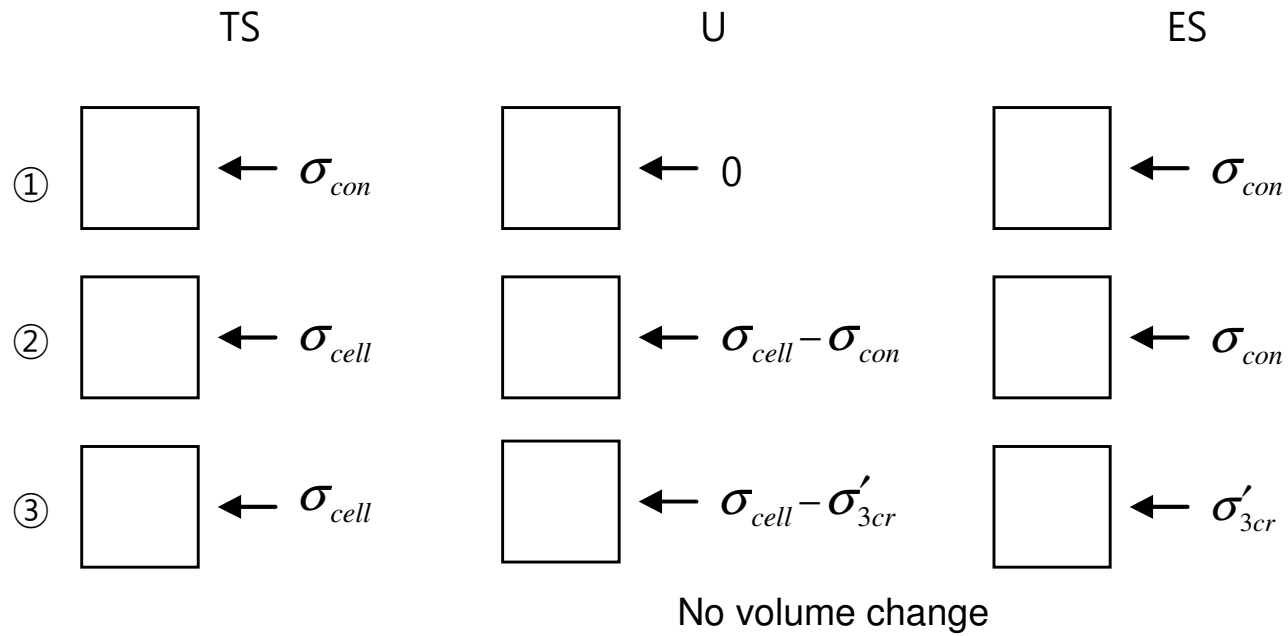
    * look at lateral stresses

TS	U	ES	

① $\quad\square\quad\leftarrow\ \sigma_{con}(1)$ $\square\quad\leftarrow\ (0)$ $\square\quad\leftarrow\ \sigma_{con}(1)$

② $\quad\square\quad\leftarrow\ \sigma_{cell}(3)$ $\square\quad\leftarrow\ \dfrac{\sigma_{cell}(3)-\sigma_{con}(1)}{=(2)}$ $\square\quad\leftarrow\ \sigma_{con}(1)$

③ $\quad\square\quad\leftarrow\ \sigma_{cell}(3)$ $\square\quad\leftarrow\ \sigma_{cell}(3)-\sigma'_{3cr}\ (5)$ $\square\quad\leftarrow\ \sigma'_{3cr}(5)$

$$= (-2)$$

$$\downarrow \text{cavitation}$$

$$(-1)$$

$$\downarrow$$

$$(4)$$

$\sigma_1 - \sigma_3$ ε_a

$(-)\ -1$

$\text{u}\quad 0$

$(+)\ +2$

$(-)$

Vol

$(+)$

A) $\sigma_{cell} \leq \sigma'_{3cr} - 1$

<div>
           TS   U   ES
</div>

① □ ← σ_{con} □ ← 0 □ ← σ_{con}

② □ ← σ_{cell} □ ← $\sigma_{cell} - \sigma_{con}$ □ ← σ_{con}

③ □ ← σ_{cell} -1 □ ← $\sigma_{3cell} + 1$

And compression occurs $(+ \Delta V)$

B) $\sigma_{cell} > \sigma'_{3cr}$ -1

TS	U	ES

① $\square \leftarrow \sigma_{con}$ $\qquad$ $\square \leftarrow 0$ $\qquad$ $\square \leftarrow \sigma_{con}$

② $\square \leftarrow \sigma_{cell}$ $\qquad$ $\square \leftarrow \sigma_{cell} - \sigma_{con}$ $\qquad$ $\square \leftarrow \sigma_{con}$

③ $\square \leftarrow \sigma_{cell}$ $\qquad$ $\square \leftarrow \sigma_{cell} - \sigma'_{3cr}$ $\qquad$ $\square \leftarrow \sigma'_{3cr}$

No volume change
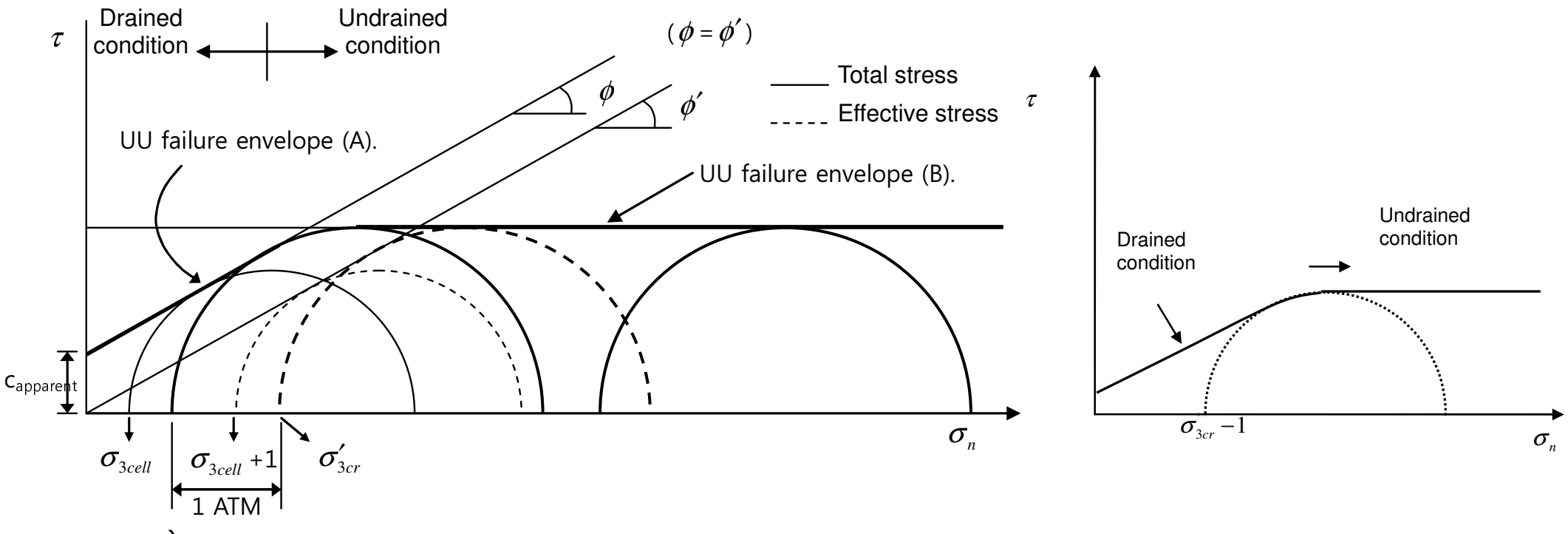
4) Comparison between Drained & Undrained Behavior $\rightarrow$ Clay

   (To evaluate critical condition for design).
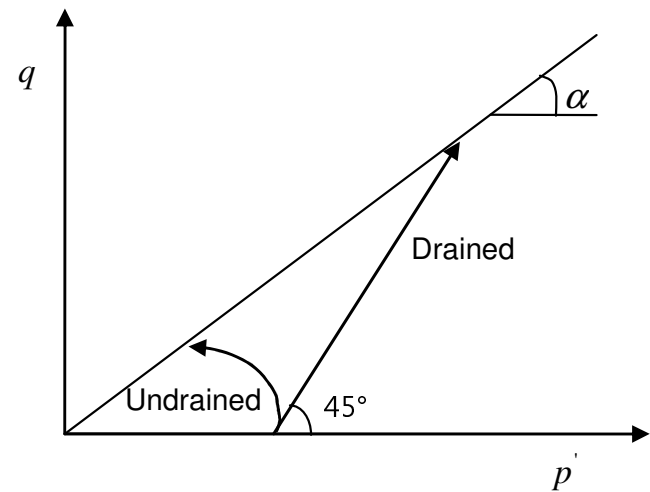
   <u>Run CIU Test.</u> (Say $\sigma'_{CR} = 5$).

   ⊙ *Test* ⓐ

   $\sigma'_{3cell} = 10$, $u_b = 10$ $\Rightarrow$ $\sigma_{3cell} = 20$.

	TS	U	ES
consol.	□ ← 20	10	□ ← 10
shear	□ ← 20	15	□ ← 5

● <u>Mohr's Circle</u>

ϕ'

Drained shearing.
(Effective stress)

Undrained shearing.
(Effective stress)

Undrained shearing.
(Total stress)

τ_{dr}

τ_{un}

5   10   20 σ_n

$\sigma'_{3i} = \sigma'_{3fd}$ $\sigma_{3i} = \sigma_{3fu}$

$\sigma'_{3fu} = \sigma'_{3CR}$ $(= \sigma_{3fd})$

$\sigma_1 - \sigma_3$

Drained

Undrained

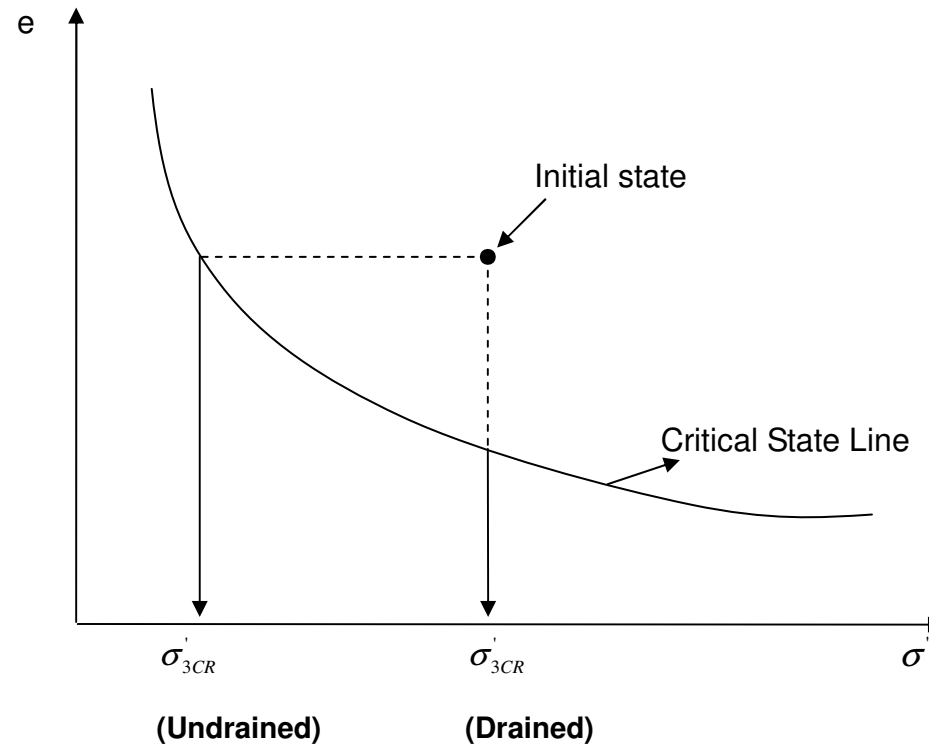ε_a

q

α

Drained

Undrained   45°

p'
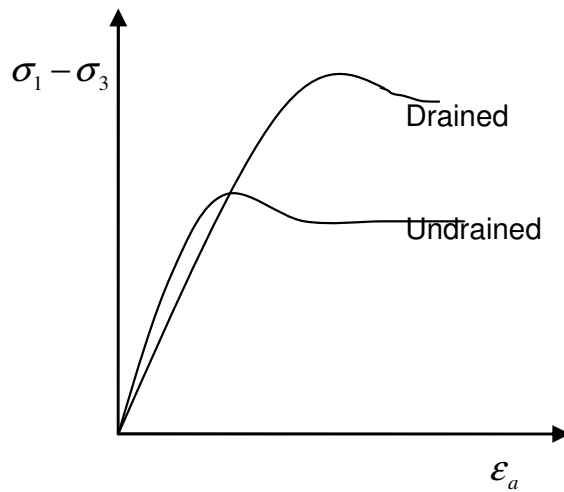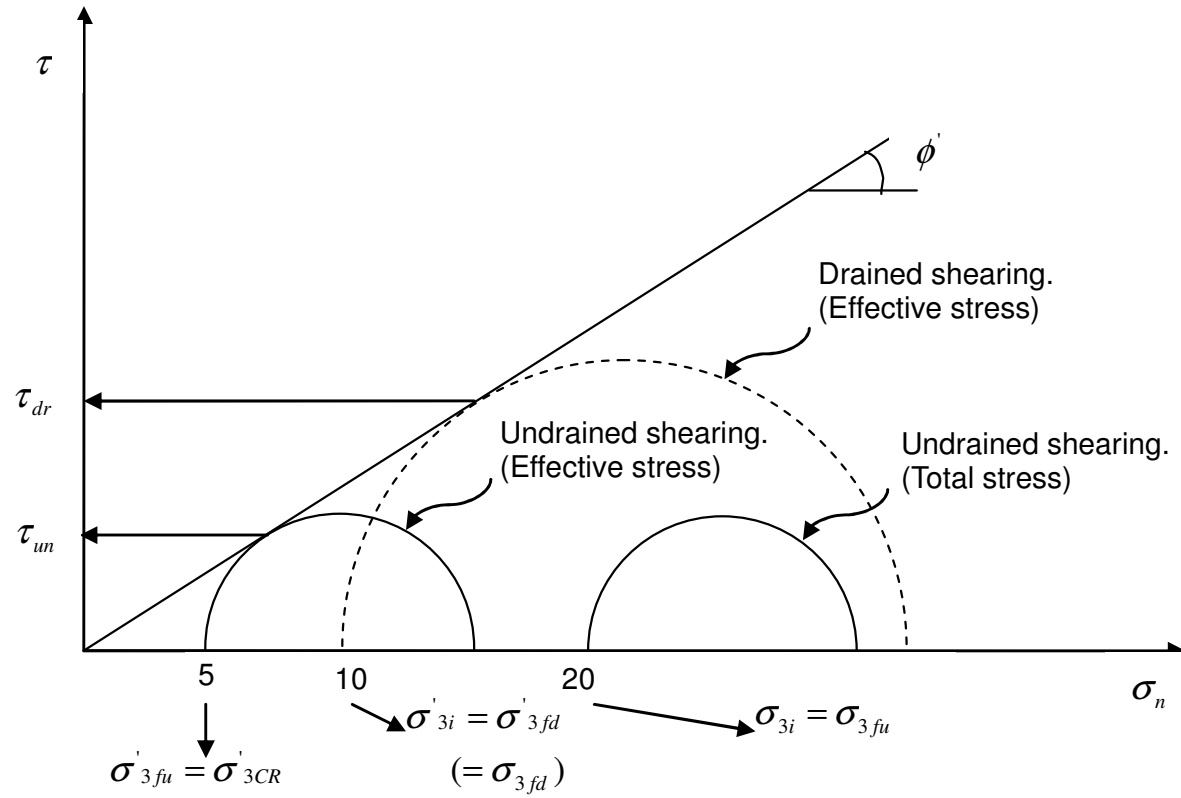
$\sigma'_{3initial} (= \sigma'_{3cell}) > \sigma'_{3CR}$ (i.e. Loose sand or NC).
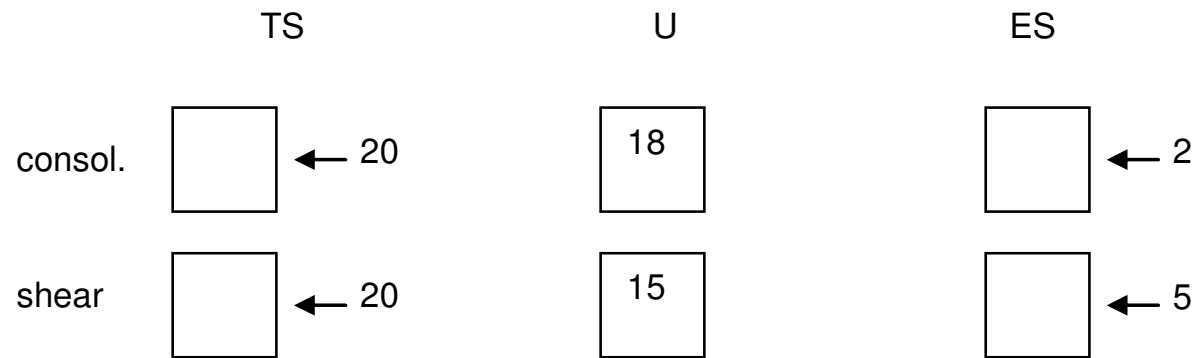
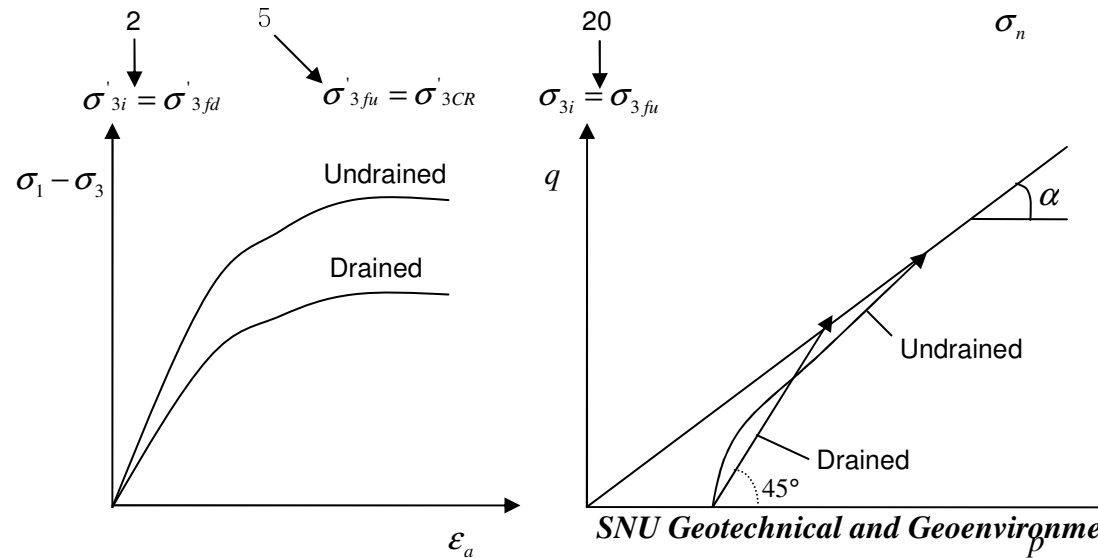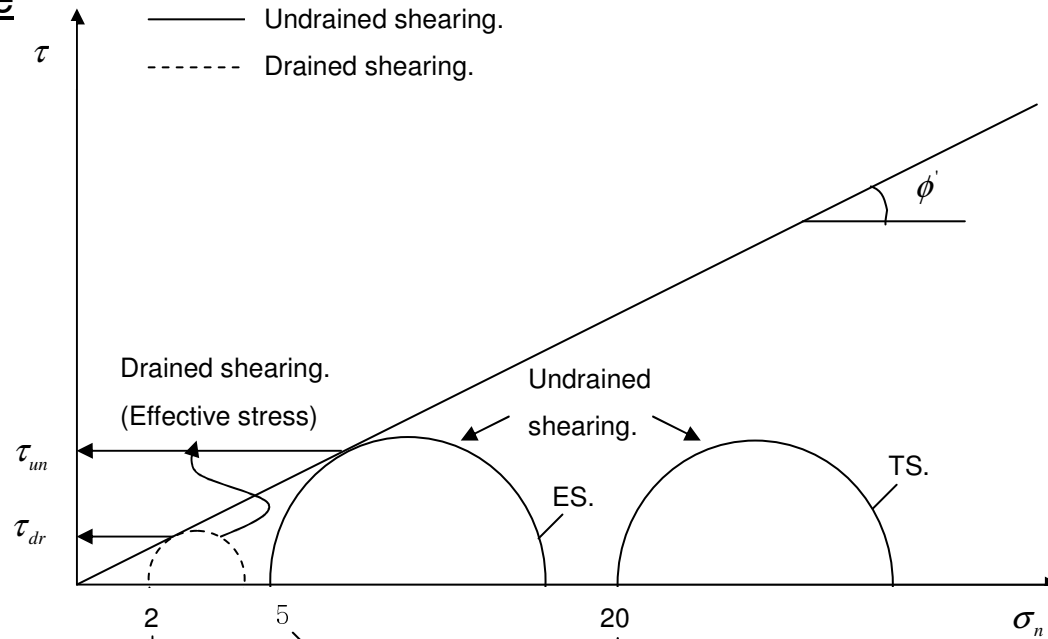$\Rightarrow$ Undrained strength governs for loading (TXC) conditions.

⊙ *Test* ⓑ

$\sigma'_{3cell} = 2$, $u_b = 18$ $\Rightarrow$ $\sigma_{3cell} = 20$ $(\sigma'_{3CR} = 5)$.

$\Rightarrow$ $\sigma'_{3cell} < \sigma'_{3CR}$

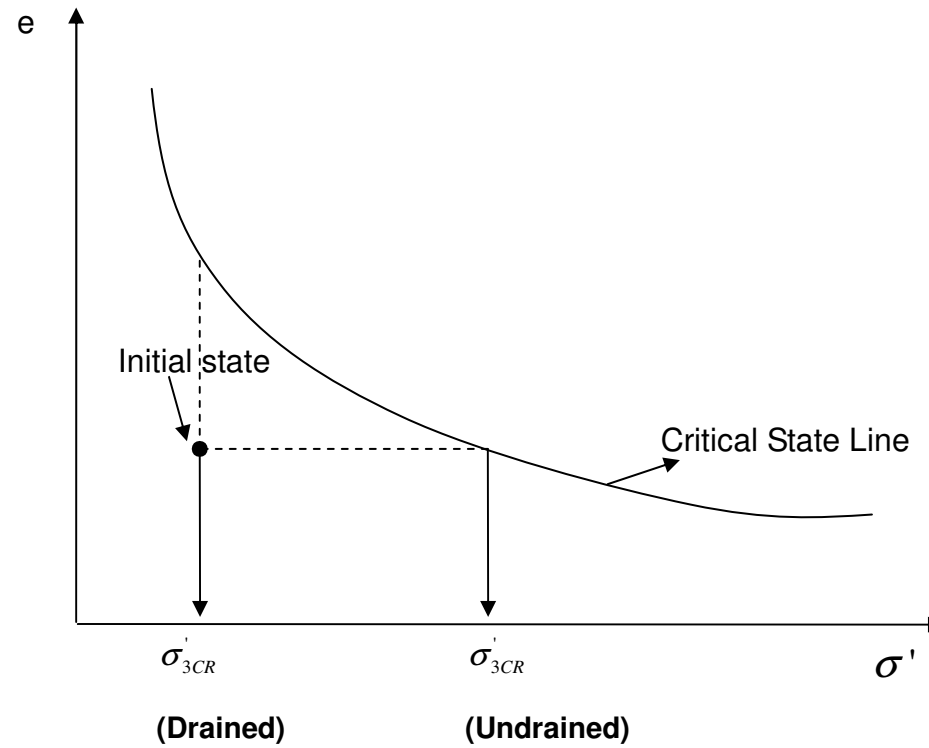|	TS		U	ES	
consol.	☐	← 20	18	☐	← 2
shear	☐	← 20	15	☐	← 5

● <u>Mohr's Circle</u>

$\sigma'_{3initial} < \sigma'_{3CR}$ (i.e. Dense sand or OC clay)

$\Rightarrow$ Drained strength governs for loading (TXC) conditions.

● **Comparison of Drained and Undrained Strength for Stress Paths in Compression**

Loading (Loading and Unloading for Triaxial Compression).

q

$(u_b = 0)$

ϕ'

ESP for Undrained Loading

of NC soil.

$\Rightarrow$ TXC and RTXC

ESP for Undrained Loading

of heavily OC soil.

$\Rightarrow$ TXC and RTXC

TSP for TXC of Undrained Loading

(ESP for TXC of Drained Loading)

$\Rightarrow$ NC and OC

p, p'

TSP for RTXC of Undrained Loading

(ESP for RTXC of Drained Loading)

$\Rightarrow$ NC and OC

	NC Soil.	Heavily OC soil.
TXC	CD > CU	CD < CU
RTXC	CD $\approx$ CU	CD << CU