O pewnych problemach badań trójosiowych

Marek Barański
PIG-PIB

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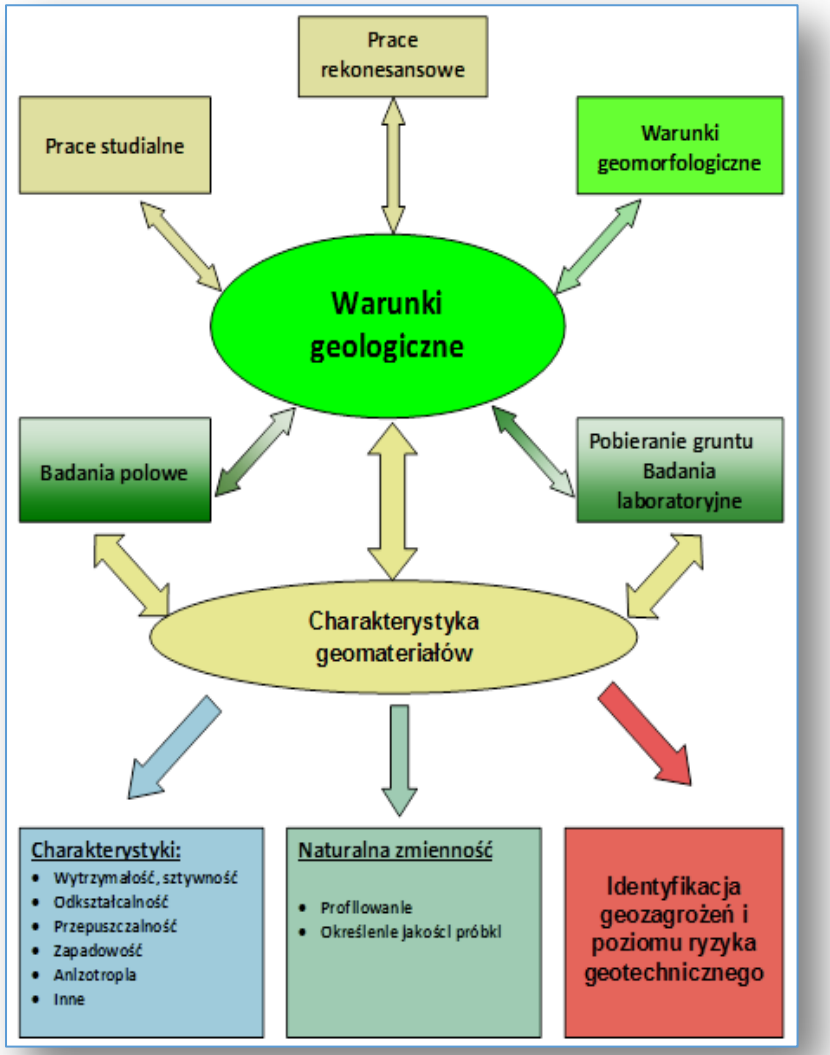

Soil Behaviour - SB

$$SB = f(\sigma', \sigma'_H, S_r, e, \dot{\varepsilon}, T, \emptyset, \dots)$$

Hight, Leroueil (2003)

Badania laboratoryjne – warunki konieczne

- Personel
- **Wiedza** – podstawy merytoryczne: mechanika gruntów, hydrogeologia, procedury i standardy badań - normy, instrukcje i specyfikacje inwestora, analiza problemu geotechnicznego, dobór metod badawczych……
- **Aparatura**
- Czas
- Koszty

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Aparatura badawcza

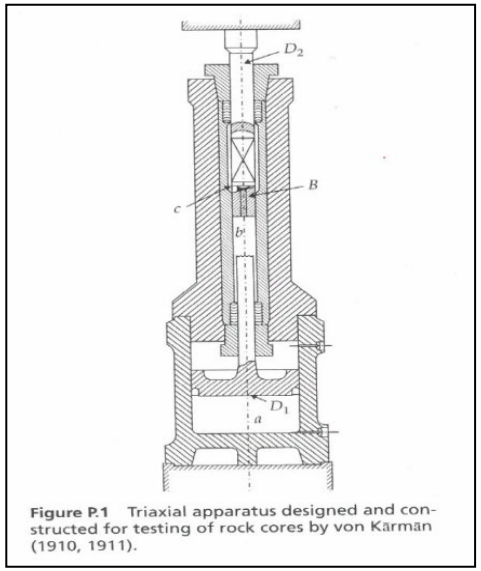
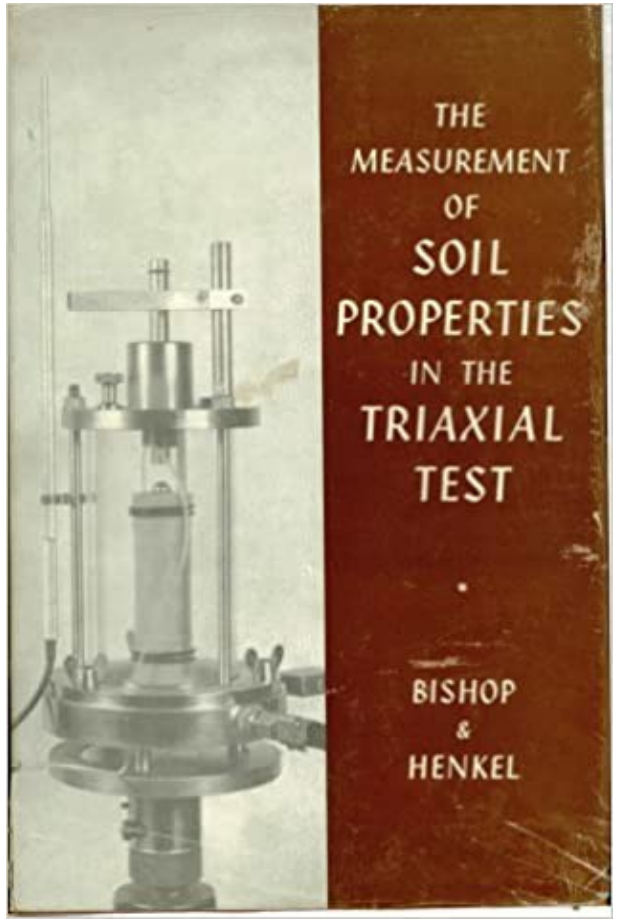
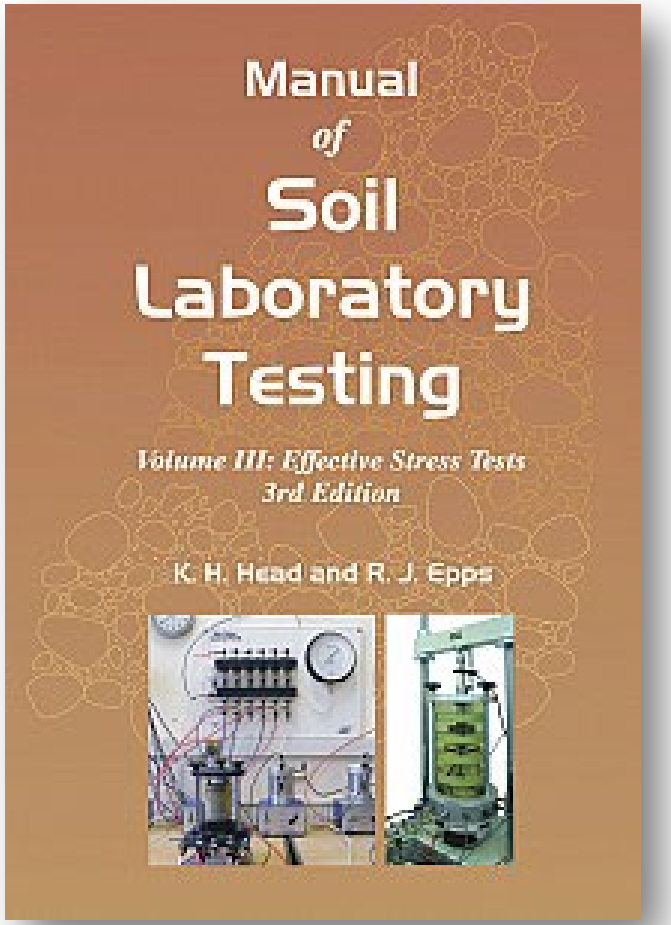
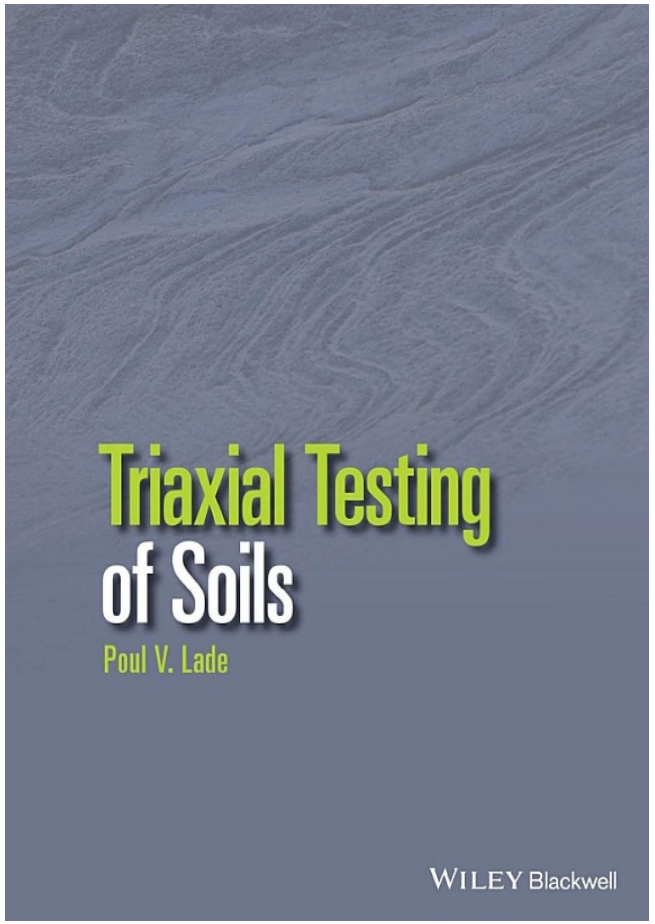


Figure P.1 Triaxial apparatus designed and constructed for testing of rock cores by von Kármán (1910, 1911).

Badania trójosiowe







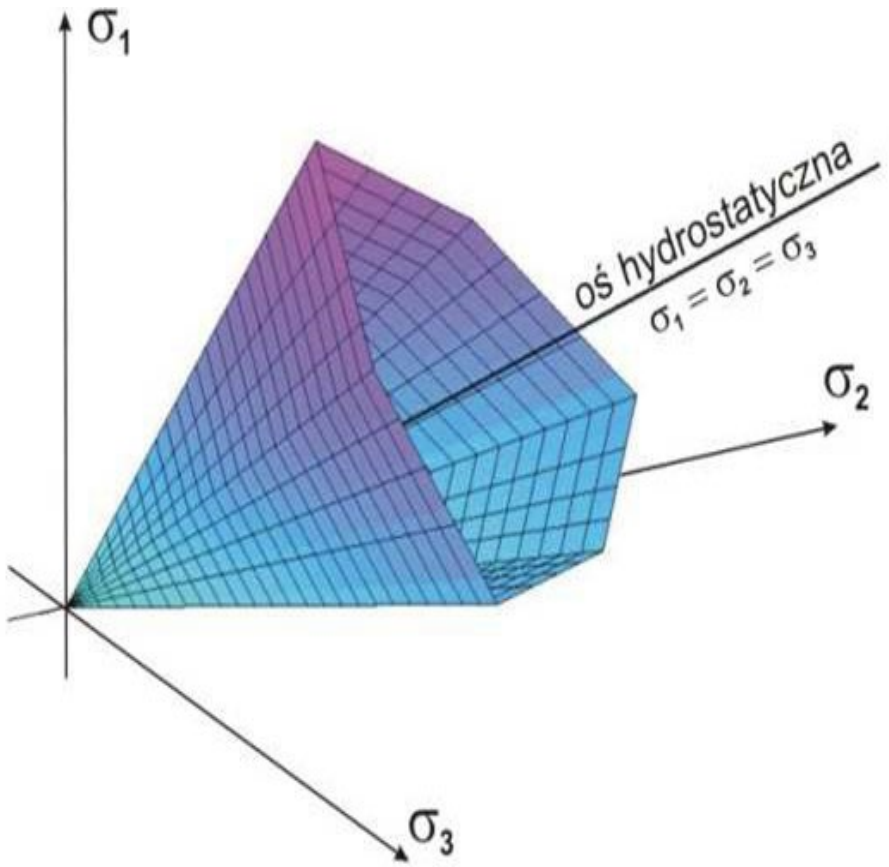
Kryterium Coulomba-Mohra

$$|\tau| \leq \sigma \tan \varphi + c$$

$$\sigma'_1 - \sigma'_3 = (\sigma'_1 + \sigma'_3) \sin \varphi' + 2c' \cos \varphi'$$

$$\boldsymbol{q - p \sin \varphi' - c' \cos \varphi' = 0}$$

$$\tau_f = c' + (\sigma - u) \tan \varphi' + (u_a - u) \tan \varphi^b$$



Normy – dokumenty referencyjne

Unia Europejska

1. PN-EN ISO 17892-9:2018-05 – Rozpoznanie i badania geotechniczne. Badania laboratoryjne gruntów. Część 9: Ściskanie trójosiowe z konsolidacją na próbkach całkowicie nasyconych wodą - *32 strony/38 stron*

Wielka Brytania

1. BS 1377-: 1990 Part 1: General requirements and sample preparation – *30 stron*
2. BS 1377-: 1990 Part 8: Shear strength test (effective stress) – *31 stron*

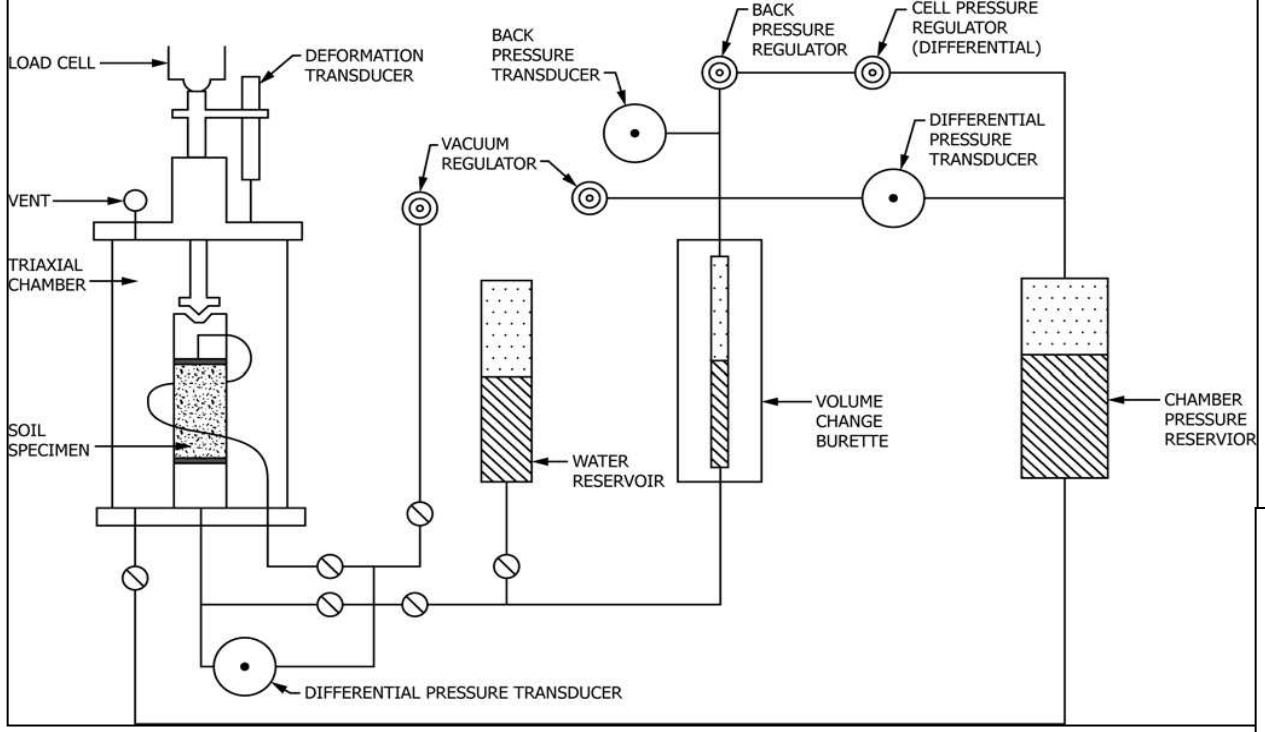
USA

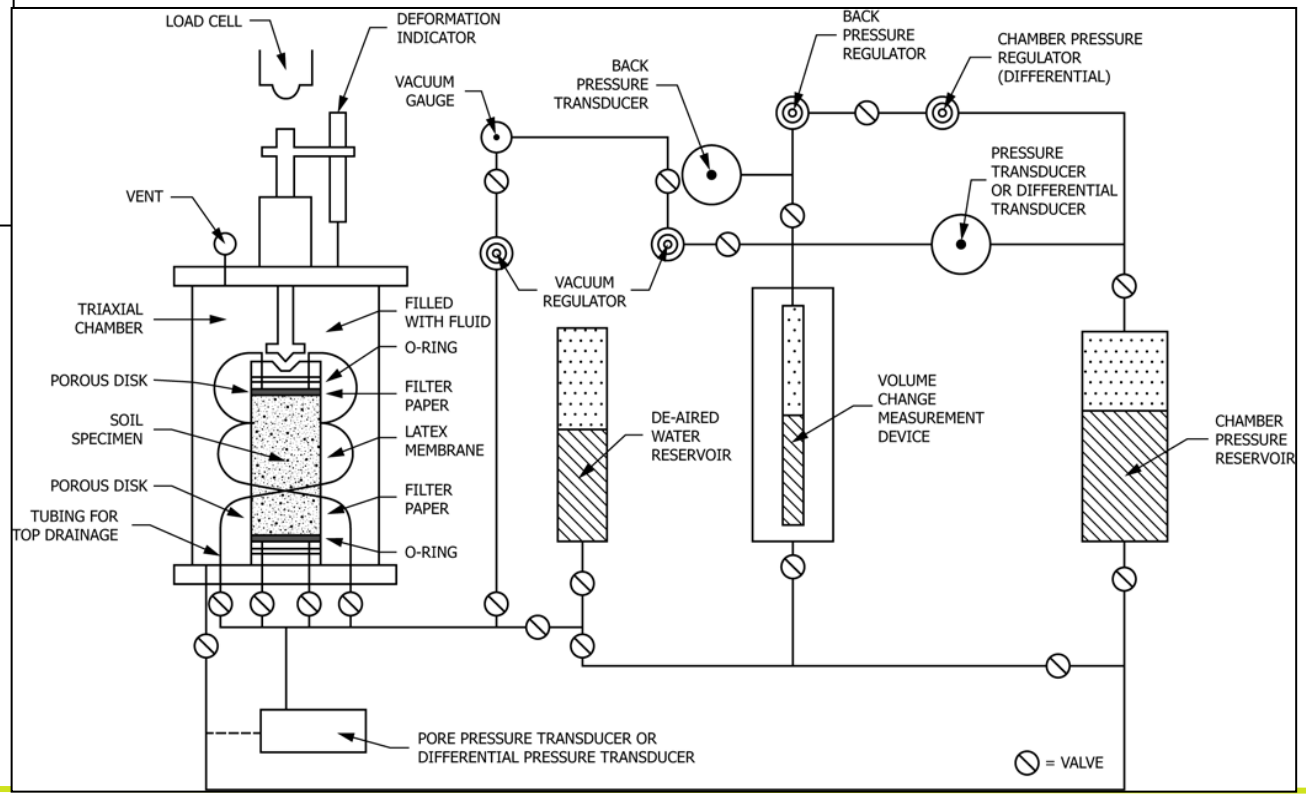
1. ASTM D4767-11 (2020) Consolidated Undrained Triaxial Compression Test for Cohesive Soils – *14 stron*
2. ASTM D7181-20 – Consolidated Drained Triaxial Compression Test for Soils - *12 stron*

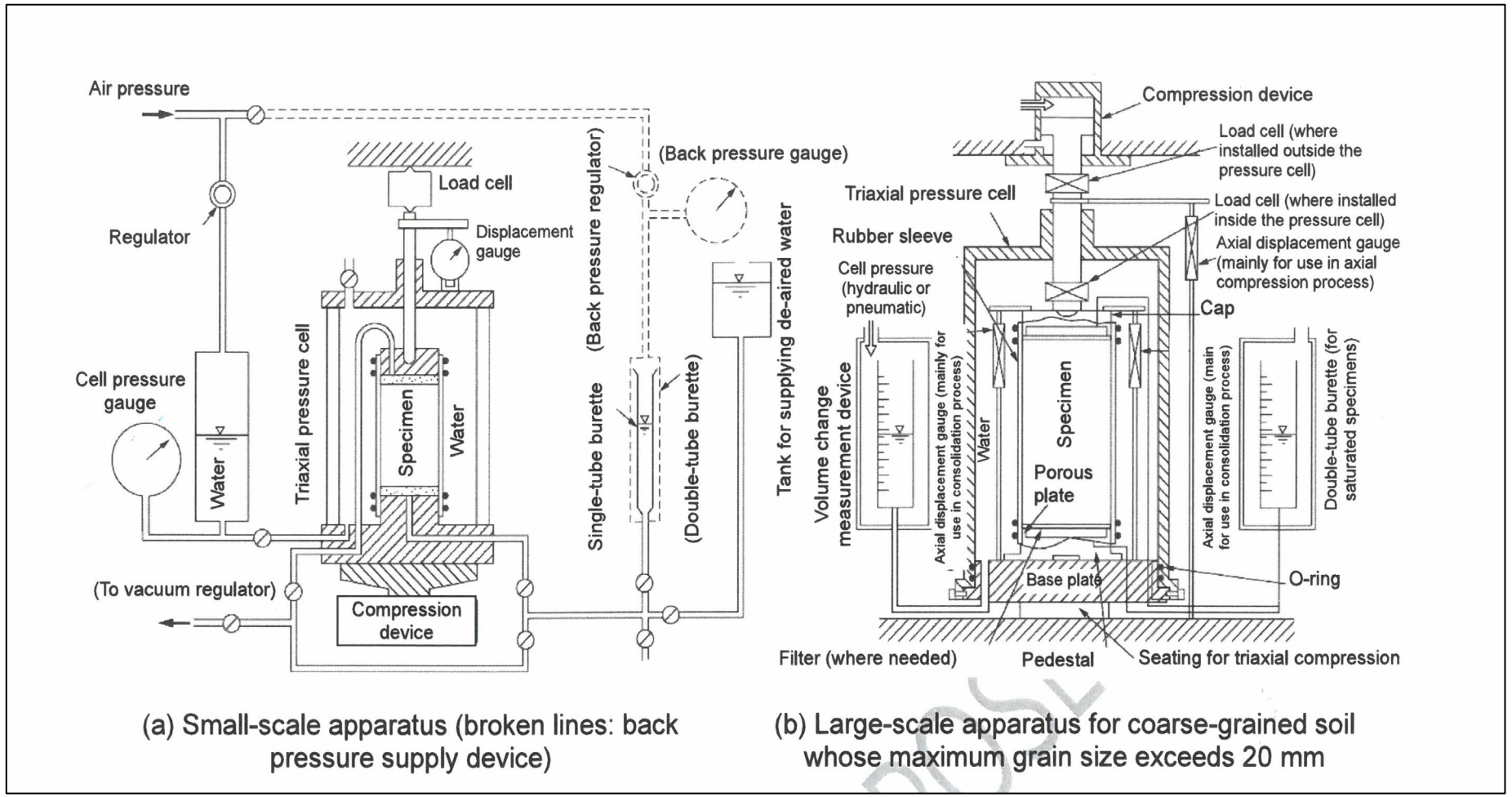
Nippon-koku – państwo japońskie

1. JGS 0520-2020 – Preparation of soil specimens for triaxial test – *10 stron*
2. JGS 0530-2020 – Preparation of specimens of coarse granular materials for triaxial tests – *10 stron*
3. JGS 0522-2020 – Method for consolidated-undrained triaxial compression test on soils - *7 stron*
4. JGS 0523-2020 – Method for consolidated-undrained triaxial compression test on soils with pore water pressure measurements – *8 stron*
5. JGS 0524-2020 – Method for consolidated-drained triaxial compression test on soils – *7 stron*
6. JGS 0525 -2020 – Method for K_0 consolidated-undrained triaxial compression test on soils with pore water pressure measurements – *11 stron*
7. JGS 0526 -2020 – Method for K_0 consolidated-undrained triaxial extension test on soils with pore water pressure measurements – *6 stron*

Układy badawcze -schematy



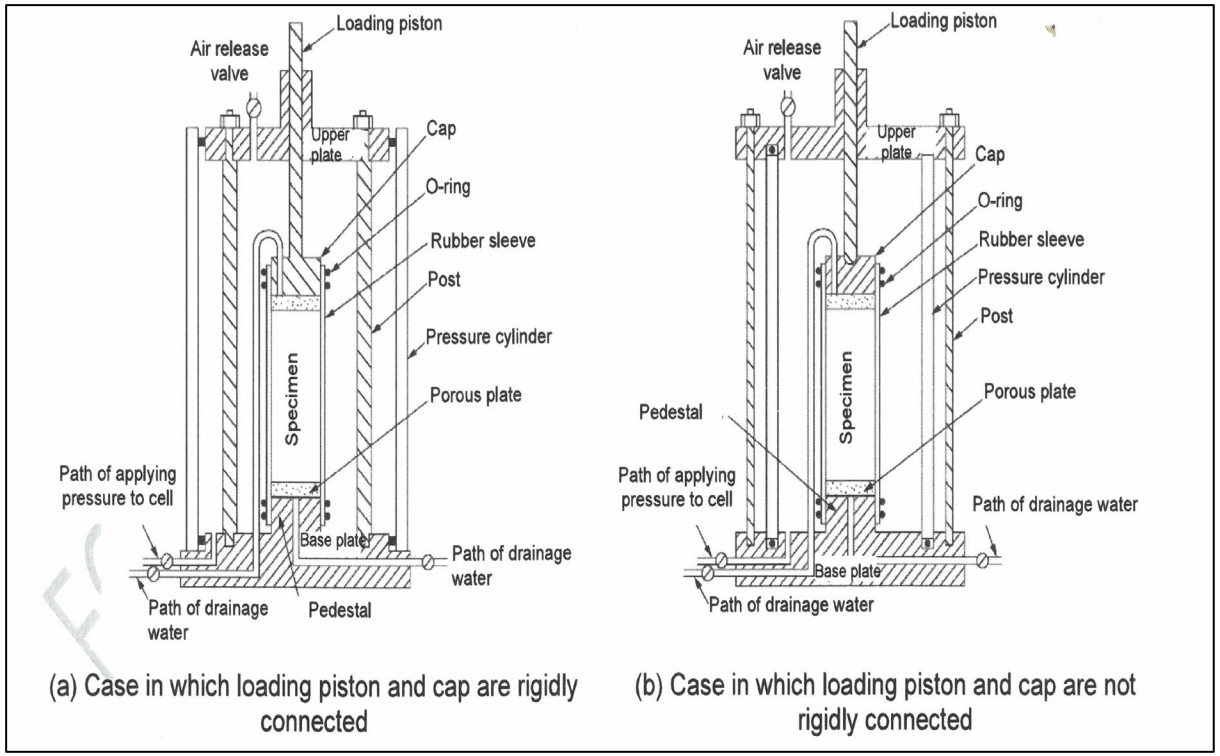




(a) Small-scale apparatus (broken lines: back pressure supply device)

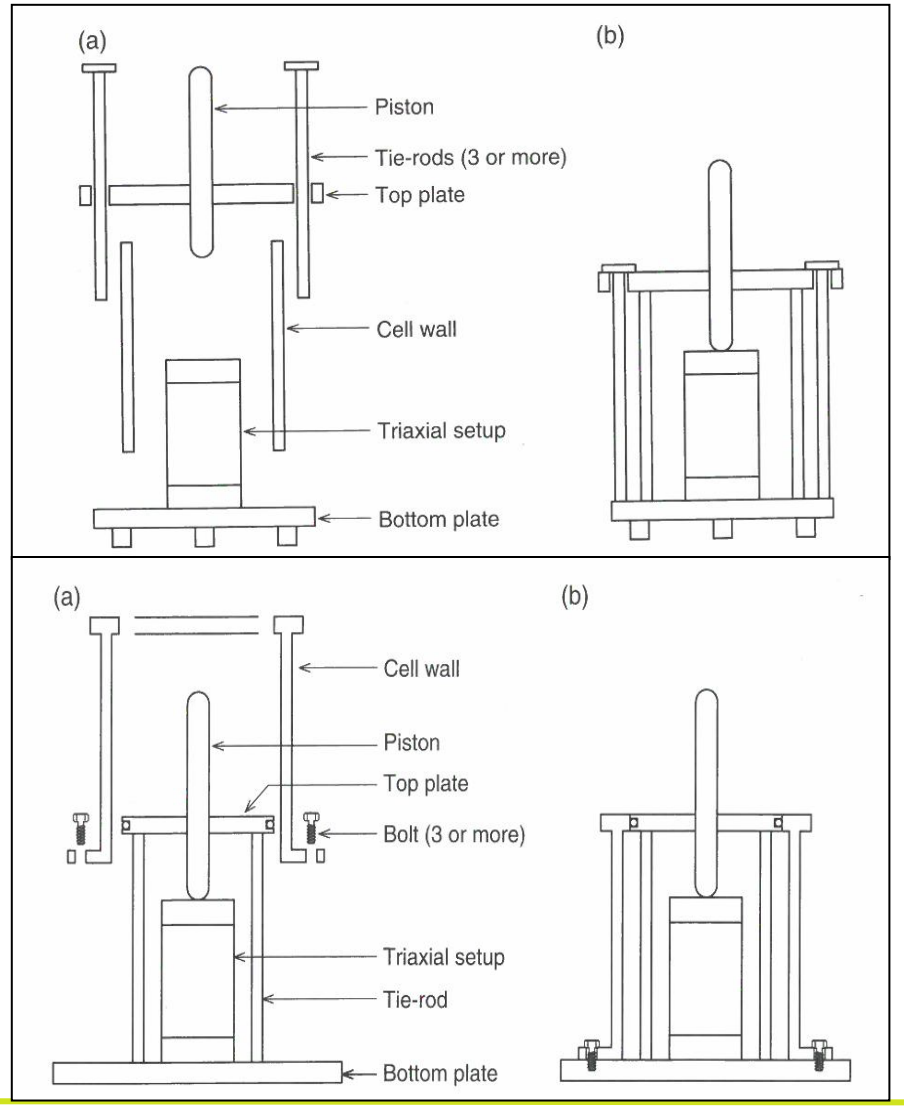
(b) Large-scale apparatus for coarse-grained soil whose maximum grain size exceeds 20 mm

Rodzaje komór badawczych



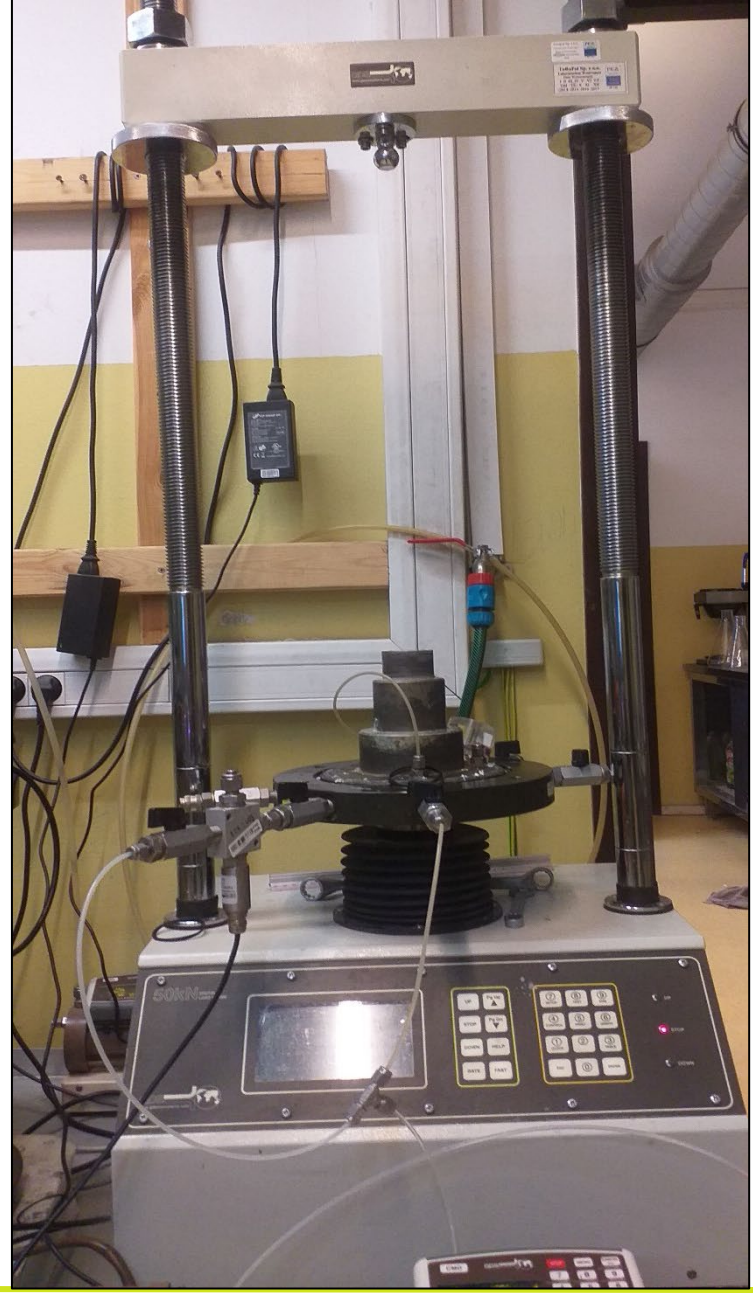
(a) Case in which loading piston and cap are rigidly connected

(b) Case in which loading piston and cap are not rigidly connected



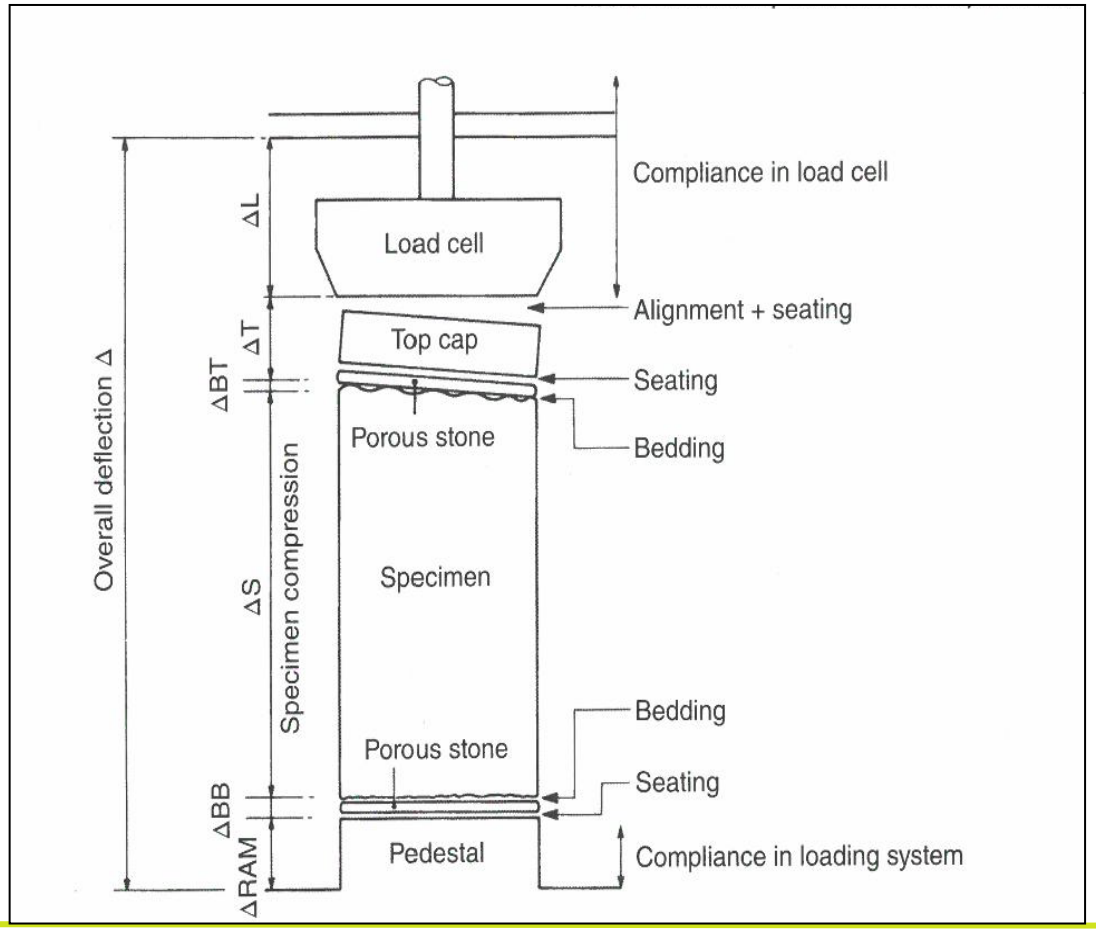
Zdjęcia GEOTEKO

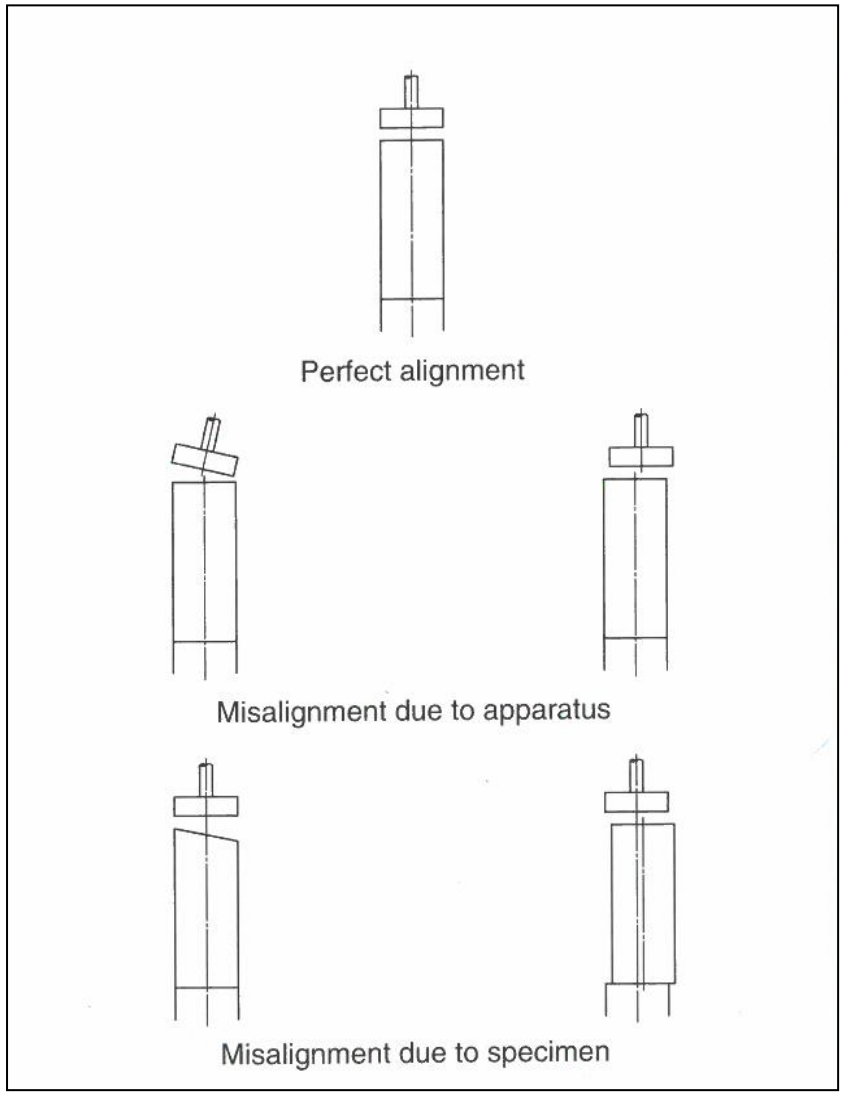

GDS
SWP 2MPa
DIGITAL LOAD FRAME V2

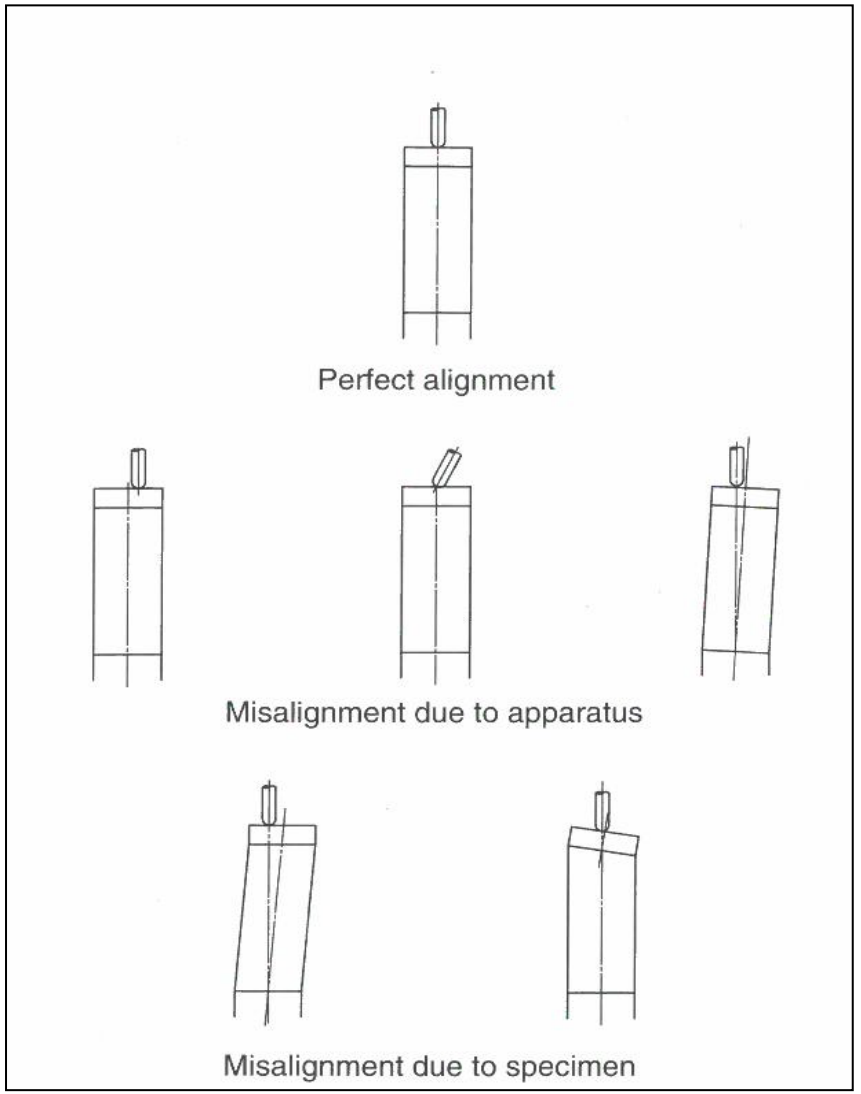

50kN

Błędy

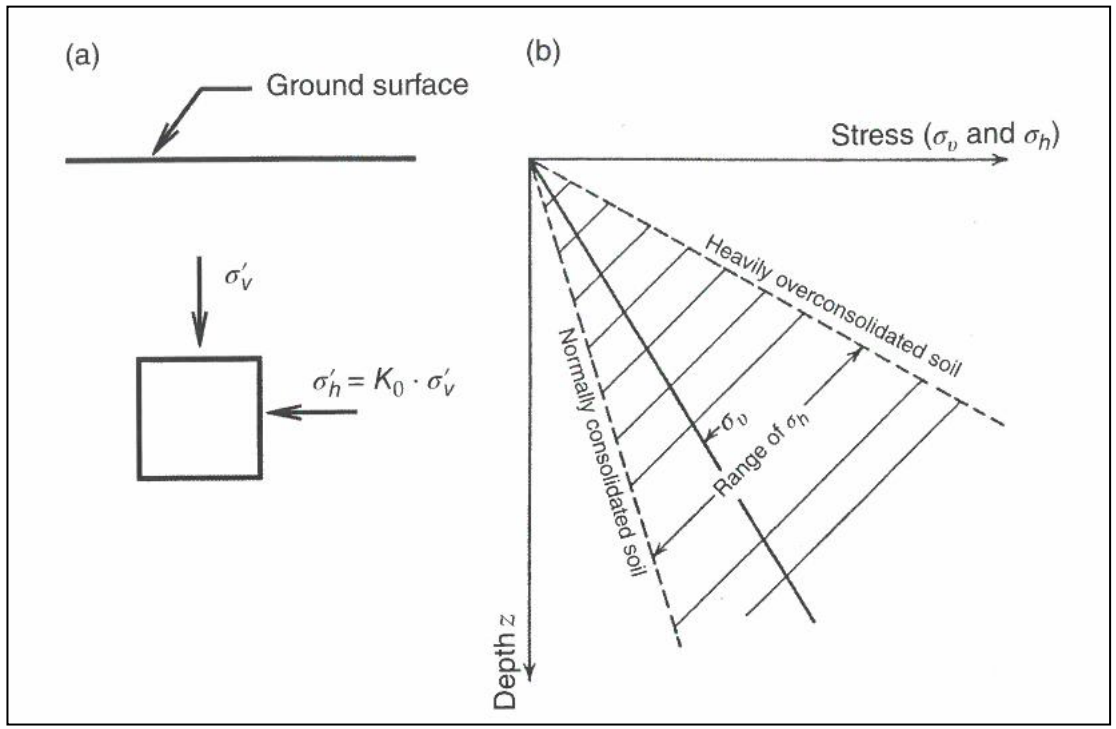
Type of error	Caused by
Seating errors	• Gaps closing between piston or internal load cell and specimen cap • Gaps closing between end plates and porous stones
Alignment errors	• Porous stones of nonuniform thickness • Non-verticality and eccentricity of loading ram • Non-horizontality of end platen surfaces • Tilt of specimen
Bedding errors	Surface irregularities and poor fit at the interface between the specimen and the porous stones
Compliance errors	• The tie-rods extend and cause relative displacement of the top plate of the triaxial cell with respect to the piston • Deflection of the internal load cell • The lubricant and rubber sheets are compressed in systems using lubricated ends • The porous paper at specimen ends is compressed
Nonuniform strain errors	Nonuniform deformations in specimen due to end restraint



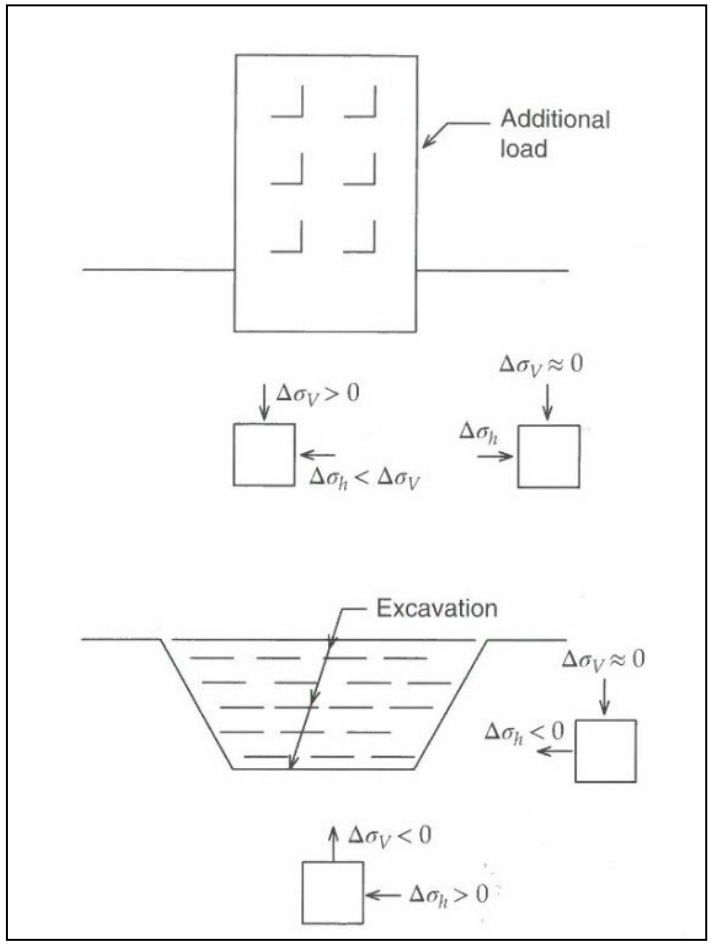

Perfect alignment
Misalignment due to apparatus
Misalignment due to specimen


Perfect alignment
Misalignment due to apparatus
Misalignment due to specimen

Analiza stanu naprężenia i problemu geotechnicznego

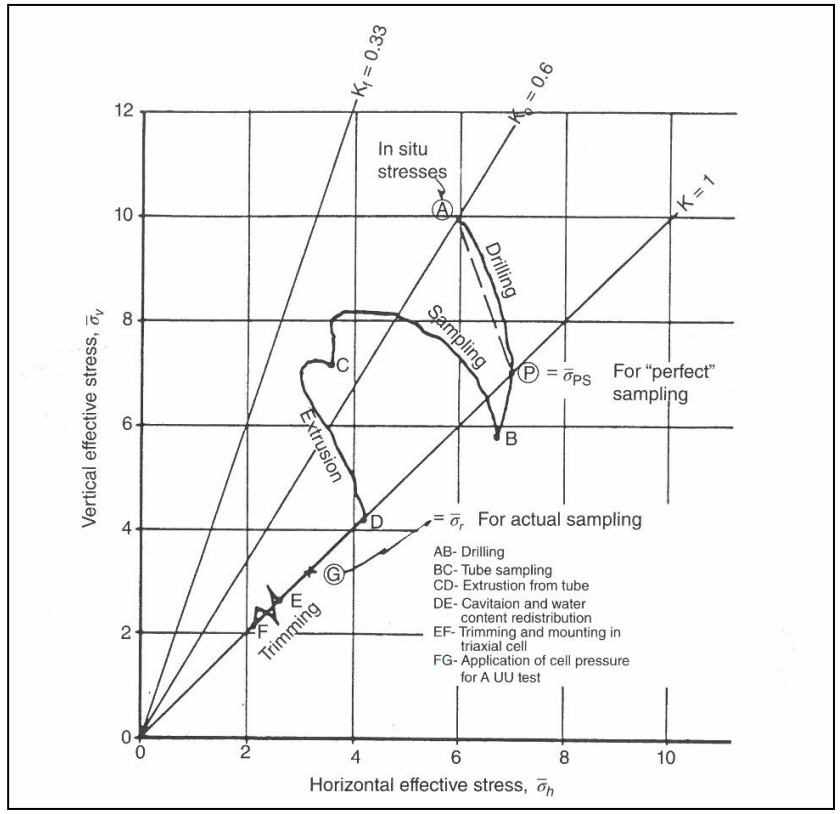


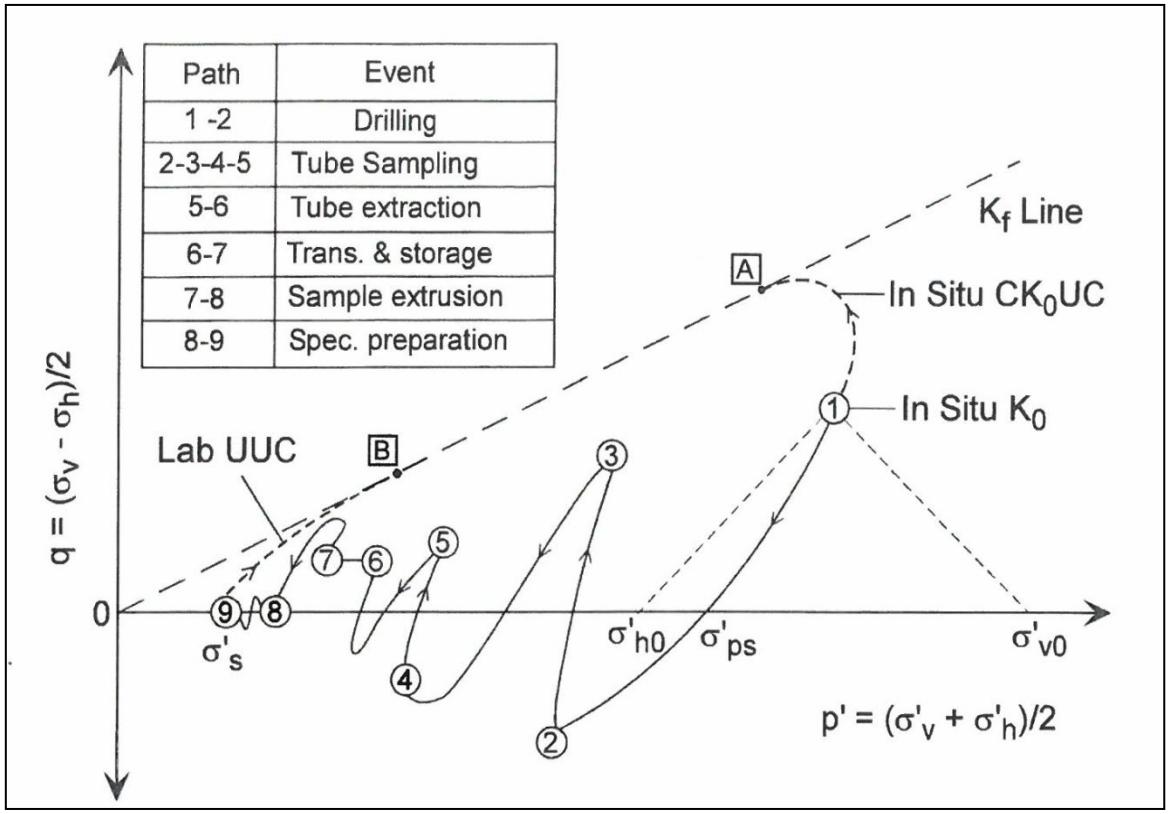
Stan NC / OC ?



Zmiana stanu naprężenia w podłożu

Badanie trójosiowe





$$\boldsymbol{sin\varphi = \frac{\sigma_1 - \sigma_3}{\sigma_1 + \sigma_3} = \frac{F}{F + 2A\sigma_3}}$$

$$A = A_c\left(\frac{1-\varepsilon_v}{1-\varepsilon_1}\right) \qquad A_c = (V_0 - \Delta V_{sat} - \Delta V_c)/H_c \qquad A_{c1} = A_0\left(1 - \frac{2}{3}\varepsilon_{vc}\right) \qquad \boldsymbol{A_c \neq A_{c1}}$$

$$H_c = H_0 - \Delta H_0 \qquad H_{c1} = H_0\left(1 - \frac{1}{3}\varepsilon_{vc}\right) \qquad \boldsymbol{H_c \neq H_{c1}}$$

$$\varepsilon_1 = \frac{\Delta h}{H_c} \qquad \boldsymbol{H_c \neq H_{c1}}$$

$$\boldsymbol{\sigma_3' = \sigma_3 - \Delta u = \sigma_3 - (u_t - u_b)}$$







$$\sigma_3' = \sigma_3 - \Delta u = \sigma_3 - (u_t - u_b)$$

Dziękuję za uwagę

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