NGI soil laboratory testing

Triaxial test

- *isotropic, anisotropic and K_o-consolidation*
- *monotonic and cyclic loading*
- *drained and undrained shearing*
- *stress-strain-strength properties*
- *creep tests*
- *special testing programs*

BACKGROUND

The triaxial test is the most basic and most used laboratory test in geotechnical engineering. Also at NGI the triaxial test has been the cornerstone test since NGI was established in 1953. Special equipment and procedures have been developed to determine as reliable soil parameters as possible for a wide range of geotechnical problems and soil types, especially very soft and quick clays.

TESTING EQUIPMENT AND PROCEDURES

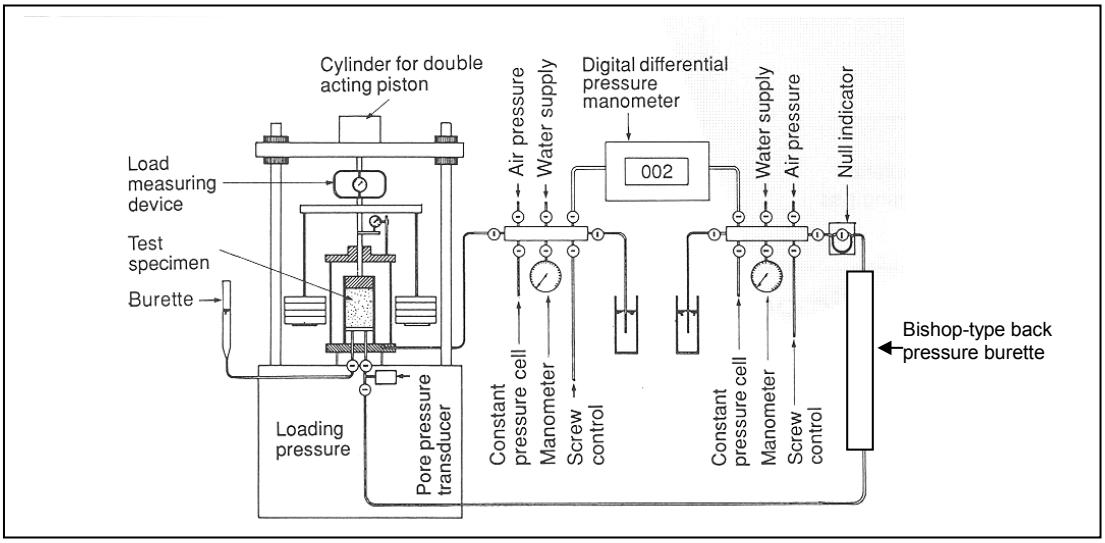
A cylindrical soil specimen with diameter of 36, 54, 72 or 80 mm is used. Other diameters are available upon request. A typical height of twice the diameter is enclosed in a rubber membrane inside the triaxial cell. Equipment and techniques are available to handle a range of soil types, including sample preparation, trimming and mounting of the specimen inside the triaxial cell. Special care is given to very soft soil by the "untouched by hand method" - which makes it possible to push the sample directly from the sample tube into the rubber membrane. Method of reconstitution of sand specimens is chosen according to desired density and structure.

After applying the back-pressure the specimen is consolidated isotropically or anisotropically before undrained or drained shearing. Static and cyclic loading can be performed as either stress-controlled or strain-controlled. The specimen can be subjected to varying cyclic stress or strain levels and frequencies.

Experience and research at NGI through several decades have improved the equipment and the testing techniques for triaxial tests and helped achieve high quality.

SPECIAL FEATURES / CAPABILITIES

- 14 triaxial units with 4 mobile pneumatic cyclic units
- One servo-hydraulic closed-loop cyclic testing system
- Accurate measurement of small strains
- G_{max} (maximum shear modulus) can be measured by bender element in top and bottom of specimen measuring shear wave velocity
- Tests on samples containing gas under both monotonic and cyclic loading
- Use of smooth end plattens for shorter samples and stiff soils
- "Untouched by hand" and paraffin methods for minimum disturbance and accurate measurement on soft clays
- Permeability measurement under back pressure



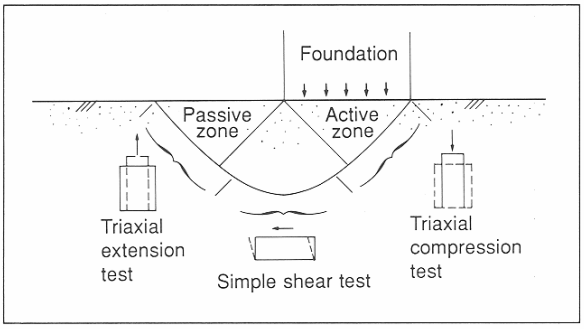
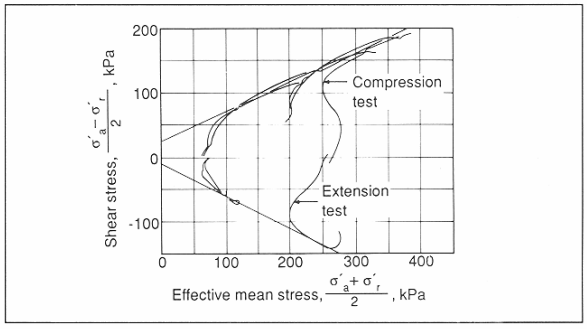
Sketch of triaxial test set-up

Key NGI references:

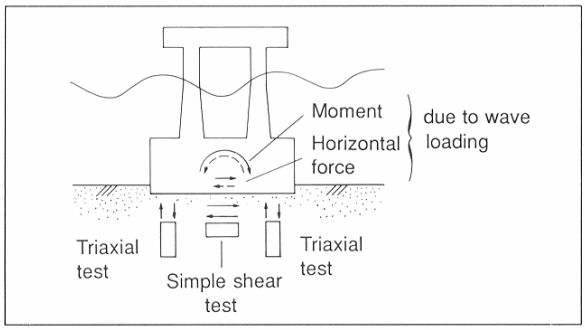
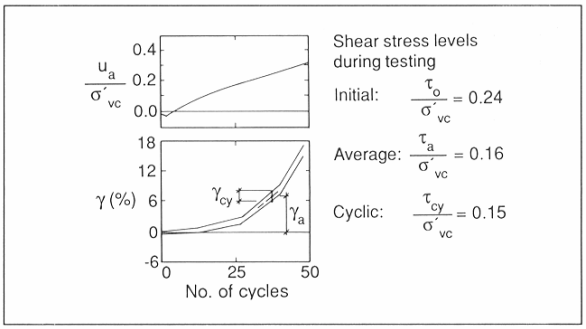
Berre, T. (1981). Triaxial testing at NGI. Geotechnical Testing Journal, Vol. 5, 1982, No. 1/2, pp. 3-17.

Lacasse, S. and T. Berre (1988). Triaxial testing methods for soils. State-of-the-art paper. ASTM, Special Technical Publication, 977, pp. 264-289.

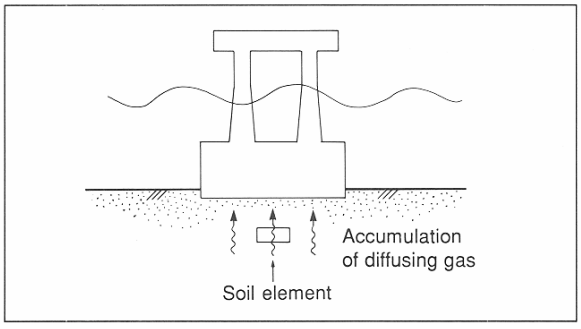
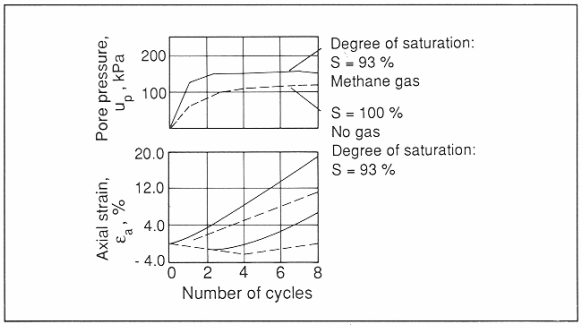
Example applications of triaxial test

Geotechnical problem	Laboratory test results
	

Stability of shallow foundation or excavation in soft clay

Cyclic loading of gravity base structure

Effect of shallow gas on cyclic behaviour of dense sand

P.O. Box 3930 Ullevaal Stadion
N-0806 Oslo, Norway

Street address: Sognsveien 72, 0855 Oslo

Telephone: +47 22 02 30 00
Telefax: +47 22 23 04 48
E-mail: ngi@ngi.no
Internet: www.ngi.no