SCHEDA N°1

Il candidato esponga le differenze tra una prova di taglio diretto classica e una effettuata in scatola di taglio di grandi dimensioni.

Il candidato esponga l'utilizzo di un tubo inclinometrico e descriva le modalità di esecuzione di una misurazione.

Il candidato illustri le diverse tipologie di rischio in un laboratorio geotecnico.

Il candidato esponga quale procedura informatica (es. MS Office) deve seguire per restituire i dati di una prova edometrica in forma di grafico.

Il candidato legga e traduca in italiano il testo in lingua inglese allegato.

SCHEDA N°2

Il candidato esponga la differenza tra una prova di permeabilità in laboratorio eseguita a carico costante e una eseguita a carico variabile.

Il candidato illustri lo scopo di una prova Lugeon e la sua esecuzione.

Secondo il D.Lgs 81/2008 e s. m. i., cosa sono i DPI, quando devono essere impiegati e quali sono i requisiti che devono possedere?

Il candidato esponga quale procedura informatica (es. MS Office) deve seguire per restituire i dati di una prova di taglio diretto in forma di grafico.

Il candidato legga e traduca in italiano il testo in lingua inglese allegato.

SCHEDA N°3

Il candidato illustri la metodologia più comune per la determinazione dei limiti di consistenza con i dovuti riferimenti alla normativa tecnica.

Il candidato illustri in quali casi è opportuno utilizzare una cella piezometrica piuttosto che un piezometro a tubo aperto.

Secondo il D.Lgs 81/2008 e s. m. i., che differenza c'è tra DPC e DPI e chi deve predisporli?

Il candidato esponga quale procedura informatica (es. MS Office) deve seguire per restituire i dati di una prova triassiale in forma di grafico.

Il candidato legga e traduca in italiano il testo in lingua inglese allegato.

SCHEDA N°4

Il candidato illustri le modalità di esecuzione di un'analisi granulometrica, con gli appropriati riferimenti alla normativa tecnica.

Il candidato esponga i metodi per il campionamento indisturbato di terreno e le caratteristiche delle attrezzature da impiegare.

Secondo il D.Lgs 81/2008 e s. m. i., cos'è il DVR, chi lo redige e cosa deve contenere?

Il candidato esponga quale procedura informatica (es. MS Office) deve seguire per elaborare i dati di un test per determinare il limite di liquidità.

Il candidato legga e traduca in italiano il testo in lingua inglese allegato.

SCHEDA N°5

Il candidato illustri in quale modo si può determinare la RCS in laboratorio, con gli appropriati riferimenti alla normativa tecnica.

Il candidato illustri scopo e modalità di esecuzione di una prova su piastra.

Secondo il D.Lgs 81/2008 e s. m. i., cosa si intende per RAR e RAD di un laboratorio e quali sono i loro compiti?

Il candidato esponga quale procedura informatica (es. MS Office) deve seguire per elaborare i dati di una prova Proctor in forma di grafico.

Il candidato legga e traduca in italiano il testo in lingua inglese allegato.

— the application of increments of cell pressure with closed drainage, with resulting increase in pore water pressure, or

— the application of increments of both cell and back pressure with open drainage.

The selection of the method of saturation shall ensure that the effective stresses within the specimen are not raised to a level that affects behaviour during the shear stage.

NOTE A pore water pressure at the end of saturation of at least 300 kPa is normally required to ensure adequate saturation except in the case of soft clay specimens taken from below groundwater, when this high pore water pressure is not necessary.

6.3.2.2 The effective stresses acting on the specimen during saturation shall not exceed the specified effective consolidation stresses.

6.3.2.3 If performing saturation with closed drainage, the following should also be met:

— the observed increase in back pressure during increments of cell pressure should be at least 90 % of the corresponding increase in cell pressure.

— for effective consolidation stresses below 20 kPa the difference in the increment of cell and back pressure should be kept below 2 kPa.

If these criteria cannot be met, saturation using open drainage should be considered to ensure that the requirements of 6.3.2.2 are met.

If applying back pressure using open drainage, the change in effective stress should be not greater than 5 kPa during saturation.

6.3.2.4 For dilatant materials, the back pressure should be high enough to prevent gas coming out of solution during shearing of the specimen.

6.3.3 Saturation checks

6.3.3.1 The following check to ensure that the saturation is adequate may be performed prior to consolidation or immediately prior to shearing. The latter option will give higher confidence that the specimen is adequately saturated for the shearing stage.

6.3.3.2 The saturation of the specimen shall be checked by measuring the B-value. To perform the check, close the drainage to the specimen, increase the cell pressure by an isotropic increment ($\Delta\sigma$) and record the corresponding increase in pore pressure (Δu). The value of the isotropic increment needs to be carefully chosen, reflecting the nature of the sample and the intended final effective stresses required on the sample, but increments between 10 kPa and 100 kPa are often found to be appropriate.

6.3.3.3 Calculate the B-value according to Formula (1):

$$B = \frac{\Delta u}{\Delta \sigma_c} \qquad (1)$$

6.3.3.4 Saturation should be considered complete when a B-value of at least 0,95 is achieved. If the B-value is less than 0,95, further increments of cell pressure, or cell and back pressure (6.3.2.1) shall be applied and the B-value re-measured (6.3.3.2 and 6.3.3.3). If during repeated increments the B-value shows no significant increase, the saturation stage may be considered complete.

6.3.3.5 The measured B-value may increase with time. If the B-value requirement is not satisfied within 10 min after application of an isotropic increment, steps should be taken to improve the saturation of the

6.7.1.2 Initial readings of all measuring devices shall be taken and the position of all valves checked. Record the rate of volumetric strain immediately prior to shearing.

6.7.1.3 Select an appropriate logging frequency for all measurement devices commensurate with the parameters that are to be reported. Ideally at least 15 readings should be taken prior to failure, and at intervals no greater than 1 % vertical strain. For brittle materials, readings may need to be taken at smaller intervals of strain to define failure.

6.7.1.4 If the axial strain at which the test is to be stopped has not been specified, the test may be stopped when the strain reaches 15 %, or exceeds the strain at peak deviator stress by 5 %, or when the deviator stress has reduced by 20 % from the peak value, whichever occurs earlier.

6.7.2 Undrained tests (CIU and CAU)

6.7.2.1 Close the drainage lines so that no drainage can take place during shearing.

6.7.2.2 The rate of strain shall be selected so that adequate equalization of pore pressure occurs during the shear stage. If no documented information about allowable rate of strain is available, the rate of vertical displacement of the load frame, v_{max} shall not exceed the value calculated from Formula (2) based on the undrained F values in Table 1:

$$v_{max} = \frac{H_c \times \varepsilon_{vf}}{F \times t_{50}} \text{ or } v_{max} = \frac{H_c \times \varepsilon_{vf}}{(F/4) \times t_{100}} \quad (2)$$

The values of the consolidation times, t_{50} and t_{100}, can be determined from a plot of volume against time during consolidation, following one of the methods in ISO 17892-5.

Table 1 — Factors for calculating rate of displacement of load frame

Drainage conditions during consolidation	Values of F (for H_i/D_i = 2)	
	Undrained test	Drained test
from one end	2,1	34
from both ends	8,4	34
from radial boundary and one end	7,2	56
from radial boundary and two ends	9,2	64

6.7.3 Drained tests (CID and CAD)

6.7.3.1 Tests shall be run slowly enough to ensure negligible pore pressure changes in the specimen during shearing. The specimen shall be allowed to drain freely during shearing. If no documented information about allowable rate of strain is available, the rate of vertical displacement of the load frame, v_{max} shall not exceed the value calculated from Formula (2) based on drained F values in Table 1. These F values assume that the drainage conditions during consolidation and drained shearing are the same.

6.7.3.2 For drained tests the maximum rate of vertical displacement of the loading frame, v_{max} should not exceed 10 % per hour

6.7.3.3 For drained tests on specimens with no side drains, and one-way drainage, the choice of strain rate may be verified by measuring the pore pressure and the constant back pressure to show that they differ by no more than 4 % of the effective horizontal stress.

6.8 Dismounting

6.8.1 For coarse grained soils a rough sketch of the specimen indicating the main failure planes may be made, or a photograph taken, before the pressures are removed.

6.8.2 Close the specimen drainage valves, unload the piston and reduce the cell and back pressure to zero. Drain the cell fluid.

6.8.3 Remove the specimen from the triaxial cell as quickly as possible and remove the membrane and porous discs and filter papers if used.

6.8.4 Sketch or photograph the specimen to illustrate the mode of failure.

6.8.5 Weigh the whole specimen.

6.8.6 Cut the specimen open to allow any internal structures or inhomogeneity to be identified and recorded. If there are particles greater than 1/10 of the specimen diameter, their size and approximate proportion shall be noted. A photograph of the cut specimen may be taken.

NOTE The presence of particles greater than 1/10 of the specimen diameter can affect the results. The magnitude of the effects will depend on the nature of the specimen and the quantity, location and composition of these particles.

6.8.7 Either determine the dry mass of the entire specimen, or determine the water content of a representative part of the specimen without further delay in accordance with ISO 17892-1 in order that the dry mass may be calculated. If a failure surface is present, an additional water content may be taken from near the failure surface.

7 Test results

7.1 Bulk density, dry density and water content

7.1.1 Calculate the initial water content from the final dry mass and the initial wet mass if the whole specimen has been dried. Otherwise the water content of the representative part of the specimen (6.8.7) shall be used.

7.1.2 Calculate the initial bulk and dry densities from the initial measurements of specimen dimensions and mass following the linear measurement procedures in accordance with ISO 17892-2.

7.1.3 The initial void ratio and initial degree of saturation, based on a particle density value measured in accordance with ISO 17892-3, or estimated, may be calculated if required.

7.2 Calculations of test parameters

7.2.1 Height after consolidation

If the height of the specimen after isotropic consolidation, H_c is not measured, it should be estimated according to Formula (3).

$$H_c = (1 - f \times \frac{\Delta V_c}{V_i}) \times H_i \qquad (3)$$

NOTE The value of f is typically 1/3 for homogenous soils with isotropic stresses but other values can be appropriate for soils with anisotropic stresses.

— callipers, either analogue or digital, readable to 0,1 mm or 0,1 % of the measured length, whichever value is greater.

6 Test procedure

6.1 General requirements and equipment preparation

6.1.1 The test specimen shall be cylindrical with a diameter not less than 34 mm and a height from 1,8 to 2,5 times the diameter. The largest particle size should not exceed 1/6 of the specimen diameter. Specimens of other sizes or height to diameter ratios may be tested using special procedures.

6.1.2 The drainage tubes and valves shall be checked before each test to confirm that they are not clogged.

6.1.3 Confining membranes should be immersed in water for at least 24 h before being used. The membranes shall be free of excess surface water on the inside before being placed onto the soil specimen.

6.1.4 The porous discs shall be clean and not clogged.

6.1.5 Prior to each test check that there is no visible sign of damage to any of the equipment and that the piston runs smoothly.

6.1.6 If leakage of water from the cell or any water line is observed at any time during the test, the test shall be halted, the pressure removed from the leaking part if necessary and the leak eliminated before resuming the test. The effect of the leak on the sample shall be evaluated and if detrimental the test may be judged invalid.

6.1.7 The system may be checked for leaks when the set-up is ready for the triaxial cell to be mounted. A small suction, (for example 10 kPa but not more than the intended effective stress) may be applied to the drainage tubes. The vacuum shall then be shut off. If the vacuum decreases over a time period of about 2 min, efforts should be made to detect and eliminate any leaks in the membrane or drainage tubes.

6.2 Preparation of specimens

6.2.1 The following procedures shall apply to undisturbed, remoulded, re-compacted or reconstituted samples.

6.2.2 Examine undisturbed samples prior to testing. If significant disturbance is apparent in the specimen this should be recorded in the test report. Highly disturbed samples will not provide meaningful results and should not be tested.

6.2.3 Take care to maintain the water content of the specimen during the preparation process. If the process is interrupted, the specimen shall be protected so that the water content does not change. Air circulation around the specimen shall be avoided.

6.2.4 Cut and trim the specimen to the required dimensions. Take care to avoid deforming the specimen during the cutting and trimming process.

6.2.5 The soil specimen end surfaces shall be plane and perpendicular to the longitudinal axis in accordance with ISO 17892-2. Grooves and holes in the ends and sides of the specimen should be removed by further trimming or a new specimen selected if available. Otherwise, fill grooves or holes not exceeding 1/6 of the specimen diameter with remoulded sample material. Grooves and holes in the ends may be filled with a material that hardens with time and which does not release or absorb water.

specimen and system before performing shear, for example by applying a higher level of back pressure and/or longer duration of back pressure. The B value measurement shall be repeated.

6.3.3.6 The measured B-value may decrease with time, for example if a system with an air-bearing is used in the triaxial cell. If so, further B-value checks may also be required at later stages of the test.

6.3.3.7 If the end of saturation stage B-value requirement (6.3.3.4) cannot be accomplished, this shall be reported as a deviation which could also include a description of the measures taken to improve the saturation.

6.4 Isotropic consolidation (CIU and CID tests)

6.4.1 Adjust the cell pressure until the difference between the cell pressure and the pore pressure becomes equal to the specified effective stress.

6.4.2 If the cell pressure has been applied under undrained conditions, open the drainage line. Record the volume change as a function of time.

NOTE The vertical strain during consolidation can be measured by keeping the piston in contact with the top cap by applying a small load on the piston throughout the consolidation stage, by attaching the piston to the top cap by a suction device or by a fixed connection.

6.5 Anisotropic consolidation (CAU and CAD tests)

6.5.1 The effective stress path followed during anisotropic consolidation shall not approach failure at any time during consolidation.

6.5.2 Anisotropic consolidation may be achieved by one of the following methods:

a) The specimen may be isotropically consolidated with an effective stress equal to one of the required effective consolidation stresses. Once primary consolidation is complete under isotropic consolidation, deviator stress shall be applied by adjusting either the vertical or horizontal stress until the required anisotropic stress state is achieved with the specimen fully drained. This procedure may need to be carried out in steps to avoid excessive excess pore pressure.

b) Pressure ramps which control the horizontal and vertical stresses simultaneously to a pre-defined anisotropic stress state.

c) Pressure ramps that apply horizontal and vertical stresses that are controlled by the specimen behaviour, for example by maintaining a constant diameter of the specimen.

6.6 End of consolidation

The consolidation stage should be considered complete when the volume change is less than 0,1 % of the specimen volume per hour or 0,1 cm^3/h, whichever is greater, and the excess pore pressure when measured, is at least 95 % dissipated. If this criterion cannot be met the implications for the test results shall be evaluated and included in the test report.

6.7 Shearing

6.7.1 General

6.7.1.1 For all types of shearing described in this document, the total cell pressure shall be kept constant (with the accuracy that can be achieved with the equipment specified in 5.6) and the specimen loaded to failure (sheared) by moving the piston into the triaxial cell with a constant rate (with the accuracy specified in 5.7).