SA Water

SOUTH AUSTRALIAN WATER CORPORATION

TG 10l

TECHNICAL GUIDELINE

GENERAL TECHNICAL INFORMATION FOR GEOTECHNICAL DESIGN

~ Part L ~
Soil Testing

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No Changes Required In the January 2007 Edition

The following lists the major changes to the December 2004 edition of TG 10l:

1. Nil

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Section 1: Scope

Section 2: Hand Test for the Estimation of the Consistency of Clays and the Density of Sands with Correlation to UCS and SPT

Table 2.1 - Description of Hand Test for the Estimation of Consistency of Clay and the Density of Sand with Correlation to UCS and SPT.

Material		Hand Test (2)	Unconfined Compressive Strength q_u (1)	SPT (blows per 300 mm)
CLAYS	Very Soft Clay	Easily penetrated 40 mm with fist	< 25 kPa	< 2
	Soft Clay	Easily penetrated 40 mm with thumb	25 – 50 kPa	2 – 4
	Firm Clay	Moderate effort needed to penetrate 30 mm with thumb	50 – 100 kPa	4 – 8
	Stiff Clay	Readily indented with thumb but penetrated only with great effort	100 – 200 kPa	8 – 15
	Very Stiff Clay	Readily indented by thumbnail	200 – 400 kPa	15 – 30
	Hard Clay	Indented with difficulty by thumbnail	> 400 kPa	> 30
SANDS	Loose Clean Sand	Takes footprint (~25 kPa) more than 10 mm deep	n/a	< 10
	Medium-Dense Clean Sand	Takes footprint (~25 kPa) 3 mm to 10 mm deep	n/a	10 – 30
	Dense Clean Sand or Gravel	Takes footprint (~25 kPa) less than 3 mm deep	n/a	30 – 50

(1) The unconfined compressive strength (q_u) of a clay is equal to:
   a. The penetrometer reading.
   b. Twice the undrained shear strength ($2C_u$).

c. The “safe bearing capacity” for a typical shallow, vertically loaded, strip footing if the allowable settlement is about 25 mm. (FS = 2 on shear failure.)

(2) All field identification tests should be done on a freshly exposed hand-trimmed area by an engineer / technical officer competent in such work. Care must be taken to ensure that the soil in the test area was not compacted or loosened during the excavation. The moisture condition of the material at the time of testing must be recorded. If a clay soil is dry, and it is likely that it will become wetter during the life any structure proposed for the location, then the test area should be saturated and the water given time to be absorbed before repeating the trimming and the testing.

This “Technical Note” was prepared by Ed Collingham, 20/01/2003
(Ex Principal Engineer Geotechnical)

Section 3: Alternative In-Situ Tests for Shear Strength Parameters

Any in situ test for estimating the shear strength parameters – as an alternative to the triaxial testing of undisturbed – samples would need to have the following attributes:

1. Avoid the difficulties of and disturbance due to recovering samples;

2. Be continuous down the profile to give enough data to pick up the variability and allow averages to be estimated;

3. Be robust to cope with the inevitable rock and stone randomly distributed through the fill;

4. Be a good indicator of "consistency" irrespective of soil type – it is assumed likely that (for example) medium dense sands and stiff clays will be found together in a dam;

5. (In association with the previous attribute) test a reasonable volume of the in situ material to provide a "mechanical" averaging; and

6. Provide samples for detailed logging.

The only test that appears to meet all these criteria is the Standard Penetration Test. The SPT, apart from being simple and cheap:

(a) Is in-situ;

(b) Is continuous;

(c) Is certainly robust;

(d) Has a blow count for loose sands (< 10) similar to that for firm clay (4 to 8), and the blow count for medium dense sands (10 to 30) is similar to that for stiff (8 to 15) to very stiff (15 to 30) clays;

(e) Does effectively test a reasonable volume of material because the blow count depends not only on the consistency of the material picked up in the tube but also on the soil surrounding and ahead of the tube;

(f) Recovers a reasonable sample for detailed visual/tactile logging and hand penetrometer testing.

Other possible in situ tests (such as vane shear tests, pressuremeter or cone penetrometer), variously: are meant for softer clays; would be confused by sands; would be confused by the rapid changes or anisotropy in material type; would be stopped or damaged by stone; do not recover a sample for logging; or would be very expensive to perform.

This “Technical Note” was prepared by Ed Collingham, 06/02/2002
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