

NEW ZEALAND STANDARD

METHODS OF TESTING SOILS
FOR CIVIL ENGINEERING
PURPOSESPart 6
Soil strength tests6.5
DETERMINATION OF THE PENETRATION RESISTANCE OF A
SOILTEST 6.5.2
Hand method using a dynamic cone penetrometer

6.5.2.1

Scope

This method sets out the procedure for determining the resistance of a soil to the penetration of a steel cone driven by a 9 kg falling mass (see Note (1)).

6.5.2.2

Related documents

The provisions of Part 1 of this Standard are applicable to, and shall be read in conjunction with, this method of test.

6.5.2.3

Apparatus

- A dynamic cone penetrometer conforming to the dimensions and masses given in fig. 6.5.2.
- For procedure 1, a scale graduated in millimetres and accurate to 1 mm.
- A sight board or other suitable datum.

6.5.2.4

Procedure

6.5.2.4.1

The test shall be conducted using either Procedure 1 or Procedure 2 as set out below.

6.5.2.4.2

Procedure 1

- Excavate to the level at which the test is to be started (see Note (2)). At this level remove any material such as crushed rock or gravel which will be too hard to penetrate

with the penetrometer or which may damage the equipment.

Measure the depth from ground level to the excavated surface to the nearest 10 mm and record.

- Hold the penetrometer vertical with the point of the cone on the surface of the layer to be tested and gently tap the hammer on the anvil until the widest part of the cone has started to penetrate the surface.
- With the lower end of the scale on the datum and the scale parallel to the shaft of the penetrometer, take a reading alongside the ring engraved near the base of the hammer to the nearest 1 mm and record this as the origin of depth readings at zero blows.
- Raise the hammer to the stop (see Note (3)) and allow it to fall freely onto the anvil. Take the depth reading to the nearest 1 mm in the manner described in step (c) and record.
- Repeat (d) until either:
 - The penetrometer cone reaches the required depth
 - The penetrometer has been driven to the full length of the rod, or
 - Eight consecutive blows give less than 20 mm penetration (see Note (4)).

6.5.2.4.3

Procedure 2

- Excavate to the level at which the test is to

be started (see Note (2)). At this level remove any material such as crushed rock or gravel which will be too hard to penetrate with the penetrometer or which may damage the equipment.

Measure the depth from ground level to the excavated surface to the nearest 10 mm and record.

- (b) Hold the penetrometer vertical with the point of the cone on the surface of the layer to be tested and gently tap the hammer on the anvil until the widest part of the cone has started to penetrate the surface.
- (c) Set the datum at the level of one of the lower graduations on the shaft.
- (d) Raise the hammer to the stop (see Note (3)) and allow it to fall freely onto the anvil. If this or any subsequent blow causes more than 50 mm of penetration, record the amount of penetration for that blow, otherwise continue with additional blows until the next graduation on the shaft is level with the datum. Since the penetration will not in general correspond to the exact level of the graduation, count the number of blows to penetrate to or just beyond the graduation and record. In soft layers of soil it may be more convenient to estimate the penetration per blow (to the nearest 10 mm) and record.
- (e) Repeat (d) until either:
 - (i) The penetrometer cone reaches the required depth
 - (ii) The penetrometer has been driven to the full length of the rod, or
 - (iii) Eight consecutive blows give less than 20 mm penetration (see Note (4)).

6.5.2.5

Calculations

Where desired, calculate the penetration resistance by totalling the number of blows to produce 300 mm penetration.

6.5.2.6

Reporting of results

6.5.2.6.1

Report the following as appropriate:

- (a) Results:
 - (i) The depth below ground level at the commencement of penetration

- (ii) The penetration resistance (blows per 300 mm penetration) and depth to centre of tested interval, and/or
 - (iii) The cumulative number of blows and the corresponding depths of penetration, presented either as a table or graph, and/or
 - (iv) The number of blows for each graduation interval (50 mm) and the depth of penetration.
- (b) Subsurface conditions if determined (see Note (1)), for example visual description of the soil, density, water content and the location of the ground water table.
 - (c) General information:
 - (i) The date of test
 - (ii) The location of test
 - (iii) The reduced level of the ground surface at the test site.

6.5.2.6.2

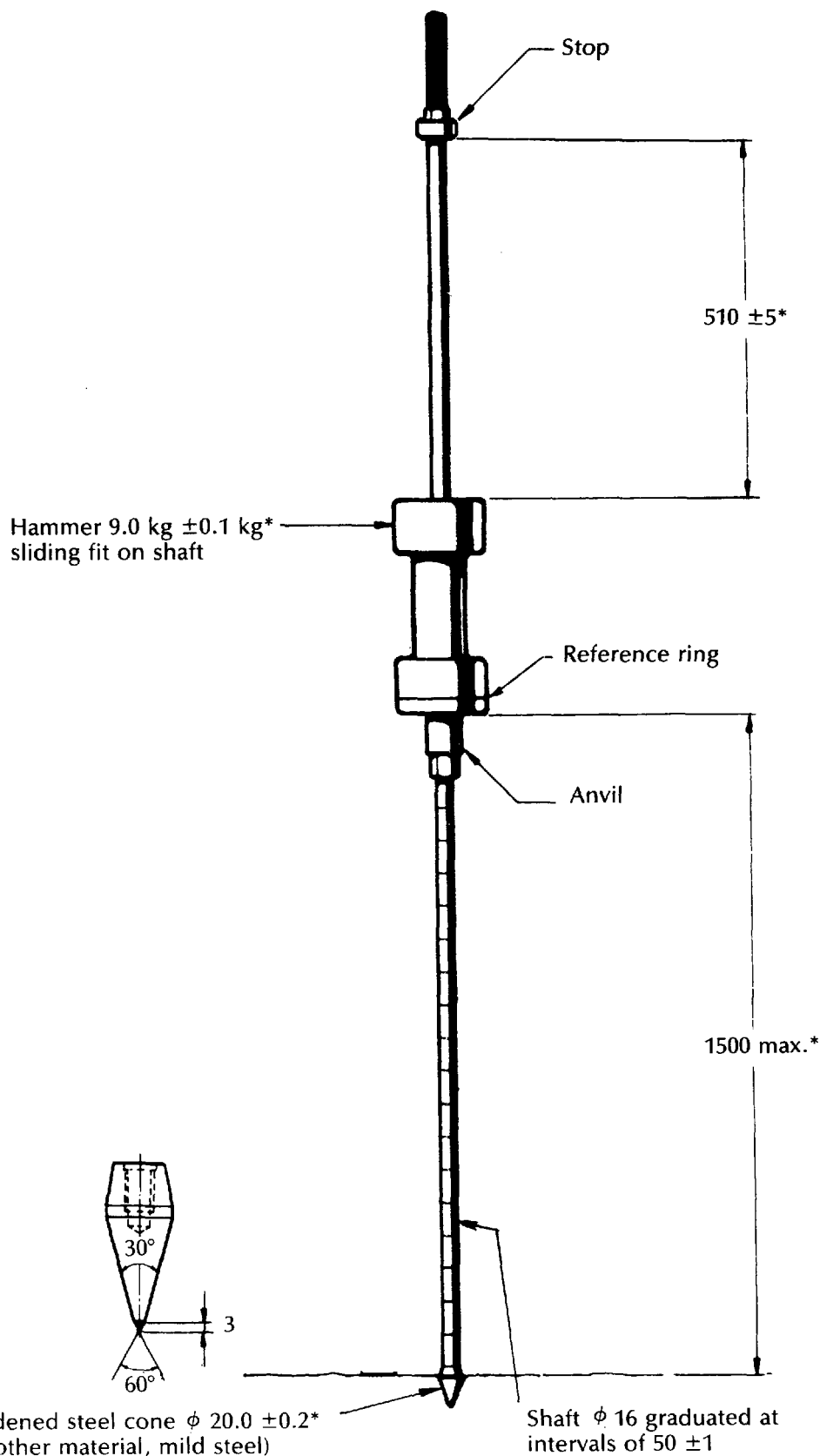
State that the result was obtained in accordance with this Standard Test Method.

NOTES ON TEST 6.5.2

- (1) Factors affecting the penetration resistance of soil are material type, density and water content. Tests for these properties can be undertaken in conjunction with field strength testing to indicate changes in material type and water content with depth. This information will help to determine the limits of substantially uniform strength layers and to indicate abnormal readings.
- (2) The location of possible subsurface services such as gas, water, electricity and telephone should be determined before commencing this test.
- (3) When raising the hammer take care that it does not strike the stop with such force as to lift the penetrometer.
- (4) To avoid damage to the penetrometer, the test should be stopped when eight blows will cause a penetration of less than 20 mm. If this high penetration resistance is thought to be due to an isolated stone or other obstruction another test should be commenced on the same layer close by but at least 100 mm away from the first test. If there is reason to believe that the high penetration resistance is due to a hard layer thought to overlie a soft layer which is pertinent to the investigation, the hard layer should be excavated and the test recommenced on the soft layer. When penetrating a hard layer above a soft layer, one blow may cause considerable penetration as the cone breaks through into the soft layer. In this case the distance penetrated for the final blow shall not be considered with the readings for the hard layer and the approximate depth of the bottom of the hard layer shall be recorded.

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Test 6.5.2:1988



NOTE -

- (1) All linear dimensions are in millimetres (not to scale).
- (2) Essential dimensions are indicated by an asterisk.
- (3) This design has been found satisfactory but alternative designs may be employed provided the essential requirements are fulfilled.
- (4) Similar equipment has sometimes been referred to in New Zealand as the Scala Penetrometer.

Fig. 6.5.2
DYNAMIC CONE PENETROMETER

Part 6
Soil strength tests