IS 4968-1 (1976): Method for subsurface sounding for soils, Part 1: Dynamic method using 50 mm cone without bentonite slurry [CED 43: Soil and Foundation Engineering]

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Indian Standard

METHOD FOR SUBSURFACE SOUNDING FOR SOILS

PART I DYNAMIC METHOD USING 50 mm CONE WITHOUT BENTONITE SLURRY

(First Revision)

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PART I DYNAMIC METHOD USING 50 mm CONE WITHOUT BENTONITE SLURRY

(First Revision)

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AMENDMENT NO. 1 OCTOBER 1987

TO

IS:4968(Part 1)-1976 METHOD FOR SUBSURFACE SOUNDING FOR SOILS

PART 1 DYNAMIC METHOD USING 50 mm CONE WITHOUT BENTONITE SLURRY

(First Revision)

(Pages 3 and 4) - Substitute 'IS:2131-1981' for 'IS:2131-1963'.

(Pages 3 and 4, footnote with '*' mark) - Substitute the following for the existing footnote:

'*Method of standard penetration test for soils (first revision).'

(Pages 4 to 6, clause 2) - Substitute the following for the existing clause:

"2. EQUIPMENT

2.1 The cone driving rods, driving head, hoisting equipment shall conform to IS:10589-1983 'Specification for equipment for determination of subsurface sounding of soils'."

(Pages 5 and 7) - Delete Fig. 1 and 2.

(BDC 23)

Reprography Unit, BIS, New Delhi, India

Indian Standard

METHOD FOR SUBSURFACE SOUNDING FOR SOILS

PART I DYNAMIC METHOD USING 50 mm CONE WITHOUT BENTONITE SLURRY

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part I) (First Revision) was adopted by the Indian Standards Institution on 22 December 1976, after the draft finalized by the Soil Engineering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The resistance N_{cd} (*see* Note) to penetration of the cone in terms of number of blows per 300 mm of penetration may be correlated with the bearing capacity of cohesionless soils and also possibly with the load carrying capacity of piles. The correlations are qualitative rather than quantitative in nature and are influenced by the character of the soils, such as grain-size distribution, surcharge pressure, permeability, and degree of saturation. The extra work required to determine the penetration resistance is small compared to the value of the data obtained, but these data only provide a rough indication of the consistency or relative density of the soil.

NOTE — The resistance to penetration in the standard penetration test (IS : 2131-1963*) shall be designated as N, that to a 50 mm cone as N_{cd} and that to a 62·5 mm cone using bentonite slurry as N_{cbr} [IS : 4968 (Part II)-1976†].

0.2.1 Correlation between cone penetration values (N_{cd}) and penetration values obtained by other methods may be developed for a given site by conducting the latter tests adjacent (about 3 to 5 m) to the location of the cone test (*see* Note).

NOTE — However for the 62·5 mm cone driven dry up to a depth of 9 m (without bentonite slurry) [*see* IS : 4968 (Part II)-1976†], for medium to fine sands, the following relationships have been developed by the Central Building Research Institute, Roorkee. These relationships, when utilized, shall be used with caution.

$N_{cbr} = 1{\cdot}5\ N$ up to a depth of 4 m

$N_{cbr} = 1{\cdot}75\ N$ for depths of 4 to 9 m.

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*Method for standard penetration test for soils.

†Method for subsurface sounding for soils: Part II Dynamic method using cone and bentonite slurry (*first revision*).

where

N_{cbr} = cone resistance obtained with a 62·5 mm cone driven dry (number of blows for 300 mm penetration); and

N = resistance to penetration in the standard penetration test (in accordance with IS : 2131-1963*), (number of blows for 300 mm penetration).

0.3 This standard was first published in 1968. In this revision several changes have been made taking into consideration the experience gained in conducting the test and in the manufacture of the equipment. The major changes made relate to the material of the cone and the hammer criteria for stopping of driving of the cone and the limitations. Reference has also been made to the automatic arrangement for controlling the drop of the hammer.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practice in the field in this country.

0.5 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

1. SCOPE

1.1 This standard covers the procedure for determining the resistance of different soil strata to dynamic penetration of a 50-mm cone and thereby obtaining an indication regarding their relative strengths or density or both. The method helps reconaissance survey of wide areas in a shorter time which will enable selective *in situ* testing or sampling for typical profile. It can provide useful data for local conditions where reliable correlations have been established.

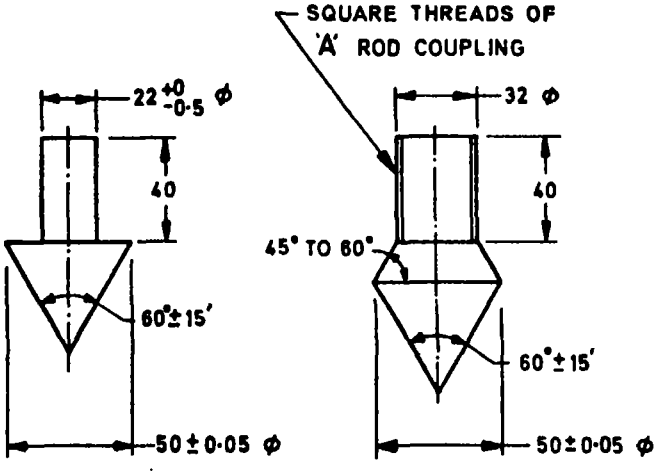
2. EQUIPMENT

2.1 Cone — The cone with threads (recoverable) shall be of suitable steel with the tip hardened. The cone without threads (expendable) may be of mild steel. The dimensions and shape of the cone shall be as given in Fig. 1A and 1B. For the cone without threads, a cone adopter as shown in Fig. 1C shall be provided.

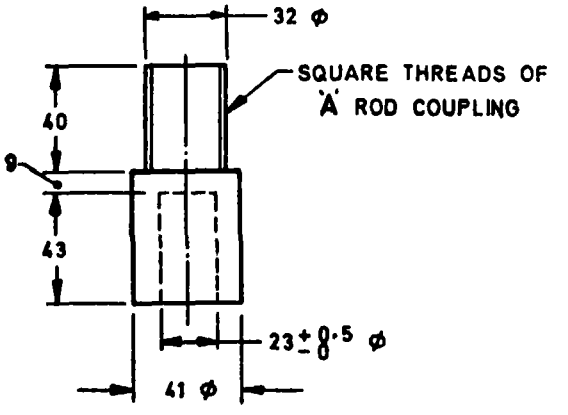
NOTE — The cone without threads will be left in the ground after the completion of the test.

*Method for standard penetration test for soils.

†Rules for rounding off numerical values (*revised*).



1A CONE 1B THREADED CONE



1C CONE ADOPTER

All dimensions in millimetres.

FIG. 1 CONE AND CONE ADOPTER

2.2 Driving Rods — The rods used for the test should be *A* rods of suitable lengths with threads for joining *A* rod coupling at either end. The rods should be marked at every 100 mm.

NOTE — The outer and internal diameters of *A* rods are 41·27 mm and 28·57 mm respectively.

2.3 Driving Head — The driving head shall be of mild steel with threads at either end for a rod coupling (*see* Note under **2.2**). It shall have a diameter of 100 mm and a length of 100 to 150 mm.

2.4 Hoisting Equipment — Any suitable hoisting equipment, such as a tripod may be used. The equipment shall be designed to be stable under conditions of impact of the hammer over the driving head when the cone is driven during the test. Provision shall be made to enable the operator to climb up the equipment for fixing the pulley, ropes, etc. A typical set-up using a tripod is shown in Fig. 2. Suitable guides shall be provided to keep the driving rod vertical.

2.5 Hammer — The hammer used for driving the cone shall be of mild steel or cast iron with a base of mild steel. It shall be 250 mm high and of suitable diameter. The weight of the hammer together with the chain shall be 65 kg. It shall have a hole at the centre running throughout its length and of suitable diameter for *A* rod (*see* Note under **2.2**) and/or guide to pass freely through it. The clearance between the rod and/or guide and the hole in the hammer shall be about 5 mm.

NOTE — An automatic arrangement for controlling the drop of the hammer may be preferred, if available.

3. PROCEDURE

3.1 The 50 mm diameter 60° cone shall be fitted loosely to the driving rod (*A* rod) (*see* Note under **2.2**) through a cone adopter or the threaded cone shall be screwed to the driving rod. The hammer head shall be joined to the other end of the *A* rod with *A* rod coupling. A guide rod 150 cm long shall be connected to the hammer head. This assembly shall be kept vertical, with the cone resting on the ground to be tested. The cone shall then be driven into the soil by allowing the 65 kg hammer to fall freely through a height of 750 mm each time. The number of blows for every 100 mm penetration of the cone shall be recorded. The process shall be repeated till the cone is driven to the required depth (*see* Note and **4.1**).

NOTE — To save the equipment from damage, driving may be stopped when the number of blows exceeds 35 for 100 mm penetration.

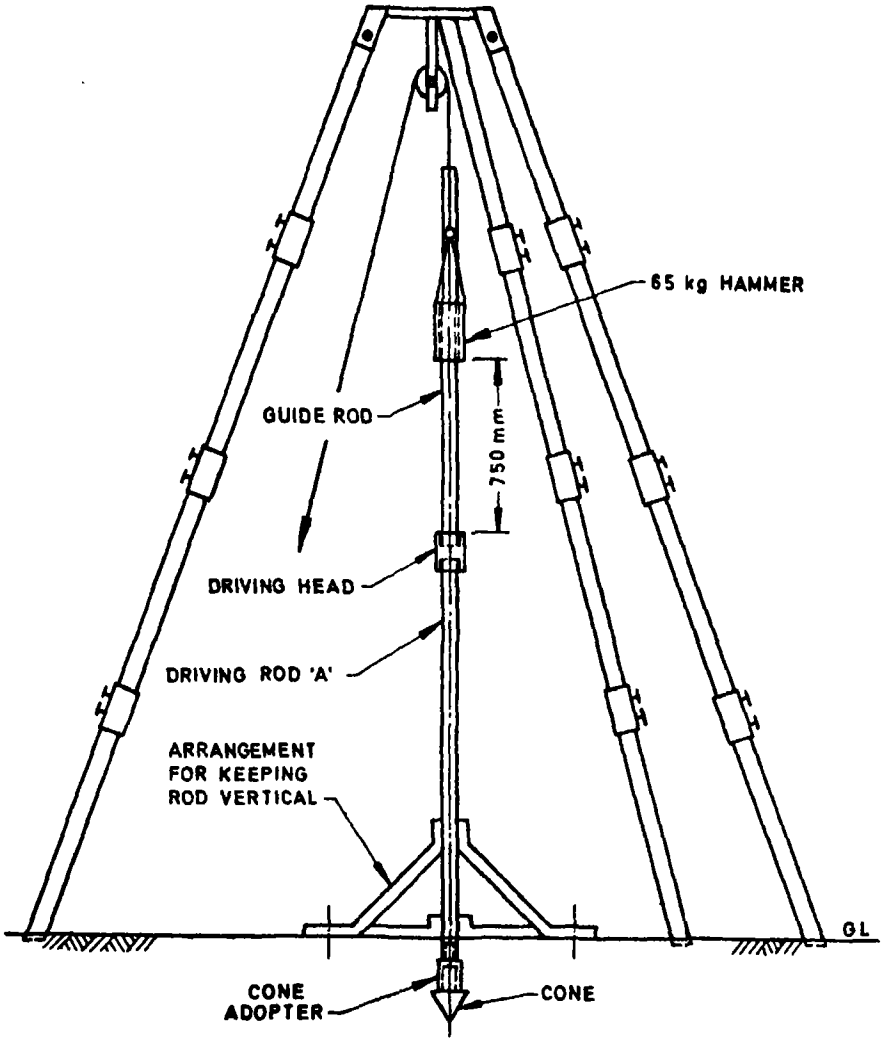


FIG. 2 TYPICAL ASSEMBLY OF EQUIPMENT FOR CONE PENETRATION TEST

4. LIMITATIONS

4.1 The maximum depth to which the cone should be driven will depend upon the type of soil, the position of the water table and the purpose of the test. If correlations of cone penetration values obtained by other methods is desired in interpretation, in cohesionless soils the depth may be limited to 5 m; in mixed soil with some binding material the depth may be 10 m. If the test is used for obtaining a general qualitative idea of the strata, the cone may be driven to any convenient depth.

5. REPORT

5.1 The number of blows (N_{cd}) as a continuous record for every 300 mm of penetration shall be shown in a tubular statement or shown as a graph between N_{cd} and depth. Records of the test shall also include the following:

a) Date of probing;
b) Location;
c) Elevation of ground surface;
d) Depth of water table and its likely variation, from available information;
e) Total resistance at the required levels;
f) Any interruption in probing, with reasons;
g) Any other information available, for example, type of soil; and
h) Diameter of the cone used in the test.

(*Continued from page* 2)

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