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METHODS OF TEST FOR SOILS

PART XXX LABORATORY VANE SHEAR TEST

(First Revision)

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Indian Standard

METHODS OF TEST FOR SOILS

PART XXX LABORATORY VANE SHEAR TEST

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part XXX) (First Revision) was adopted by the Indian Standards Institution on 31 October 1980, after the draft finalized by the Soil and Rock Mechanics Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The laboratory vane shear test for the measurement of shear strength of cohesive soils is useful for soils of low shear strength of less than about 0·5 kgf/cm^2. This test gives the undrained strength of the soil and the undisturbed and remoulded strengths obtained are used for evaluating the sensitivity of the soil. This standard was first published in the year 1968. This revision has been prepared to incorporate revised shape of vane found useful for this test.

0.3 In reporting the result of a test of 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*.

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1. SCOPE

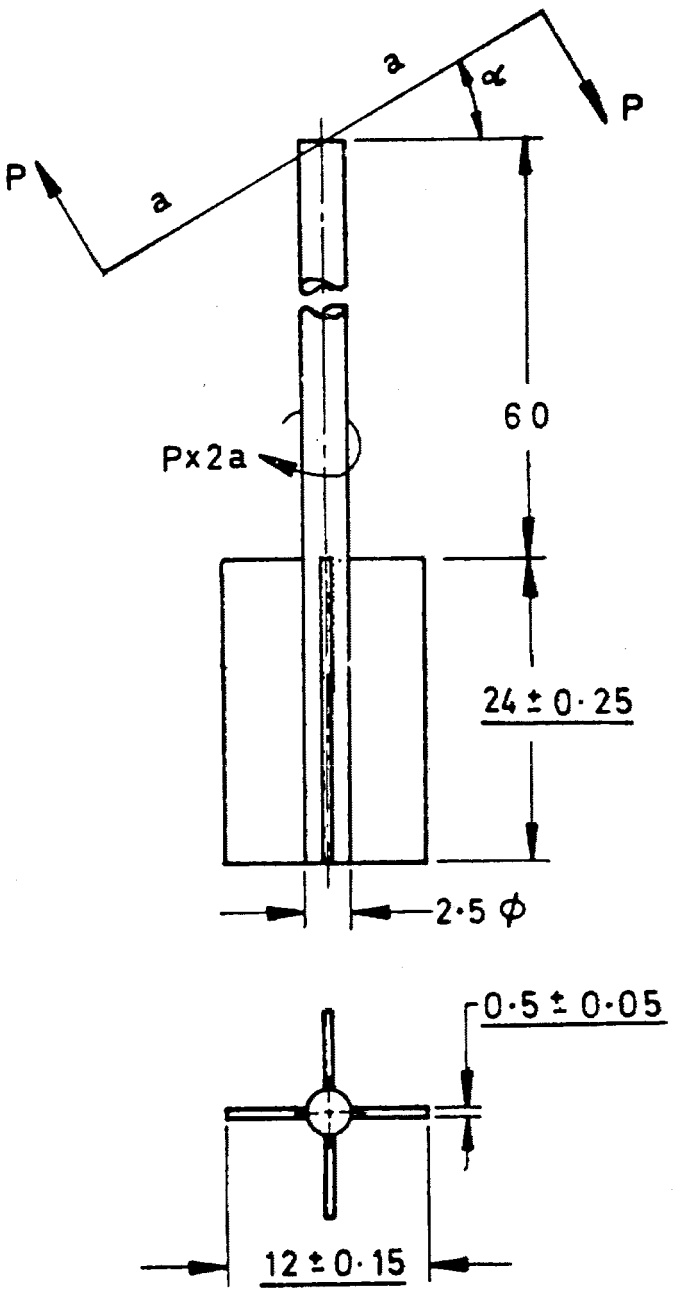
1.1 This standard (Part XXX) covers the procedure of conducting laboratory vane shear test on cohesive soils of low shear strength for determining their undrained shear strength.

2. APPARATUS

2.1 Vane — The vane shall consist of four blades each fixed at 90° to the adjacent blades as illustrated in Fig. 1. The vane should not deform under the maximum torque for which it is designed. The penetrating

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

edge of the vane blades shall be sharpened having an included angle of 90°. The vane blades shall be welded together suitably to a central rod, the maximum diameter of which should preferably not exceed 2·5 mm in the portion of the rod which goes into the specimen during the test. The vane should be properly treated to prevent rusting and corrosion.



All dimensions in millimetres.

Essential dimensions underlined.

FIG. 1 PRINCIPLE OF VANE SHEAR TEST

2.2 The apparatus may be either of the hand-operated type or motorized. Provisions should be made in the apparatus for the following:

a) Fixing of vane and shaft to the apparatus in such a way that the vane can be lowered gradually and vertically into the soil specimen.

b) Fixing the tube containing the soil specimen to the base of the equipment for which it should have suitable hole.

c) Arrangement for lowering the vane into the soil specimen (contained in the tube fixed to the base) gradually and vertically and for holding the vane properly and securely in the lowered position.

d) Arrangement for rotating the vane steadily at a rate of approximately 1/60 rev/min (0·1°/s) and for measuring the rotation of the vane.

e) A torque applicator to rotate the vane in the soil and a device for measuring the torque applied to an accuracy of 0·05 cm.kgf.

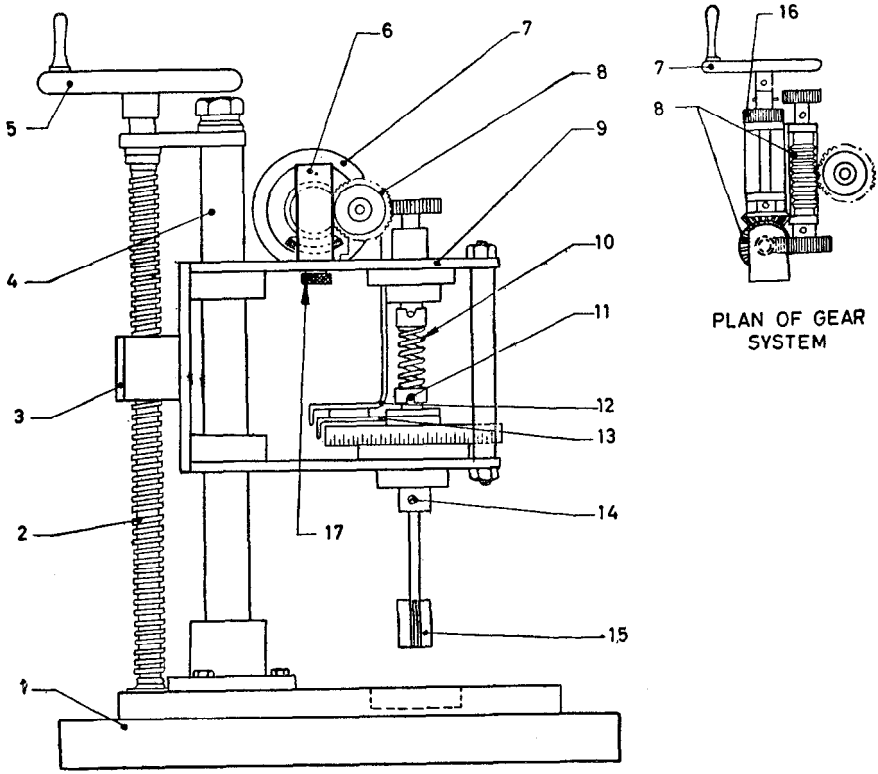
f) A set of springs capable of measuring shear strength of 0·5 kgf/cm^2.

2.2.1 A typical form of the hand operated apparatus is shown in Fig 2.

3. PROCEDURE

3.1 The specimen in the tube should be at least 37·5 mm in diameter and 75 mm long. Mount the specimen container with the specimen on the base of the vane shear apparatus and fix it securely to the base. If the specimen container is closed at one end it should be provided at the bottom with a hole of about 1 mm diameter. Lower the shear vanes into the specimen to their full length gradually with minimum disturbance of the soil specimen so that the top of the vane is at least 10 mm below the top of the specimen. Note the readings of the strain and torque indicators. Rotate the vane at a uniform rate approximately 0·1 °/s by suitably operating the torque applicator handle until the specimen fails. Note the final reading of the torque indicator. Torque readings and the corresponding strain readings may also be noted at desired intervals of time as the test proceeds.

3.2 Just after the determination of the maximum torque rotate the vane rapidly through a minimum of ten revolutions. The remoulded strength should then be determined within 1 minute after completion of the revolution.



This is only a typical example and any design of apparatus satisfying the requirements specified in 2 may be used.

1 Base
2 Lead screw
3 Nut
4 Support pillar
5 Lead screw handle
6 Gear bracket
7 Torque applicator handle
8 Slow motion bevel & work gears
9 Bracket
10 Torque spring
11 Locating pins
12 Strain indicating pointer
13 Maximum pointer
14 Vane fixing screw
15 Shear vanes
16 Normal speed gear
17 Gear bracket clamp screws

FIG. 2 LABORATORY VANE SHEAR APPARATUS

4. COMPUTATIONS

4.1 For vane testing instruments that do not read the torque directly, a calibration curve to convert the readings to cm.kgf of torque shall be provided. These calibration curves shall be checked periodically.

4.2 Calculate the shear strength of the soil using the following formula :

$$S=\frac{3}{19}T$$

where

S=shear strength in kgf/cm^2, and

T=torque in cm.kgf.

NOTE 1 — This formula is based on the following assumptions:

a) Shearing strengths in the horizontal and vertical directions are the same;

b) At the peak value, shear strength is equally mobilized at the end surface as well as at the centre; and

c) The shear surface is cylindrical and has a diameter equal to the diameter of the vane.

NOTE 2 — It is important that the dimensions of the vane are checked periodically to ensure that the vane is not distorted or worn.

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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Alteration

(*Page 5, clause 3.1, line 1*) - Substitute '30 mm' '37.5 mm'.

C 23)

Reprography Unit, BIS, New Delhi, India