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Indian Standard

METHODS OF TEST FOR SOILS

PART 1 PREPARATION OF DRY SOIL SAMPLES FOR VARIOUS TESTS

(Second Revision)

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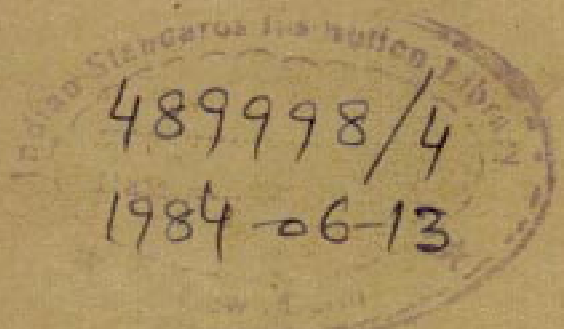

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Indian Standard

METHODS OF TEST FOR SOILS

PART 1 PREPARATION OF DRY SOIL SAMPLES FOR VARIOUS TESTS

(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Indian Standards Institution on 28 November 1983, after the draft finalized by the Soil Engineering and Rock Mechanics Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 With a view to establishing uniform procedure for the determination of different characteristics of soils, Indian Standards on methods of test for soils (IS : 2720) have been formulated in various parts. This part covers method of preparation of samples for the various laboratory tests covered in the standard. This part was first published in 1966 and revised in 1972. Since then more parts of this standard have been published covering additional characteristics besides some of the published parts have been revised wherein requirements have been modified. This revised version has therefore been formulated in order to up date in this respect.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard (Part 1) covers the method of preparation of dry samples from the bulk soil sample received from the field for various laboratory tests.

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

2. APPARATUS

2.1 Wooden-Mallet — for breaking soil clods.

2.2 Trays — for air drying of soil, of suitable size and of non-rusting material.

2.3 Pulverizing Apparatus — Either mortar and rubber covered pestle or a mechanical device consisting of mortar and a power-driven rubber covered pestle suitable for breaking up the aggregation of soil particles without reducing the size of the individual grains. Pestle and mortar made of soft wood may also be used.

2.4 Sampler — A suitable riffle sampler or sample splitter for quartering the samples (*see* IS : 1607-1960*).

2.5 Sieves — of sizes 75-mm, 63-mm, 37·5-mm, 19-mm, 13·2-mm, 9·50-mm, 6·7-mm, 4·75-mm, 2·00-mm and 425-micron [*see* IS : 460 (Part 1)-1978†].

2.6 Drying Apparatus

a) *Drying Oven* — Thermostatically controlled, with interior of non-corroding material to maintain the temperature between 105 and 110°C.

b) Other suitable drying apparatus.

2.7 Balances

a) Capacity 10 kg and minimum sensitivity 100 g.

b) Capacity 1 kg and minimum sensitivity 1 g.

c) Capacity 250 g and minimum sensitivity 0·01 g.

3. PREPARATION OF SAMPLE FOR TESTS

3.1 General — Soil sample as received from the field shall be dried in the air or in sun. In wet weather a drying apparatus may be used in which case the temperature of the sample should not exceed 60°C. The clods may be broken with a wooden-mallet to hasten drying. The organic matter, like tree roots and pieces of bark should be removed from the sample. Similarly, matter other than soil, like shells should also be separated from the main soil mass. A noting shall be made of such removals and their percentage of the total soil sample noted. When

*Methods for dry sieving.

†Specification for test sieves : Part I Wire cloth test sieves (*second revision*).

samples are to be taken for estimation of organic content, lime content, etc, total sample should be taken for estimation without removing shells, roots, etc.

3.2 Drying of the Sample — The amount of drying depends upon the proposed test to be conducted on the particular sample. The type, temperature and duration of drying of soil samples for different tests are given in Table 1. When oven is used for drying, the temperature in the oven shall not exceed 110°C (*see* Note). Chemical drying of samples should not be adopted for any tests.

NOTE — Soils containing organic or calcareous matter should not be dried at temperature above 60°C.

TABLE 1 QUANTITY OF SOIL SAMPLE REQUIRED FOR CONDUCTING THE TESTS

(*Clauses* 3.2, 3.3 *and* 4.1)

SL NO.	TEST	TYPE, TEMPERATURE AND DURATION OF DRYING	AMOUNT OF SOIL SAMPLE REQUIRED FOR TEST	DEGREE OF PULVERIZATION (PASSING IS SIEVE SIZE)	REF TO PART OF IS : 2720[1]
(1)	(2)	(3)	(4)	(5)	(6)
i)	Water content	Oven, 24 h	As given in Table 2	—	Part 2[2]
ii)	Specific gravity	Oven 105-110°C, 24 h	50 g for fine grained soils	2 mm	Part 3/Sec1[3]
			400 g for fine, medium and coarse grained soils	—	Part 3/Sec 2[4]
iii)	Grained size analysis	Air drying	As given in Table 3	—	Part 4[5]
iv)	Liquid limit	do	270 g	425 micron	Part 5[6]
v)	Plastic limit	do	60 g	do	do

[1]Methods of test for soils.
[2]Determination of water content.
[3]Determination of specific gravity, Section 1 Fine grained soils.
[4]Determination of specific gravity, Section 2 Fine, medium and coarse grained soils.
[5]Grain size analysis.
[6]Determination of liquid and plastic limits.

(*Continued*)

TABLE 1 QUANTITY OF SOIL SAMPLE REQUIRED FOR CONDUCTING THE TESTS — *Contd*

Sl No.	Test	Type, Temperature and Duration of Drying	Amount of Soil Sample Required for Test	Degree of Pulverization (Passing IS Sieve Size)	Ref to Part of IS : 2720[1]
(1)	(2)	(3)	(4)	(5)	(6)
vi)	Shrinkage factors	Air drying	100 g	425 micron	Part 6[2]
vii)	Compaction				
	a) Light compaction	do	6 kg (15 kg if soil is susceptible to crushing)	19 mm	Part 7[3]
	b) Heavy compaction	do	do	19 mm	Part 8[4]
	c) Constant mass	do	2 kg	4·75 mm	Part 9[5]
viii)	Unconfined compressive strength	oven 110°C ± 5°C	1 kg	—	Part 10[6]
ix)	Triaxial compression (unconsolidated)	do	1 kg/5 kg	—	Part 11[7]
x)	Triaxial compression (consolidated)	do	do	—	Part 12[8]
xi)	Direct shear	Air drying/Oven 110°C±5°C	1 kg	4·75 mm	Part 13[9]

[1]Methods of test for soils.

[2]Determination of shrinkage factors.

[3]Determination of water content dry density relation using light compaction.

[4]Determination of water content dry density relation using heavy compaction.

[5]Determination of dry density — moisture content relation by constant weight of soil method.

[6]Determination of unconfied compressive strength.

[7]Determination of shear strengh parameters of specimen tested in unconsolidated undrained triaxial compression without the measurement of pore water pressure.

[8]Determination of shear strength parameters of soil from consolidated undrained triaxial compression test with measurement of pore water pressure.

[9]Direct shear test.

(*Continued*)

TABLE 1 QUANTITY OF SOIL SAMPLE REQUIRED FOR CONDUCTING THE TESTS — *Contd*

Sl No.	Test	Type, Temperature and Duration of Drying	Amount of Soil Sample Required for Test	Degree of Pulverization (Passing IS Seive Size)	Ref to Part of IS : 2720[1]
(1)	(2)	(3)	(4)	(5)	(6)
xii)	Density index (relative density)	Oven, 105-110°C, 24 h	As per size of particle given below: 75 mm 45 kg 37·5 ,, 12 ,, 19 ,, 12 ,, 9·50 ,, 12 ,, 4·75 ,, 12 ,,	—	Part 14[3]
xiii)	Consolidation properties	Air drying/Oven 110°C ± 5°C	500 g	—	Part 15[3]
xiv)	CBR	Air drying	6 kg	19 mm	Part 16[4]
xv)	Permeability	Oven, 105-110°C, 24 h	2·5 kg (100 mm dia)/ 5 kg (200 mm dia)	9·5 mm	Part 17[5]
xvi)	Field moisture equivalent	Air drying	15 g	425 micron	Part 18[6]
xvii)	Centrifuge moisture equivalent	do	10 g	do	Part 19[7]
xviii)	Linear shrinkage	do	450 g	do	Part 20[8]
xix)	Chemical tests				
	a) Total soluble solids	Oven, 105-110°C, 24 h	10 g	2 mm	Part 21[9]
	b) Organic matter	Air drying	100 g	do	Part 22[10]

[1]Methods of test for soils.
[2]Determination of density index (relative density) of cohesionless soils.
[3]Determination of consolidation properties.
[4]Laboratory determination of CBR.
[5]Laboratory determination of permeability.
[6]Determination of field moisture equivalent.
[7]Determination of centrifuge moisture equivalent.
[8]Determination of linear shrinkage.
[9]Determination of total soluble solids.
[10]Determination of organic matter.

(*Continued*)

TABLE 1 QUANTITY OF SOIL SAMPLE REQUIRED FOR CONDUCTING THE TESTS — *Contd*

Sl No.	Test	Type, Temperature and Duration of Drying	Amount of Soil Sample Required for Test	Degree of Pulverization (Passing IS Sieve Size)	Ref to Part of IS : 2720[1]
(1)	(2)	(3)	(4)	(5)	(6)
	c) Calcium carbonate	Oven, 105-110°C, 24 h	5 g	—	Part 23[2]
	d) Cation exchange capacity	do	80-130 g	—	Part 24[3]
	e) Silica-sesquioxide ratio	do	15 g	—	Part 25[4]
	f) *p*H value	do	30 g	425 micron	Part 26[5]
	g) Total soluble sulphates	do	30 g	—	Part 27[6]
xx)	Vane shear	Air drying/oven 110°C ± 5°C	250 g	—	Part 30[7]
xxi)	Negative pore water pressure	do	1 kg/5 kg	—	Part 35[8]
xxii)	Permeability of granular soils	do	do	—	Part 36[9]
xxiii)	Sand equivalent value	105 ± 5°C	1 500 g	4·75 mm	Part 37[10]
xxiv)	Direct shear	Air drying	up to 120 g	Above 4·75 mm	Part 39/Sec 1[11]
xxv)	Free swell index	Oven dry	20 g	425 micron	Part 40[12]
xxvi)	Swelling pressure	Air drying/ Oven dry	2 kg	2 mm	Part 41[13]

[1]Methods of test for soils.
[2]Determination of calcium carbonate.
[3]Determination of cation exchange capacity.
[4]Determination of silica sesquioxide ratio.
[5]Determination of *p*H value.
[6]Determination of total soluble sulphates.
[7]Laboratory vane shear test.
[8]Measurement of negative pore water pressure.
[9]Laboratory determination of permeability of granular soils (constant head).
[10]Determination of sand equivalent values of soils and fine aggregates.
[11]Direct shear test for soils containing gravel: Section 1 Laboratory test.
[12]Determination of free swell index of soils.
[13]Measurement of swelling pressure of soils.

3.3 Degree of Pulverization — The big clods may be broken with the help of wooden mallet. Further pulverization may be done in pestle and mortar. The pulverized soil shall be passed through the specified sieve for the particular test and the soil retained on that sieve shall be again pulverized for sieving. This procedure should be repeated until on further attempts at pulverizing very little soil passes through the specified sieve. Care should be taken not to break up the individual soil particles (*see* Table 1).

4. QUANTITY OF SAMPLE

4.1 The quantities of soil sample required for conducting various laboratory tests are given in Table 1 for guidance.

NOTE — For actual quantities, corresponding part of IS : 2720 shall be referred.

4.2 When a smaller quantity has to be taken out of a bigger soil mass the representative sampling shall be done by quartering or riffling.

NOTE — In the case of coarse gravel or gravelly soils quartering by forming a cone shall not be done. The entire sample shall be thoroughly mixed and spread on a flat surface. The sample so spread shall be divided into four quadrants and diagonally opposite quadrants mixed. This process shall be repeated till the desired quantity of sample is obtained.

TABLE 2 QUANTITY OF SAMPLE REQUIRED FOR DETERMINATION OF WATER CONTENT

SIZE OF PARTICLES MORE THAN 90 PERCENT PASSING	MINIMUM QUANTITY OF SOIL SPECIMEN TO BE TAKEN FOR THE TEST MASS IN g
425-micron IS Sieve	25
2-mm IS Sieve	50
4·75 mm IS Sieve	200
9·50 mm IS Sieve	300
19 mm IS Sieve	500
37·5 mm IS Sieve	1 000

TABLE 3 QUANTITY OF SOIL REQUIRED FOR GRAIN SIZE ANALYSIS

MAXIMUM SIZE OF MATERIAL PRESENT IN SUBSTANTIAL QUANTITIES mm	MASS TO BE TAKEN FOR TEST kg
75	60
37·5	25
19	6·5
13 2	3·5
9·5	1·5
6·7	0·75
4·75	0·4

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