IS : 2720 (Part XXI) - 1977
(Reaffirmed 1995)

Indian Standard

METHODS OF TEST FOR SOILS

PART XXI DETERMINATION OF TOTAL SOLUBLE SOLIDS

(First Revision)

First Reprint MAY 1983

UDC 624·131·41 : 543·83

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 2

April 1978

Indian Standard

METHODS OF TEST FOR SOILS

PART XXI DETERMINATION OF TOTAL SOLUBLE SOLIDS

(First Revision)

Soil Engineering Sectional Committee, BDC 23

Chairman	*Representing*
PROF DINESH MOHAN	Central Building Research Institute (CSIR), Roorkee
Members	
ADDITIONAL CHIEF ENGINEER	Public Works Department, Government of Uttar Pradesh
SHRI D. C. CHATURVEDI (*Alternate*)	
ADDITIONAL DIRECTOR RESEARCH (RDSO)	Railway Board (Ministry of Railways)
DEPUTY DIRECTOR RESEARCH (RDSO) (*Alternate*)	
PROF ALAM SINGH	University of Jodhpur, Jodhpur
LT-COL AVTAR SINGH	Engineer-in-Chief's Branch, Army Headquarters
MAJ V. K. KANITKAR (*Alternate*)	
DR A. BANERJEE	Cementation Co Ltd, Calcutta
SHRI S. GUPTA (*Alternate*)	
CHIEF ENGINEER (D & R)	Irrigation Department, Government of Punjab
DIRECTOR (IPRI) (*Alternate*)	
SHRI K. N. DADINA	In personal capacity (*P-820, 'P' New Alipore, Calcutta 700053*)
SHRI A. G. DASTIDAR	In personal capacity (*5, Hungerford Street, 12/1, Hungerford Court, Calcutta 700017*)
SHRI R. L. DEWAN	Irrigation Research Institute, Khagaul, Patna
DR G. S. DHILLON	Indian Geotechnical Society, New Delhi
SHRI A. H. DIVANJI	Asia Foundations & Construction (P) Ltd, Bombay
SHRI A. N. JANGLE (*Alternate*)	
DR SHASHI K. GULHATI	Indian Institute of Technology, New Delhi
DR G. V. RAO (*Alternate*)	
SHRI V. G. HEGDE	National Buildings Organization, New Delhi
SHRI S. H. BALCHANDANI (*Alternate*)	
SHRI O. P. MALHOTRA	Public Works Department, Government of Punjab
SHRI J. S. MARYA	Roads Wing (Ministry of Shipping & Transport), New Delhi
SHRI N. SEN (*Alternate*)	

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
SHRI R. S. MELKOTE DEPUTY DIRECTOR (CSMRS) (*Alternate*)	Central Water Commission, New Delhi
SHRI T. K. NATARAJAN	Central Road Research Institute (CSIR), New Delhi
REPRESENTATIVE	Hindustan Construction Co Ltd, Bombay
RESEARCH OFFICER	Building & Roads Research Laboratory, Chandigarh
SHRI K. R. SAXENA	Engineering Research Laboratories, Hyderabad
SECRETARY DEPUTY SECRETARY (*Alternate*)	Central Board of Irrigation & Power, New Delhi
*DR SHAMSHER PRAKASH DR GOPAL RANJAN (*Alternate*)	University of Roorkee, Roorkee
SHRI H. D. SHARMA	Irrigation Research Institute, Roorkee
SUPERINTENDING ENGINEER EXECUTIVE ENGINEER (*Alternate*)	Public Works Department, Government of Tamil Nadu
SHRI B. T. UNWALLA SHRI T. M. MENON (*Alternate*)	Concrete Association of India, Bombay
SHRI H. C. VERMA SHRI V. K. VASUDEVAN (*Alternate*)	All India Instruments Manufacturers & Dealers Association, Bombay
SHRI D. AJITHA SIMHA, Director (Civ Engg)	Director General, ISI (*Ex-officio Member*)

Secretary

SHRI G. RAMAN
Deputy Director (Civ Engg), ISI

Soil Testing Procedures and Equipment Subcommittee, BDC 23 : 3

Convener

PROF ALAM SINGH	University of Jodhpur, Jodhpur

Members

SHRI AMAR SINGH	Central Building Research Institute (CSIR), Roorkee
LT-COL AVTAR SINGH MAJ V. K. KANITKAR (*Alternate*)	Engineer-in-Chief's Branch, Army Headquarters
DEPUTY DIRECTOR RESEARCH (SOIL MECHANICS-I) (RDSO) ASSISTANT DIRECTOR RESEARCH (SOIL MECHANICS-I) (RDSO) (*Alternate*)	Railway Board (Ministry of Railways)
SHRI R. L. DEWAN	Irrigation Research Institute, Khagaul, Patna
DIRECTOR (I & C) SHRI K. S. PREM (*Alternate*)	Beas Dams Projects, Talwara Township
SHRI H. K. GUHA SHRI N. N. BHATTACHARAYA (*Alternate*)	Geologist Syndicate Pvt Ltd, Calcutta

(*Continued on page* 8)

*Also represents Institution of Engineers (India), Delhi Centre.

Indian Standard

METHODS OF TEST FOR SOILS

PART XXI DETERMINATION OF TOTAL SOLUBLE SOLIDS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part XXI) (First Revision) was adopted by the Indian Standards Institution on 30 December 1977, after the draft finalized by the Soil Engineering Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 With a view to establish uniform procedures for the determination of different characteristics of soils and also for facilitating comparative studies of the results, the Indian Standards Institution is bringing out this Indian Standard Methods of test for soils (IS : 2720) which is being published in parts. Forty one parts of this standard have been published. This part [IS : 2720 (Part XXI)-1977] deals with the method of test for the determination of total soluble solids in soils. The presence of soluble solids in a soil is one of the important aspects requiring examination since these water soluble solids greatly influence the engineering properties of the soil. Two methods for the determination of soluble solids are given. The first method, the gravimetric method (designated as the standard method), gives the percentage of soluble solids accurately in absolute terms. The second method, the conductimetric method (designated as the subsidiary method) may be used for rapid assessment.

0.2.1 This standard was first published in 1965. In this revision, the conductimetric method has been simplified by specifying the use of a conductivity meter or bridge.

0.3 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 practices in this field in this country. This has been met by deriving assistance from the following publication:

INDIA. MINISTRY OF IRRIGATION AND POWER. CBIP. Publication No. 42 Standards for testing soils, 1963. Central Board of Irrigation and Power, New Delhi.

0.4 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 (Part XXI) lays down the determination of total soluble solids content in soil both by gravimetric method which has been specified as the standard method and conductimetric method which has been specified as a subsidiary method.

2. GRAVIMETRIC METHOD (STANDARD METHOD)

2.1 Apparatus

2.1.1 *Bottle Shaker*

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

2.1.3 *Chemical Balance* — sensitive to 0·001 g.

2.1.4 *Buchner or Glass Funnel* — about 10 cm diameter.

2.1.5 *Glazed Porcelain Dish or Glass Dish*

2.1.6 *Filtering Flask* — capacity 500 ml.

2.1.7 *Glass Bottle* — capacity 250 ml, with rubber bang.

2.1.8 *Measuring Cylinder* — capacity 100 ml.

2.1.9 *Pipette* — 50 ml and 100 ml.

2.1.10 *Vacuum Pump*

2.1.11 *Desiccator* — with any desiccating agent other than sulphuric acid.

2.1.12 *Thermometer*

2.1.13 *Water Bath*

2.1.14 *Filter Candle*

2.1.15 *Filter Paper* — Whatman No. 42 or its equivalent.

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

2.2 Procedure

2.2.1 A representative sample passing a 2-mm IS Sieve from the air dried sample prepared in accordance with IS : 2720 (Part I)-1972* shall be dried to constant weight in an oven at a temperature of 105 to 110°C. Out of this, about 10 g of soil shall be accurately weighed and transferred to a 250-ml glass bottle. 100-ml of distilled water shall be added to it; the bottle shall then be stoppered and fitted in the shaker and shaken overnight (at least 15 h). The soil shall then be allowed to settle and the clear portion decanted off and filtered through Whatman No. 42 filter paper or equivalent. If by simple filtration the filtrate is not clear, the operation shall be repeated employing a filter candle with a vacuum pump.

2.2.2 Take 50-ml of the clear filtrate in a pre-weighed porcelain dish, or glass dish and concentrate by evaporating in the water both before finally drying in the oven at 110°C. The dish shall then be cooled to room temperature in a desiccator and weighed to get the weight of the residue. The percentage of total soluble solids in the soil shall then be calculated on the basis of the soil taken for analysis.

2.3 Report

2.3.1 The results shall be reported to the nearest 0·01 percent as a percentage by weight of oven-dry soil.

2.3.2 The observations of the test shall be suitably recorded. A recommended proforma for the record is as given in Appendix A.

3. CONDUCTIMETRIC METHOD (SUBSIDIARY METHOD)

3.1 Apparatus

3.1.1 *Conductivity Meter/Bridge with Known Cell Constant (Unbreakable)* — The instrument is designed to carry out the measurement of specific conductance and specific resistance of various electrolytes and also measurement of ohmic resistance with measuring accuracy of ± 3 percent in 7 or 8 ranges varying from at least 1 mhos to 10 mhos.

3.1.2 *Physical Balance* — sensitivity 0·01 g.

3.1.3 *Measuring Cylinder* — capacity 50-ml.

3.1.4 *Beaker* — 150-ml.

3.1.5 *Glass Rod or Stirrer*

*Methods of test for soils: Part I Preparation of dry soil samples for various tests (*first revision*).

3.2 Procedure — Take 10 g of oven-dry soil sample as mentioned in **2.2**. Distilled water shall be added to it and stirred intermittently with a glass rod or by any stirring machine. The soil suspension thus prepared shall be allowed to settle in the beaker for about 30 minutes. The supernatant liquid shall be transferred into another beaker and specific conductivity determined using the conductivity meter/bridge.

NOTE — The equipment before using, shall be checked with a saturated calcium sulphate solution which shall give specific conductivity of 2·2 mhos/cm at 25°C. If not, the conductivity cell is to be cleaned.

3.3 Report

3.3.1 The results shall be reported in millimhos/cm.

3.3.2 The results obtained by conductivity meter/bridge may be interpretted as indicated below:

Conductivity meter/bridge readings	*Total soluble solid content*
Below 1 millimho/cm	Normal
1 to 2 millimhos/cm	Fairly good
2 to 3 millimhos/cm	High
Above 3 millimhos	Very high

APPENDIX A

(*Clause* 2.3.2)

PROFORMA FOR RECORDING

Project ..... Details of Sample.....

1. Sample number			
2. Mass of oven-dry soil taken (w), in g			
3. Volume of clear filtrate taken, in ml	50	50	50
4. Procelain dish or glass dish number, in g			
5. Mass of dish with residue after oven drying, in g			
6. Mass of dish, in g			
7. Mass of residue (w_1), in g			
8. Percentage of soluble solids $\frac{2\ w_1}{w} \times 100$			

(*Continued from page* 2)

Members	*Representing*
DR SHASHI K. GULHATI	Indian Institute of Technology, New Delhi
SHRI R. K. JAIN	United Technical Consultants (P) Ltd, New Delhi
DR P. K. DE (*Alternate*)	
SHRI O. P. MALHOTRA	Building & Roads Research Laboratory, Chandigarh
RESEARCH OFFICER (BLDG & ROADS) (*Alternate*)	
SHRI R. S. MELKOTE	Central Water Commission, New Delhi
DEPUTY DIRECTOR (CSMRS) (*Alternate*)	
SHRI P. JAGANNATHA RAO	Central Road Research Institute (CSIR), New Delhi
SHRI V. V. S. RAO	In personal capacity (*F-24, Green Park, New Delhi*)
SHRI N. SEN	Ministry of Shipping & Transport (Roads Wing), New Delhi
SHRI P. K. THOMAS (*Alternate*)	
SHRI M. M. D. SETH	Public Works Department, Government of Uttar Pradesh
DR B. L. DHAWAN (*Alternate*)	
SHRI H. C. VERMA	Associated Instruments Manufacturers (I) Pvt Ltd, New Delhi

AMENDMENT NO. 1 NOVEMBER 1983

TO

IS:2720 (Part XXI)-1977 METHODS OF TEST FOR SOILS

PART XXI DETERMINATION OF TOTAL SOLUBLE SOLIDS

(First Revision)

Addendum

(*Page 5, clause* 2.2.2) - Add the following new Note after 2.2.2:

'NOTE - In case the value of the solubility is more than 2 percent, the test be repeated with 50-ml of distilled water.'

(BDC 23)

Reprography Unit, ISI, New Delhi, India