

इंटरनेट

मानक

### Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 9143 (1979): Method for the determination of unconfined compressive strength of rock materials [CED 48: Rock Mechanics]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



“पुनर्गठित १९९६”  
“RE-AFFIRMED 1996”  
IS : 9143 - 1979  
( Reaffirmed 1987 )

## *Indian Standard*

# METHOD FOR THE DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH OF ROCK MATERIALS

( First Reprint AUGUST 1988 )

UDC 624.121.439.4

© Copyright 1979

**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## METHOD FOR THE DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH OF ROCK MATERIALS

Soil Engineering and Rock Mechanics Sectional Committee, BDC 23

*Chairman*

PROF DINESH MOHAN

*Representing*

Central Building Research Institute (CSIR),  
Roorkee

*Members*

ADDITIONAL DIRECTOR RESEARCH, Railway Board ( Ministry of Railways )  
( FE ), RDSO

DEPUTY DIRECTOR RESEARCH,  
( FE-I ), 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* )

DR R. K. BHANDARI

Central Building Research Institute (CSIR),  
Roorkee

CHIEF ENGINEER ( D & R )

Irrigation Department, Government of Punjab,  
Chandigarh

DIRECTOR ( IPRI ) ( *Alternate* )

SHRI K. N. DADINA

In personal capacity ( P-820 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

DIRECTOR ( CSMRS )

Central Water Commission, New Delhi

DEPUTY DIRECTOR ( CSMRS ) ( *Alternate* )

SHRI A. H. DIVANJI

Asia Foundations & Construction (P) Ltd, Bombay

SHRI A. N. JANGLE ( *Alternate* )

DR GOPAL RANJAN

University of Roorkee, Roorkee; and Institution of  
Engineers ( India ) ( Delhi Centre )

DR SHASHI K. GULHATI

Indian Institute of Technology, New Delhi

DR G. V. RAO ( *Alternate* )

SHRI V. G. HEGDE

National Buildings Organisation, New Delhi

SHRI H. K. JAGWANI ( *Alternate* )

( Continued on page 2 )

©.Copyright 1979

BUREAU OF INDIAN STANDARDS

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ), and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(Continued from page 1)

<i>Members</i>	<i>Representing</i>
SHRI O. P. MALHOTRA	Public Works Department, Government of Punjab, Chandigarh
SHRI T. K. NATARAJAN	Central Road Research Institute (CSIR), New Delhi
RESEARCH OFFICER SHRI K. R. SAXENA	Building & Roads Research Laboratory, Chandigarh
SECRETARY DEPUTY SECRETARY (Alternate)	Engineering Research Laboratories, Hyderabad
SHRI M. M. D. SETH	Central Board of Irrigation & Power, New Delhi
DR B. L. DHAWAN (Alternate)	Public Works Department, Government of Uttar Pradesh, Lucknow
SHRI M. K. SINGHAL	Irrigation Research Institute, Roorkee
SHRI N. SIVAOURU	Roads Wings (Ministry of Shipping & Transport)
SHRI D. V. SIKKA (Alternate)	
SUPERINTENDING ENGINEER (P & D)	Public Works Department, Government of Tamil Nadu, Madras
EXECUTIVE ENGINEER I/C (SM & RD) (Alternate)	
SHRI B. T. UNWALLA	Concrete Association of India, Bombay
SHRI T. M. MENON (Alternate)	
SHRI H. C. VERMA	All India Instruments Manufacturers & Dealers Association, Bombay
SHRI V. S. VASUDEVAN (Alternate)	
SHRI D. AJITHA SIMHA, Director (Civ Engg)	Director General, BIS (Ex-officio Member)

*Secretary*

SHRI K. M. MATHUR  
Deputy Director (Civ Engg), BIS

**Rock Mechanics Subcommittee, BDC 23 : 5**

*Convener*

SHRI R. S. MELKOTE                      Central Water Commission, New Delhi

*Members*

SHRI AMAR SINGH	Central Building Research Institute (CSIR), Roorkee
SHRI N. M. PATEL (Alternate)	
DIRECTOR	Central Water & Power Research Station, Pune
SHRI S. L. MOKHASHI (Alternate)	
DIRECTOR	Maharashtra Engineering Research Institute, Nasik
RESEARCH OFFICER (Alternate)	
SHRI B. K. KAUL	Kurukshetra University, Kurukshetra
SHRI P. L. NARULA	Geological Survey of India, Lucknow
DR T. RAMAMURTHI	Indian Institute of Technology, New Delhi
DR Y. V. RAMANA	National Geophysical Research Institute, Hyderabad
SECRETARY	Central Board of Irrigation and Power, New Delhi
DEPUTY SECRETARY (Alternate)	
DR B. SINGH	Central Mining Research Station (CSIR), Dhanbad
SHRI A. K. DUBE (Alternate)	
SHRI H. C. VERMA	Associated Instruments Mfrs (I) Pvt Ltd, New Delhi
PROF T. S. NAGARAJ (Alternate)	

# *Indian Standard*

## METHOD FOR THE DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH OF ROCK MATERIALS

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 23 March 1979, after the draft finalized by the Soil Engineering and Rock Mechanics Sectional Committee had been approved by the Civil Engineering Division Council.

**0.2** The unconfined compressive strength test is primarily an index test for strength classification of rock materials. Although it may be used in the laboratory, it is mainly intended for field measurements on rock core and outcrop specimens. The apparatus used in the test is light and portable and can be used in the laboratory as well as in the field.

**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 practice in the field in this country.

**0.4** In reporting the result of a test 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 method for determination of unconfined compressive strength of a rock sample in the form of specimens of regular geometry.

### 2. APPARATUS

**2.1** A suitable loading machine shall be used for applying and measuring the axial load to the specimen. It shall be of sufficient capacity and capable of applying load at a rate conforming to the requirements given in 4.3. It shall be verified and calibrated at suitable intervals depending on the work load.

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

**2.2** Discs made of steel having a hardness of not less than 30 HRC ( see IS : 1586-1968\* ) shall be placed at specimen ends. The thickness of the discs shall be at least 15 mm. Surfaces of the discs shall be ground and their flatness shall be within 0.025 mm. The diameter of the discs should be same as the diameter of the specimen.

NOTE — With abrasive rocks, these discs surfaces tend to roughen after a number of specimens have been tested and hence need to be resurfaced from time to time.

**2.3** One of the two discs shall incorporate a spherical seat. The spherical seat shall be placed on the upper end of the specimen. It shall be lightly lubricated with mineral oil. The specimen, the discs and the spherical seat shall be accurately centred with respect to one another and the loading frame. The curvature centre of the seat surface should coincide with the centre of the top surface of the specimen.

### 3. TEST SPECIMENS

**3.1** Test specimen shall preferably be a right circular cylinder with tolerances specified in 3.3, although specimen of any shape with regular geometry could be used. The specimen should be prepared as specified in IS : 9179-1979†.

**3.2** The specimen shall be tested at a moisture content as close to field conditions as possible.

#### 3.3 Specimen Dimensions

- a) The length to diameter ratio of cylindrical specimen shall preferably be 2 to 3.

NOTE — If the ratio is less than 2, usual correction shall be applied taking standard slenderness ratio as 2.

- b) The diameter of the specimen shall be more than ten times the largest mineral grain size in rock, preferably 45 mm, but in no case less than 35 mm.

NOTE — In case size is less than 45 mm, the tolerances given in (c) and (e) may be suitably reduced.

- c) Specimen ends shall be flat to within 0.05 mm.  
d) The ends shall be parallel to each other within 0.002  $D$  where  $D$  is the specimen diameter.  
e) The ends shall be perpendicular to the axis of the specimen within 0.001 radians ( 3.5 minutes ) or 0.05 mm in a 45 mm diameter specimen.

\*Method for Rockwell hardness test ( B and C scales ) for steel ( first revision ).

†Method for the preparation of rock specimens for laboratory testing.



- f) The cylindrical surface shall be smooth and free from abrupt irregularities, and straight to within 0.3 mm over the full length of the specimen. The dimensions of the specimen shall not vary by more than 0.2 mm over the length of the specimen.
- g) The diameter of the test specimen shall be measured to the nearest 0.1 mm by averaging two diameters measured at right angles to each other at about the upper height, the mid-height and the lower height of the specimen. It shall not vary by more than 0.3 mm over the length of the specimen.

#### 4. TEST PROCEDURE

4.1 The ability of spherical seat to rotate freely shall be checked before each test.

4.2 The surfaces of the two bearing discs and the test specimen shall be wiped clean. The specimen shall be kept on the lower disc. The axis of the specimen shall be carefully aligned with the centre of the thrust of the spherical seat. As the load is gradually brought to bear on the specimen, the movable portion of the spherically seated disc shall be adjusted to ensure uniform seating.

4.3 Load on the specimen shall be applied continuously at a constant stress rate such that failure will take place in about 5 to 15 minutes of loading. Alternatively, the stress rate shall be within the limits of 0.5 MPa/s to 1 MPa/s.

4.4 The maximum load on the specimen shall be recorded in N within 1 percent accuracy.

4.5 The number of specimens to be tested should be determined from practical considerations, but at least five are required to obtain a representative value.

#### 5. CALCULATION

5.1 The unconfined compressive strength of the specimen shall be calculated by dividing the maximum load carried by the specimen during the test, by the average original cross-sectional area [ see 3(g) ].

#### 6. REPORT

6.1 The report shall give uniaxial compressive strength for each specimen in the sample, expressed to three significant figures, together with the average result for the sample.

**6.2 The report of test shall include the following information:**

- a) Number of specimens tested;
- b) Mode of failure;
- c) Lithological description of rock;
- d) Orientation of loading axis with respect to anisotropy, for example, bedding planes, foliations, etc;
- e) Source of sample, location, depth and orientation, and date of sampling;
- f) Storage history and environment;
- g) Date of testing and type of machine used;
- h) Specimen diameter and height;
- j) Moisture content and room temperature;
- k) Duration of the test and stress rate;
- m) Other physical properties, such as specific gravity, absorption, permeability and porosity, citing their method of determination if available;
- n) Any other observation; and
- p) Should it be necessary to test specimens of shapes other than cylindrical, suitable mention of these facts shall be made in the report.

# BUREAU OF INDIAN STANDARDS

## Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 3 31 01 31, 3 31 13 75

Telegrams : Manaksanstha  
( Common to all Offices )

## Regional Offices :

Telephone

\*Western ; Manakalaya, E9 MIDC, Marol, Andheri ( East ) BOMBAY 400093 6 32 92 95

†Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054 36 24 99

Northern : SCO 445-446, Sector 35-C CHANDIGARH 160036 { 2 18 43  
3 16 41

Southern : C. I. T. Campus, MADRAS 600113 { 41 24 42  
41 25 19  
41 29 18

## Branch Offices :

Pushpak, Nurmohamed Shaikh Marg, Khanpur, AHMADABAD 380001 { 2 63 48  
2 63 49

'F' Block, Unity Bldg, Narasimharaja Square, BANGALORE 560002 22 48 05

Gangotri Complex, 5th Floor, Bhadbhada Road, T. T. Nagar, BHOPAL 462003 6 27 16

Plot No. 82/83, Lewis Road, BHUBANESHWAR 751002 5 36 27  
53/5 Ward No. 29, R. G. Barua Road, 5th Byelane, GUWAHATI 781003 —

5-8-56C L. N. Gupta Marg, (Nampally Station Road), HYDERABAD 500001 22 10 83

R14 Yudhister Marg, C Scheme, JAIPUR 302005 { 6 34 71  
6 98 32

117/418B Sarvodaya Nagar, KANPUR 208005 { 21 68 76  
21 82 92

Patliputra Industrial Estate, PATNA 800013 6 23 05

Hantex Bldg ( 2nd Floor ), Rly Station Road, TRIVANDRUM 695001 52 27

## Inspection Office ( With Sale Point ):

Institution of Engineers ( India ) Building, 1332 Shivaji Nagar, 5 24 35  
PUNE 410005

---

\*Sales Office in Bombay is at Novelty Chambers, Grant Road, Bombay 400007 89 65 28

†Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep Street, Calcutta 700072 27 68 00

---

Reprography Unit, BIS, New Delhi, India