भारतीय राष्ट्रीय मानक संस्थान
NATIONAL STANDARDS BODY OF INDIA

भारत सरकार
GOVERNMENT OF INDIA

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय
MINISTRY OF CONSUMER AFFAIRS,
FOOD & PUBLIC DISTRIBUTION
9, Bahadur Shah Zafar Marg, New Delhi 110001

व्यापक परिचालन मसौदा

हमारा संदर्भः सीईडी 48/टी-24 **16 जून 2025**

तकनीकी समिति: रॉक मैकेनिक्स विषय समिति, सीईडी 48

प्राप्तकर्ता:

क) सिविल इंजीनियरी विभाग परिषद्, सीईडीसी के सभी सदस्य
ख) सीईडी 48 के सभी सदस्य
ग) रूचि रखने वाले अन्य निकाय

प्रिय महोदय/महोदया,

निम्नलिखित भारतीय मानक का मसौदा संलग्न है:

प्रलेख संख्या	शीर्षक
सीईडी 48 (28182)WC	**चट्टान की प्रतिक्षेप कठोरता को ज्ञात करना— परीक्षण पद्धति का भारतीय मानक मसौदा** (IS 12608 का *पहला पुनरीक्षण*) ICS 93.020

कृपया इस मानक के मसौदे का अवलोकन करें और अपनी सम्मतियॉ यह बताते हुए भेजे कि यदि यह मानक के रूप में प्रकाशित हो तो इस पर अमल करने में आपके व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं ।

सम्मतियॉ भेजने की अंतिम तिथि : **17 जुलाई 2025**

सम्मति यदि कोई हो तो कृपया अधोहस्ताक्षरी को उपरिलिखित पते पर संलग्न फोर्मेट में भेजें या manoj@bis.gov.in पर ईमेल कर दें ।

यदि कोई सम्मति प्राप्त नही होती है अथवा सम्मति में केवल भाषा सम्बन्धी त्रुटि हुई तो उपरोक्त प्रलेख को यथावत अंतिम रूप दिया जाएगा। यदि सम्मित तकनीकी प्रकृति की हुई विषय समिति के अध्यक्ष के परामर्श से अथवा उनकी इच्छा पर आगे की कार्यवाही के लिए विषय समिति को भेजे जाने के बाद प्रलेख को अंतिम रूप दे दिया जाएगा ।

यह प्रलेख भारतीय मानक ब्यूरो की वैबसाइट www.bis.gov.in पर भी उपलब्ध हैं।

धन्यवाद ।

भवदीय,

(द्वैपायन भद्र)
प्रमुख (सिविल इंजीनियरी)

संलग्नक : उपरिलिखित :

भारतीय राष्ट्रीय मानक संस्थान
NATIONAL STANDARDS BODY OF INDIA

भारत सरकार
GOVERNMENT OF INDIA

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय
MINISTRY OF CONSUMER AFFAIRS,
FOOD & PUBLIC DISTRIBUTION
9, Bahadur Shah Zafar Marg, New Delhi 110001

DRAFT IN WIDE CIRCULATION

Ref: CED 48/T-24 **16 June 2025**

TECHNICAL COMMITTEE: Rock Mechanics Sectional Committee, CED 48

ADDRESSED TO:

a) All Members of Civil Engineering Division Council, CEDC
b) All Members of CED 48
c) All others interests.

Dear Sir/Madam,

Please find enclosed the following document:

Doc No.	Title
CED 48 (28182)WC	**Draft Indian Standard** **Determination of Rebound Hardness of Rock — Method of Test** (*First Revision* of IS 12608) ICS 93.020

Kindly examine the draft standard and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as National Standard.

Last Date for comments**: 17 July 2025**

Comments if any, may please be made in the attached format and mailed to the undersigned at the above address or preferably through e-mail to manoj@bis.gov.in.

In case no comments are received or comments received are of editorial nature, you may kindly permit us to presume your approval for the above document as finalized. However, in case of comments of technical in nature are received then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

The document is also hosted on BIS website www.bis.gov.in**.**

Thanking you,

Yours faithfully,

(**Dwaipayan Bhadra**)
Head (Civil Engineering)

Encl: As above

FORMAT FOR SENDING COMMENTS ON BIS DOCUMENTS

(Please use A-4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/table/fig etc. be started on a fresh box. Information in column 3 should include reasons for the comments and suggestions for modified working of the clauses when the existing text is found not acceptable. Adherence to this format facilitates Secretariat's work) (Please e-mail your comments to manoj@bis.gov.in)

Doc. No.: **CED 48 (28182) WC**

Title: **Draft Indian Standard Determination of Rebound Hardness of Rock — Method of Test**
(*First Revision* of IS 12608) ICS 93.020

LAST DATE OF COMMENT: **17/07/2025**

NAME OF THE COMMENTATOR/ORGANIZATION: _____

Sl. No.	Clause/Para/Table/ Figure No. Commented	Comments/Modified Wordings	Justification of the Proposed Change

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

Draft Indian Standard

DETERMINATION OF REBOUND HARDNESS OF ROCK — METHOD OF TEST

(*First Revision* of IS 12608)
ICS 93.020

Rock Mechanics	Last date of comments:
Sectional Committee, CED 48	**17 July 2025**

FOREWORD

(*Formal clause may be added later*)

Hardness is a concept of material behavior rather than a fundamental material property. It depends on the type and quantity of various mineral constituents of the rock and the bond strength that exists between the mineral grains. Hardness tests have been developed to predict wall strength of discontinuity in rock masses by correlating as per IS 11315 (Part 5) : 2023 "Methods for quantitative description of discontinuities in rock masses: Part 5 Wall strength".

Three types of tests, that is indentation, dynamic and scratch are used by various laboratories. Experience shows that Indentation tests are not applicable to rock due to its brittle nature and scratch tests which are done based on Mohs scale have not been found to be accurate. This Indian standard therefore, covers dynamic or rebound method of test. It covers procedures for laboratory and field-testing using the Schmidt hammer method and the shore scleroscope method.

This standard was first published in 1989. This revision incorporates modifications found necessary as a result of the experience gained with the use of the standard and to bring the standard in line with present good practices being followed in the country and abroad. The principal modifications in this revision are as follows:

a) The title of this Indian Standard has been changed from *"Method for determination of hardness of rock"* to *"Method for determination of rebound hardness of rock"* for better clarity;
b) The term **"**rebound**"** has been explicitly incorporated not only in the title but also throughout the document to accurately reflect the testing method;
c) Minimum number of test conducted on the individual test sample has been reduced from 25 to 20 for both methods;
d) N-type Schmidt hammer have been included;
e) Figure of core specimen holders has been improved for Schmidt hammer method;
f) critical specimen volume has been introduced in the shore scleroscope method;
g) provision of size-corrected values has been included for sample size less than critical specimen volume in shore scleroscope method;

h) minimum test surface area and minimum thickness of test sample has been updated as per latest practice for shore scleroscope method;
i) Test specimen preparation, testing procedures and reporting of results have been updated as per latest practice and
j) Reference of various Indian standard has been updated.

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 or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding of numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Draft Indian Standard

DETERMINATION OF REBOUND HARDNESS OF ROCK — METHOD OF TEST

(*First Revision*)

1 SCOPE

This standard covers schmidt hammer and shore scleroscope method for determination of rebound hardness of rock.

2 REFERENCES

The standards given below contain provisions, which through reference in this text, constitutes provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of this standard:

IS No.	*Title*
IS 11315 (Part 5) : 2023	Methods for quantitative description of discontinuities in rock masses: Part 5 Wall stre ngth (*first revision*)

3 GENERAL

3.1 Dynamic or Rebound Tests

The Rebound tests are based on the principle that the rebound of an elastic mass depends on the hardness of the rock surface against which the mass strikes. When the plunger of the rebound hammer is pressed against the rock surface, the spring controlled mass in the hammer rebounds. The height of rebound is taken as a measure of the rebound hardness of the material. Two methods are used as mentioned in **3.1.1** and **3.1.2**.

3.1.1 The schmidt hammer (SH) is a portable apparatus which is widely used for obtaining rebound hardness value (R) of rock surface. SH test is non-destructive test and can be used for determination of joint wall compressive strength of discontinuities in in-situ and laboratory conditions. The method is of limited use for very soft or very hard rock.

3.1.2 The shore hardness is a convenient, non-destructive method used for estimating rock rebound hardness. This can be used to estimate the uniaxial compressive strength (UCS) of rocks The Shore scleroscope is a laboratory test device that measures hardness by dropping a small diamond tipped indenter on the specimen and measuring its rebound height. Because of the small size of the diamond indenter tip and the heterogeneous nature of most rocks, it is necessary to conduct a large number of rebound tests to obtain an average value for a particular material.

4 SCHMIDT HAMMER METHOD

4.1 Apparatus

The Schmidt hammer determines the rebound hardness of a rock material. It consists of a spring-loaded piston which is released when the plunger is pressed against the rock surface (Fig.1). Energy is stored in

the spring, which automatically releases at a prescribed energy level and impacts a hammer mass against the plunger. The height of rebound of the hammer mass is measured on a ruler scale and is taken as the measure of rebound hardness value (R). Two types of Schmidt hardness are used in rocks: type L and N. The N-type hammer is less sensitive to surface irregularities and is preferred for field applications, while the L-type hammer has higher sensitivity in the lower range and gives better results in weak, porous, and weathered rocks. Also, the 'L' type's impact value is three times less than the 'N' type (0.735 Nm compared to 2.207 Nm).

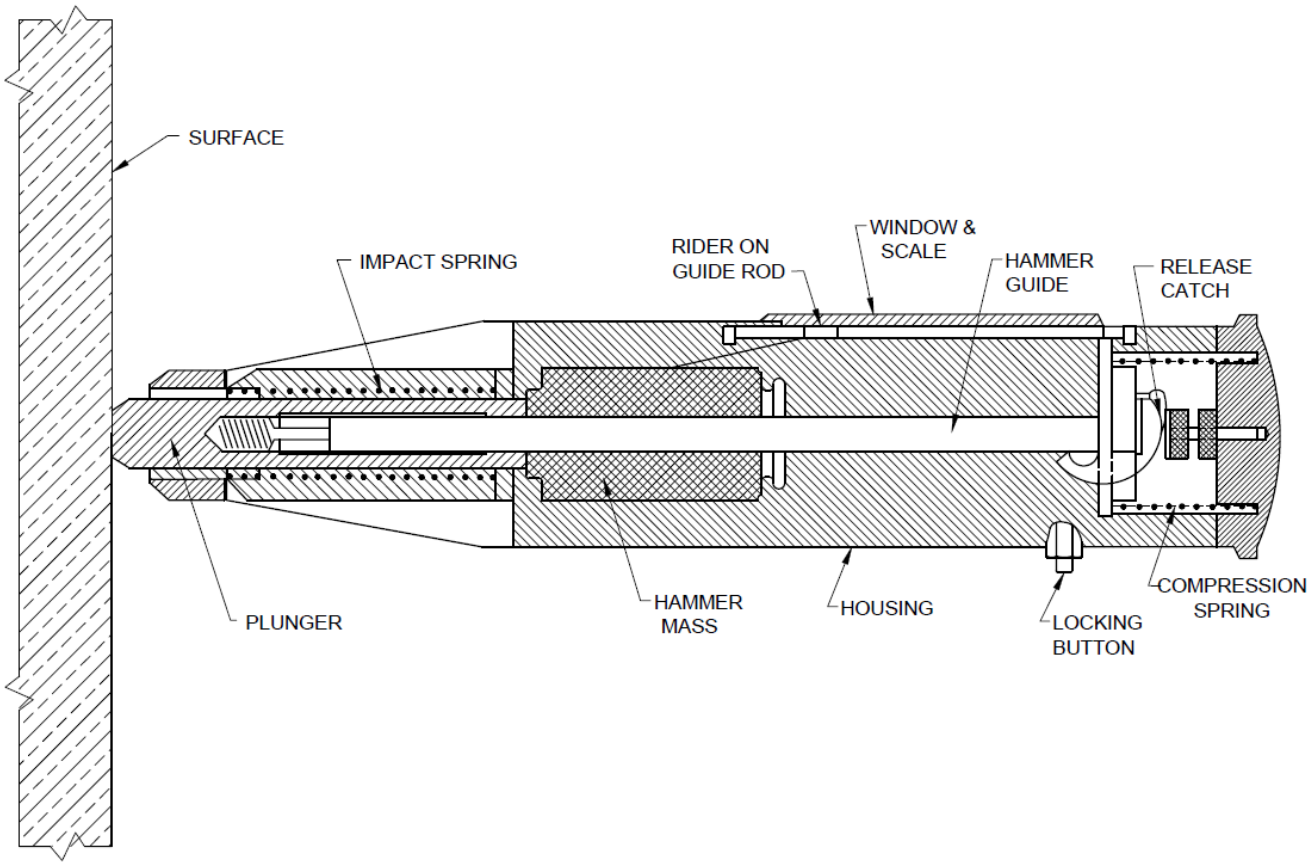

FIG. 1 TYPICAL SCHMIDT HAMMER

4.2 Procedure

4.2.1 Two consistent readings within standard range of R values as per calibration test anvil should be taken before and after testing of rock specimen. The calibration test anvil should be made of steel of known hardness. Generally, steel having Brinell hardness of 500 or a Rockwell hardness of 52 C is used for this purpose.

4.2.2 Any deviation in standard R values may suggest that the spring has lost its stiffness and should be replaced. If, replacement of spring is not feasible, a correction factor (CF) must be calculated and applied to further test readings. For finding the correction factor, average of 10 reading on the calibration test anvil should be calculated and use in the following formula:

$$\text{Correction factor} = \frac{\text{Specified standard value of the calibration test anvil}}{\text{Average of 10 readings on calibration test anvil}}$$

4.2.3 The test surface of all specimens, either in the laboratory or in the field, shall be smooth and flat over the area covered by the plunger. This area and the rock material beneath to a depth of 60 mm shall be free from cracks, or any localized discontinuity of the rock mass.

NOTE — Sometimes flat surfaces are not available in field. In such cases, tests should be conducted at the, same spot in which case first three readings should be rejected.

4.2.4 Specimens obtained for laboratory tests shall be representative of the rock to be studied. Cores should be of at least NX size (54.7 mm) for the L-type hammer and preferably T2 size (84 mm) for the N-type. Block specimens should be at least 100 mm thick at the point of impact.

4.2.5 A steel base with core holder of minimum weight 20 kg for L-type and 40 kg for N type SH is used to securely clamp the rock specimens firmly. Cored specimens should be tested in a steel core holder with a semi-cylindrical machined slot of the same radius as the core, or in a steel V-block (Fig. 2). The steel base shall be placed on a flat surface that provides firm support. V-shaped slots should be avoided for weak rocks because the unsupported portion of the core specimen falls under the impact point.

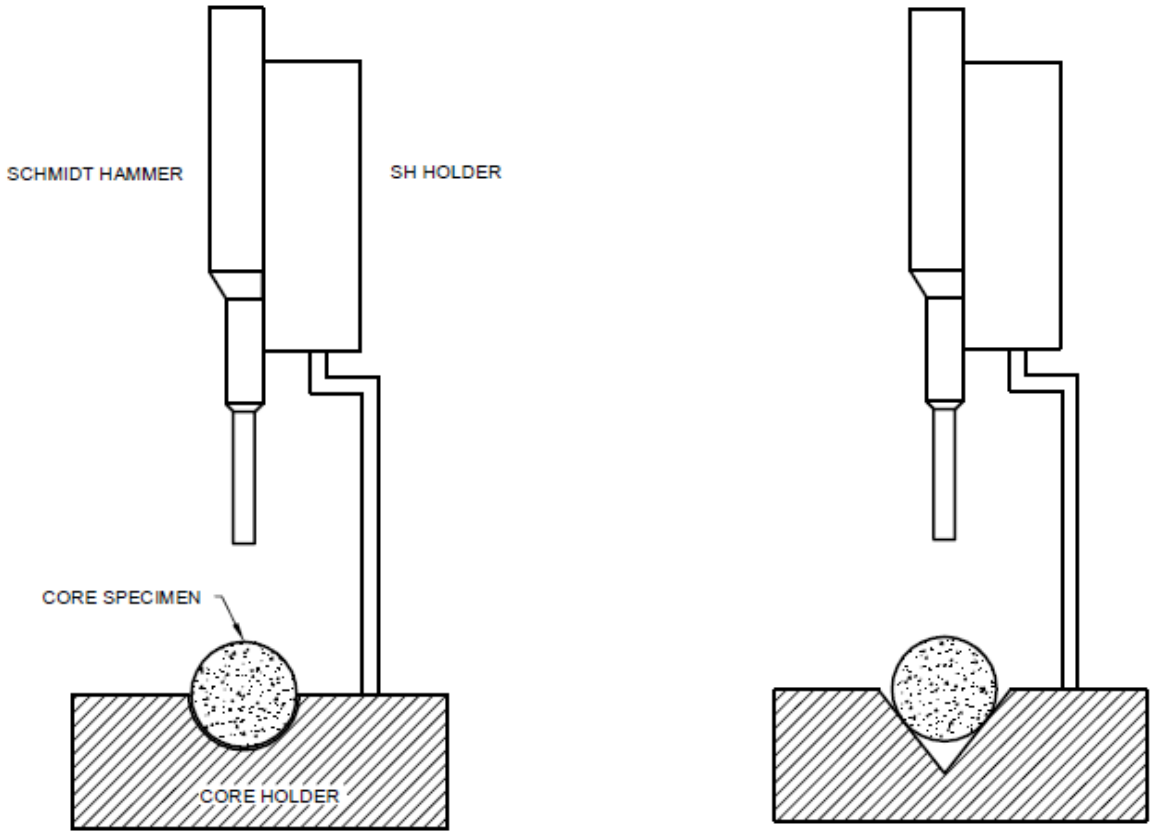

FIG. 2(A) SEMI-CYLINDRICAL CRADLE FIG. 2(B) V-SHAPED CRADLE

FIG. 2 CORE SPECIMEN HOLDERS

4.2.6 The rebound hardness value obtained will be effected by the orientation of the Schmidt hammer. For taking reading, plunger of Schmidt hammer should be placed perpendicular to the test surface without deviating more than 5°. It is recommended that the Schmidt hammer be used in one of the three positions, vertically upwards or vertically downwards or horizontally. When use of one of the three orientations is not feasible due to site conditions, the test should be conducted at the necessary angle and the results corrected to a horizontal or vertical position using the correction curves. The hammer orientation for the test and any corrections applied to non-vertical or non-horizontal orientations should be recorded and reported in the results. Corrections to reading shall be done according to IS 11315 (Part 5).

4.2.7 At least 20 individual tests shall be conducted on any one rock sample. Test locations shall be separated by at least the diameter of the plunger. Any test that causes cracking or any other visible failure shall cause that test and the specimen to be rejected.

4.3 Calculations

The measured test values for the sample should be tabulated in descending order. The lower 50 percent of the values should be discarded and the average obtained of the upper 50 percent values. This average shall be multiplied by the correction factor to obtain the Schmidt rebound hardness.

4.4 Reporting of Results

The following information shall be reported:

a) Lithological description of the rock; source of sample, including geographic location, depth and orientations;
b) Type of specimen (core, blasted or broken sample, in-situ); size and shape of core or block specimen;
c) Date of sampling, date of testing and condition of storage (that is, exposure to temperature extremes, air drying moisture, etc);
d) Hammer type (L or N);
e) Orientation of the hammer axis in the test;
f) Method of clamping sample (V-block or clamps);
g) Histogram of at least 20 rebound readings (normalized to horizontal impact direction and ordered in descending value), and the mean, median, mode and range statistics (the mean values should be rounded off to the nearest integer);
h) Photographs (or description) of impact points before and after damage. The Schmidt rebound hardness value obtained as in **4.3**

5 THE SHORE SCLEROSCOPE METHOD

5.1 Apparatus

The C-2 type shore hardness scleroscope is used for measuring the shore hardness values of a rock. The scleroscope consists of vertical barrel containing a precise bore glass tube. It consists of a diamond-tipped hammer which is manually dropped vertically and freely from a rested height on to a horizontal, polished test surface and rebounds within the glass tube. The diamond tip shall be shaped to produce a correct reading on reference bars of known hardness. The hammer of the model C-2, has diameter 5.94 mm, mass 2.300 g $\pm$ 0.500 g and overall length 20.7 mm to 21.3 mm. The distance hammer falls is $251.2\ ^{+0.13}_{-0.38}$ mm.

5.2 Procedure

a) First the instrument is calibrated by taking at least five hardness readings on the calibration test block for the specified hardness range. If the values fall within the specified hardness range, the instrument may be regarded as satisfactory; if not, the apparatus should be rectified;
b) To prevent errors resulting from misalignment, the instrument must be set or held in a vertical position, using the plumb bob or spirit level on the instrument to determine verticality. The most accurate readings of the scleroscope are obtained with the instrument mounted in a clamping stand. Lateral vibration must be avoided since they tend to cause the free fall of the hammer to be impeded and hence cause the instrument to read low;
c) The rock specimens can be prepared as cylindrical cores or cubical shapes with a critical specimen volume close to 80 cm^3 (V_C). Prior to the test, the test surface of each specimen should be ground with No. 220 sandpaper or No.1800 grade aluminum oxide abrasive powder, until a smooth test surface is obtained. An excessively coarse surface will yield low and erratic readings. The specimens should be dry since wet specimen produce lower values of shore hardness;
d) Specimens should have a minimum test surface of 10 cm^2 and a minimum thickness of 1.5 cm. Small specimens should be clamped securely with the flat test surface perpendicular to the scleroscope axis;
e) Place the test specimen in the apparatus horizontally with the ground test surface facing upwards, allowing diamond-tipped hammer to drop freely on the test surface, and carefully measuring and logging the rebounding height on the scale which ranges from 0 to 140;
f) At least 20 measurements should be made on the entire test surface of each specimen allowing at min 5 mm spacing between the two indentations and a 5 mm margin from the edges of the specimen. Values of shore hardness determined near the edges of the test specimen will be appreciably lower than those made at the center of the specimen; and
g) When a rock specimen is shaly, bedded or anisotropic, it should be tested in directions which give the greatest and the least strength values, which are generally normal and parallel to the planes of anisotropy, respectively.

5.3 Calculations

The Shore scleroscope hardness shall be the average of at least 20 measurements made on the same specimen using the above method.

a) If the tested specimen volume (V_s in cm^3) is less than critical volume ($V_c = 80\ cm^3$), then the size-corrected values of shore hardness can be estimated (SH_e) for the critical volume by using the arithmetical means of the measured shore hardness values (SH_m) in the following equation:

$$SH_e = 0.248\ (80 - V_s) + SH_m$$

b) If the specimen volume can be obtained as equal to or greater than 80 cm^3 in volume, then the arithmetical mean of the measured shore hardness values are directly taken as the shore hardness value.

5.4 Reporting of Results

The report should include the following information on each specimen tested:

a) Lithological description of the rock;
b) Source of the sample including geographic location, depth and orientation;

c) Approximate mineral composition and grain sizes of the rock specimen;
d) Date of sampling, date of testing, storage conditions, and specimen preparation procedures;
e) Specimen dimension characteristics, thickness, test surface area, and volume of the specimen;
f) Orientation of the test surface with respect to bedding or foliation planes when these are significant characteristics of the rock; and
g) The number of tests conducted and the average shore hardness value.