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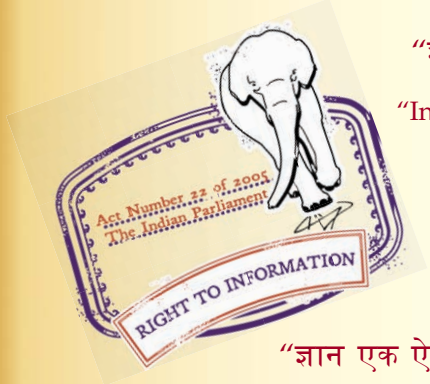

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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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METHOD FOR THE QUANTITATIVE DESCRIPTIONS OF DISCONTINUITIES IN ROCK MASSES

PART 11 CORE RECOVERY AND ROCK QUALITY DESIGNATION

UDC 624·121·32 : 622·243·572 : 006·76

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

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January 1986

Indian Standard

METHOD FOR THE QUANTITATIVE DESCRIPTIONS OF DISCONTINUITIES IN ROCK MASSES

PART 11 CORE RECOVERY AND ROCK QUALITY DESIGNATION

Rock Mechanics Sectional Committee, BDC 73

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Indian Standard

METHOD FOR THE QUANTITATIVE DESCRIPTIONS OF DISCONTINUITIES IN ROCK MASSES

PART 11 CORE RECOVERY AND ROCK QUALITY DESIGNATION

0. FOREWORD

0.1 This Indian Standard (Part 11) was adopted by the Indian Standards Institution on 29 June 1985, after the draft finalized by the Rock Mechanics Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 It is essential that both the structures of a rock mass and the nature of its discontinuities are carefully described for determining the mechanical behaviour. This Indian Standard covering various parameters to describe discontinuities in rock masses is being formulated in various parts each part covering one parameter. This part covers core recovery and rock quality designation. The other parts covering other parameters are also being formulated.

0.3 The rock quality designation (RQD), is a simple and practical method of describing the quality of core from borings. The geomechanics classification for rock mass rating is more comprehensive. Geomechanics classification although initially developed for tunnels, has been appliied to rock slopes and foundations, ground rippability assessment, as well as to mining problems.

0.4 This code will be helpful in collection of field data for applying the geomechanics classification for use in civil engineering.

0.5 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*.

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

1. SCOPE

1.1 This standard (Part 11) covers the method for the determination of core recovery, and RQD.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions of terms given in IS : 11358-1986* shall apply.

3. SYMBOLS

3.1 For the purpose of this code, unless otherwise defined in the test, the following symbols shall apply:

RQD Rock quality designation,

V P-wave velocity obtained by seismic refraction survey,

V_r Wave velocity of rock material obtained from ultrasonic tests on cores, and

J_v (Number of joints per cubic metre), volumetric joint count.

4. CORE RECOVERY

4.1 General — Core recovery defined as the summed length of all pieces of recovered core expressed as a percentage of length drilled, should be measured and recorded to the nearest 2 percent if possible. When the core is highly fragmented the length of such portions is estimated by assembling the fragments and estimating the length of core that the fragments appear to represent. Fig. 1 shows the calculation of core recovery. Core recovery is normally used to describe individual core runs or whole bore-holes, and not specific structurally defined rock units. The results obtained in a rock mass of poor quality will be strongly dependent on the drilling equipment and on the skill of the drilling crew.

4.2 Sound rock usually furnishes high recoveries, often about 100 percent, seamy and or jointed rock may furnish low recovery and badly broken cores.

4.3 Precautions

a) Core grinding may result in excessive loss of core. Core that is damaged in this way should always be recorded.

b) Diamond core boring gives smooth and regular cores.

c) The depth drilled at the start and end of zones of core loss should be carefully recorded. The relevant length lost can then be replaced by wooden blocks with marking on both ends.

*Glossary of terms and symbols relating to rock mechanics.

d) In lime stones with solution cavities, the thickness of cavity should be estimated while drilling is going on by noting sudden increase in rate of drilling.

5. ROCK QUALITY DESIGNATION (RQD)

5.1 General — RQD is a modified core recovery percentage in which all the pieces of sound core over 10 cm long are counted as recovery, and are expressed as a percentage of the length drilled. The smaller pieces resulting from closer jointing, faulting or weathering are discounted. Fig. 1 illustrates calculation of rock quality designation.

5.1.1 The RQD has been found to be a more sensitive and consistent indicator of general rock quality compared to the gross recovery percentage as obtained in Fig. 1.

5.2 Precautions

a) If core is broken during drilling process or handling, the fresh broken pieces should be fitted together and counted as one piece, if the length exceeds the requisite value of 10 cm.

b) Material that is obviously weaker than the surrounding rock such as over consolidated gauge is discounted, even if it appears as intact pieces that are 10 cm or more in length. (This type of material will normally be recovered when using the most advanced drilling equipment and experienced or carefully supervised drilling crews.)

c) To avoid poor recovery due to drilling equipment or human factor involved, double tube core barrel of NX size (54 mm dia, inside) are specified and proper supervision is required.

d) The length of individual core pieces should be assessed along the centre line of the core, so that discontinuities that occur parallel to the drill hole should not adversely effect, RQD values of an otherwise massive rock mass.

5.3 Indirect Methods (Correlated Values) — In cases where drilling has not been possible indirect method should be used. Of the two indirect methods, one is based on dynamic testing (*see* **5.3.1**) and the other is based on degree of jointing (*see* **5.3.2**).

5.3.1 RQD is approximately equal to square of velocity ratio multiplied by 100. Velocity ratio is defined as ratio between P-wave velocity (V) obtained from seismic refraction survey in field and wave velocity (V_r) of rock material obtained from ultrasonic tests on rock cores.

$$RQD = \left(\frac{V}{V_r}\right)^2 \times 100$$

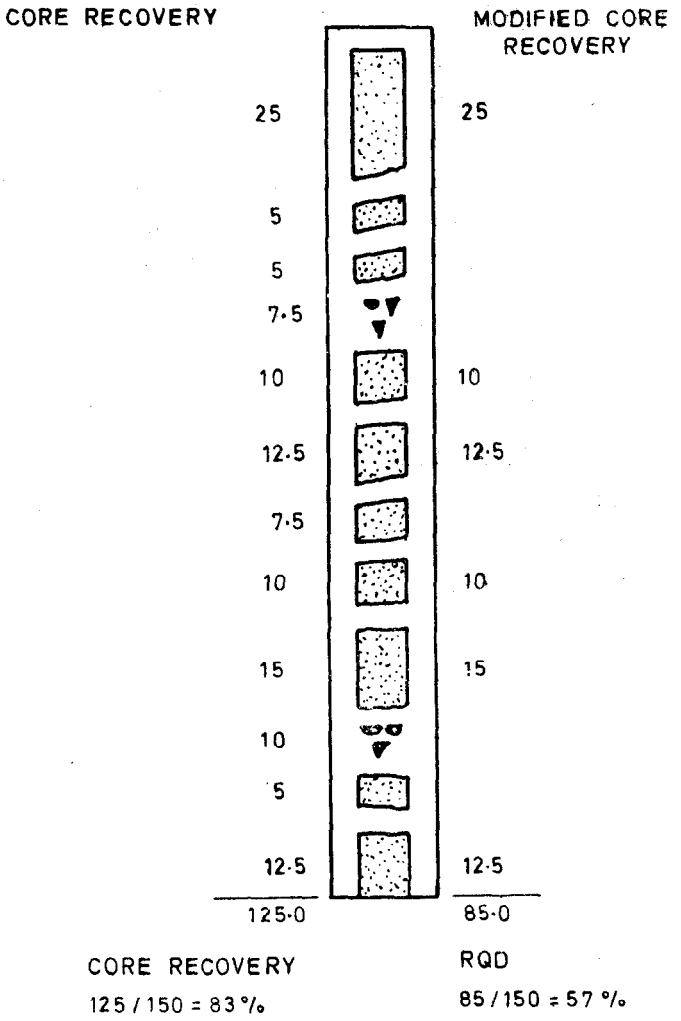

FIG. 1 MODIFIED CORE RECOVERY AS AN INDEX OF ROCK QUALITY.

5.3.2 The RQD is approximately correlated to number of joints in a cube of 1 metre as follows:

$$RQD = 115 - 3{\cdot}3\ Jv$$
$$(\ RQD = 100 \text{ for } Jv < 4{\cdot}5\ )$$

NOTE — Experience shows that actual RQD is sometimes less than above value.

5.3.3 The core quality shall be classified as under according to : *RQD*

RQD, Percent	*Core Quality*
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
25	Very poor

6. REPORTING OF RESULTS

6.1 The result of geological investigations will be reported as follows:

a) Geological description of site,
b) Core recovery, and
c) *RQD*.