



Designation: D6032/D6032M – 17

Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core¹

This standard is issued under the fixed designation D6032/D6032M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers the determination of the rock quality designation (RQD) as a standard parameter in drill core logging of a core sample in addition to the commonly obtained core recovery value (Practice D2113); however there may be some variations between different disciplines, such as mining and civil projects.

1.2 This standard does not cover any RQD determinations made by other borehole methods (such as acoustic or optical televiewer) and which may not give the same data or results as on the actual core sample(s).

1.3 There are many drilling and lithologic variations that could affect the RQD results. This standard provides examples of many common and some unusual situations that the user of this standard needs to understand to use this standard and cannot expect it to be all inclusive for all drilling and logging scenarios. The intent is to provide a baseline of examples for the user to take ownership and watch for similar, additional or unique geological and procedural issues in their specific drilling programs.

1.4 This standard uses the original calculation methods by D.U. Deere to determine an RQD value and does not cover other calculation or analysis methods; such as Monte Carlo.

1.5 The RQD in this test method only denotes the percentage of intact and sound rock in a core interval, defined by the test program, and only of the rock mass in the direction of the drill hole axis, at a specific location. A core interval is typically a core run but can be a lithological unit or any other interval of core sample relevant to the project.

1.6 RQD was originally introduced for use with conventional drilling of N-size core with diameter of 54.7 mm (2.155 in.). However, this test method covers all types of core barrels and core sizes from BQ to PQ, which are normally acceptable for measuring determining RQD as long as proper drilling

techniques are used that do not cause excess core breakage or poor recovery, or both. See 6.3 for more information on this issue.

1.7 Only the RQD classification which correlates with the common tunneling classification that was presented by Deere^{2,3} is covered in this test method. Other classification systems are not covered specifically but are mentioned in general and if used shall not be regarded as nonconformance with this standard.

1.8 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026.

1.8.1 The method used to specify how data are collected, calculated, or recorded in this standard is not directly related to the accuracy to which the data can be applied in design or other uses, or both. How one applies the results obtained using this standard is beyond its scope.

1.9 The values stated in either SI units or inch-pound units [rational values are given in brackets] are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Reporting of test results in units other than SI shall not be regarded as nonconformance with this standard.

1.10 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.11 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the*

¹ This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.12 on Rock Mechanics.

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² Deere, D. U., and Deere, D. W., The Rock Quality Designation (RQD) After Twenty Years, *Rock Classification Systems for Engineering Purposes*, ASTM STP 984, 1988, pp. 91–101.

³ Deere, D. U., and Deere, D. W., Rock Quality Designation (RQD) Index in Practice, *Contract Report G1–89–1*, Department of the Army Corps of Engineers, 1989.

*A Summary of Changes section appears at the end of this standard

Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:⁴

- D653** Terminology Relating to Soil, Rock, and Contained Fluids
- D2113** Practice for Rock Core Drilling and Sampling of Rock for Site Exploration
- D3740** Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- D5079** Practices for Preserving and Transporting Rock Core Samples (Withdrawn 2017)⁵
- D5878** Guides for Using Rock-Mass Classification Systems for Engineering Purposes
- D6026** Practice for Using Significant Digits in Geotechnical Data
- E691** Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 Definitions:

3.1.1 For definitions of common technical terms in this standard, refer to Terminology **D653**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *artificial core run*, *n*—run lengths, or intervals, created when logging the core to identify different zones or patterns of RQD in the rock mass.

3.2.2 *centerline method*, *n*—length of core sample measured along the centerline (core axis); see **Appendix X1**.

3.2.3 *core discing*, *n*—in *rock mechanics*, a phenomenon in which the drilled core breaks into disks with uniform spacing and shape due to the transient stress changes, and stress release during drilling.

3.2.4 *core recovery*, *n*—in *rock drilling*, the ratio of length of core sample recovered, both weathered and unweathered, to the length drilled, and expressed as a percent.

3.2.4.1 *Discussion*—Some literature is using a term called “total core recovery” to replace this definition. The added term “total” is an attempt to promote other types of core recovery definitions, one of which is “solid core recovery” and which is discussed in this standard and shown in the appendix to be technically flawed and should be discouraged. Therefore, it was decided to stay with a definition that is already recognized and has been used for many years in the drilling industry.

3.2.5 *core run*, *n*—in *rock drilling*, in the most basic usage, the length of the interval measured from the depth at which drilling to obtain a core sample was started to the depth at

which drilling stopped and the core barrel was retrieved to recover the cored sample.

3.2.5.1 *Discussion*—If required, the core run used to calculate the RQD can also be defined to cover a specific interval or lithology in the core samples. The length of the core run may not be equal to the length of the core sample retrieved if there is any core loss or void(s) in the coring interval or if a stub of core is left at the bottom of the drill hole. Any core sample or stub left at the bottom of the core run must be accounted for in a consistent manner in the drill logs and RQD calculations.

3.2.6 *discontinuity*, *n*—in *geomechanics*, a general term denoting any separation in a rock mass having zero or low tensile strength and is the collective term for most types of joints, fractures, weak bedding planes, weak schistosity planes, weakness zones, and shears.

3.2.7 *drill break*, *n*—in *drilling*, any mechanical or man-made break in the core that was not naturally occurring.

3.2.8 *fully circular method*, *n*—in *geomechanics*, measurement of the core length only where the core has a full circular cross section along the core axis. See **Appendix X1**.

3.2.9 *intact core*, *n*—in *geomechanics*, any segment of core between two open/unbonded, natural or mechanical discontinuities.

3.2.10 *rock quality designation (RQD)*, *n*—in *geomechanics*, a modified core recovery in which the ratio of length of core recovered to the total length drilled is modified such that only the length of the pieces of sound core that are equal to or greater than 100 mm [4 in.] in length, as measured along the core axis, are counted towards the length of core recovered, and this ratio is expressed as a percent.

3.2.11 *sound core*, *n*—in *rock drilling*, any core that is unweathered to moderately weathered and has sufficient strength to resist hand breakage.

3.2.11.1 *Discussion*—Most engineers and geologists understand what unweathered means but there is no one standard or definitions for “moderately weathered” or “resist hand breakage” and varies in the literature. However, most drillers and persons logging core usually have a good idea what either one means and would not be abused or would follow standard operating procedures used by their company. In general, hand breakage means something that cannot be indented with a finger nail and crumbles under firm blows with sharp end of a geological pick. Moderately weathered can vary in the literature. ISRM definitions for weathering were used for this standard.

3.2.12 *moderately weathered*, *n*—in *geology*, less than half of the rock material is decomposed and/or disintegrated to a soil; fresh or discolored rock is present either as a continuous framework or as core stones.

3.2.13 *tip to tip method*, *n*—in *geomechanics*, measurement of the core length as the distance between the highest point of the piece of the core along the borehole. See **Appendix**.

3.2.13.1 *Discussion*—This definition is only provided because it is used in the standard for discussions on why this measurement method is not used or approved by this standard and does not infer that the method is valid or applicable for RQD measurements.

⁴ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

⁵ The last approved version of this historical standard is referenced on www.astm.org.