Designation: D6032/D6032M – 17

Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core[1]

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.

Current edition approved March 1, 2017. Published April 2017. Originally approved in 1996. Last previous edition approved in 2008 as D6032 – 08. DOI: 10.1520/D6032_D6032M-17.

[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 schistocity 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 geologist 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 provide 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.

4. Summary of Test Method

4.1 The RQD denotes the percentage of intact and sound rock retrieved from a borehole orientated in any direction. All pieces of intact and sound rock core equal to or greater than 100 mm [4 in.] long are identified and recorded. The pieces are measured along the core axis (centerline method).

NOTE 1—The original paper by Deere states "over four inches" and many references vary between "over 4 inches" to "equal to or greater than 4 inches". This issue was posed to the D18.12 membership and the consensus was that the way it is typically been used in the field, equal to or greater than 100-mm [4 in.] is how it should be worded in this standard. References like Wikipedia do not always have the best information either and should not be assumed to be correct much less a consensus on this issue.

4.2 Pieces of core that are moderately or intensely weathered, contain numerous pores, or are friable, or any combination thereof, should not be included in the summation of pieces for the determination of the RQD. Where the core is known or believed to have been broken by handling or by the drilling process, the broken pieces (including core discing) are fitted together and counted as one piece and the pieces are fitted together, marked as a mechanical break (both on the cores and on the logs) and counted as one piece.

4.3 All the sections of core that meet the greater than or equal to 100-mm [4 inches] and soundness criteria are summed and then divided by the total length of the core run or interval of interest (see 4.3.1), as shown in Fig. 1, to give the value of RQD as a percent. Rock mechanics judgment may be necessary to determine if a piece of core qualifies as being intact and sound.

4.3.1 If required, the RQD may be determined for intervals other than a given core run. For example, determining the RQD for a given rock unit, rock type, a running value, or weighted average.

4.4 The RQD value is then used for classification of the rock quality based upon a rating system, such as the one in Deere's original paper and shown in Fig. 1 and is usually the default system to use. Some other classification system might be used, if required, at the drill site or later on in the data analysis process.

5. Significance and Use

5.1 The RQD was first introduced in the mid 1960s to provide a simple and inexpensive general indication of rock mass quality to predict tunneling conditions and support requirements. The recording of RQD has since become virtually standard practice in drill core logging for a wide variety of geotechnical explorations.

5.2 The use of RQD values has been expanded to provide a basis for making preliminary design and constructability decisions involving excavation for foundations of structures, or tunnels, open pits, and many other applications. The RQD values also can serve to identify potential problems related to bearing capacity, settlement, erosion, or sliding in rock foundations. The RQD can provide an indication of rock quality in quarries for issues involving concrete aggregate, rockfill, or large riprap.

5.3 The RQD has been widely used as a warning indicator of low-quality rock zones that may need greater scrutiny or require additional borings or other investigational work. This includes rocks with certain time-dependent qualities that by determining the RQD again after 24 h, under well-controlled conditions, can assist in determining durability.

5.4 The RQD is a basic component of many rock mass classification systems, such as rock mass rating (RMR) and Q-System, for engineering purposes. See D5878 and [2,3].

5.5 When needed, drill holes in different directions can be used to determine the RQD in three dimensions.

5.6 The concept of RQD can be used on any rock outcrop or excavation surface using line surveys as well. However, this topic is not covered by this standard.

NOTE 2—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice D3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

6. Interferences

6.1 Used alone, RQD is not sufficient to provide an adequate description of rock mass quality. The RQD does not account for discontinuity orientation, tightness, continuity, and gouge material. The RQD must be used in combination with other geological and geotechnical input.

6.2 The RQD is sensitive to the orientation of joint sets or other open or weak discontinuities with respect to the orientation of the core axis.[6] For example, a joint set parallel to the core axis may not, if at all, intersect the core sample, unless the drill hole axis happens to run along the joint plane. A joint set perpendicular to the core axis will intersect the core axis at intervals equal to the joint spacing. For intermediate orientations, the spacing of discontinuity intersections with the core will be a cosine function of angle between joints and the core axis.

6.3 The N-size are the optimal core barrel size for determining RQD. The RQD is also useful for larger core diameters provided the core diameter is clearly stated. The RQD calculated for core smaller than BQ may not be representative of the true quality of the rock mass. Larger sizes are preferred; and the smaller BQ and BWX sizes should be discouraged and; when used, should be identified with a disclaimer.

6.4 The RQD values obtained can be sensitive to the type of drill equipment and techniques that are used. Double or triple, split tube, core barrels are preferred over single tube barrels. Use of single tube core barrels will have additional issues to consider when making RQD determinations. Therefore, it is important to note what type of drill equipment and techniques were used as well as the personnel involved. Also, if conventional drilling is used, rather than, wire line drilling, then the

[6] Arild Palmstrom, Ph.D., Norconsult as, Norway, Measurements of and Correlations between Block Size and Rock Quality Designation (RQD), Published in *Tunnels and Underground Space Technology*, 20 (2005), 362-377

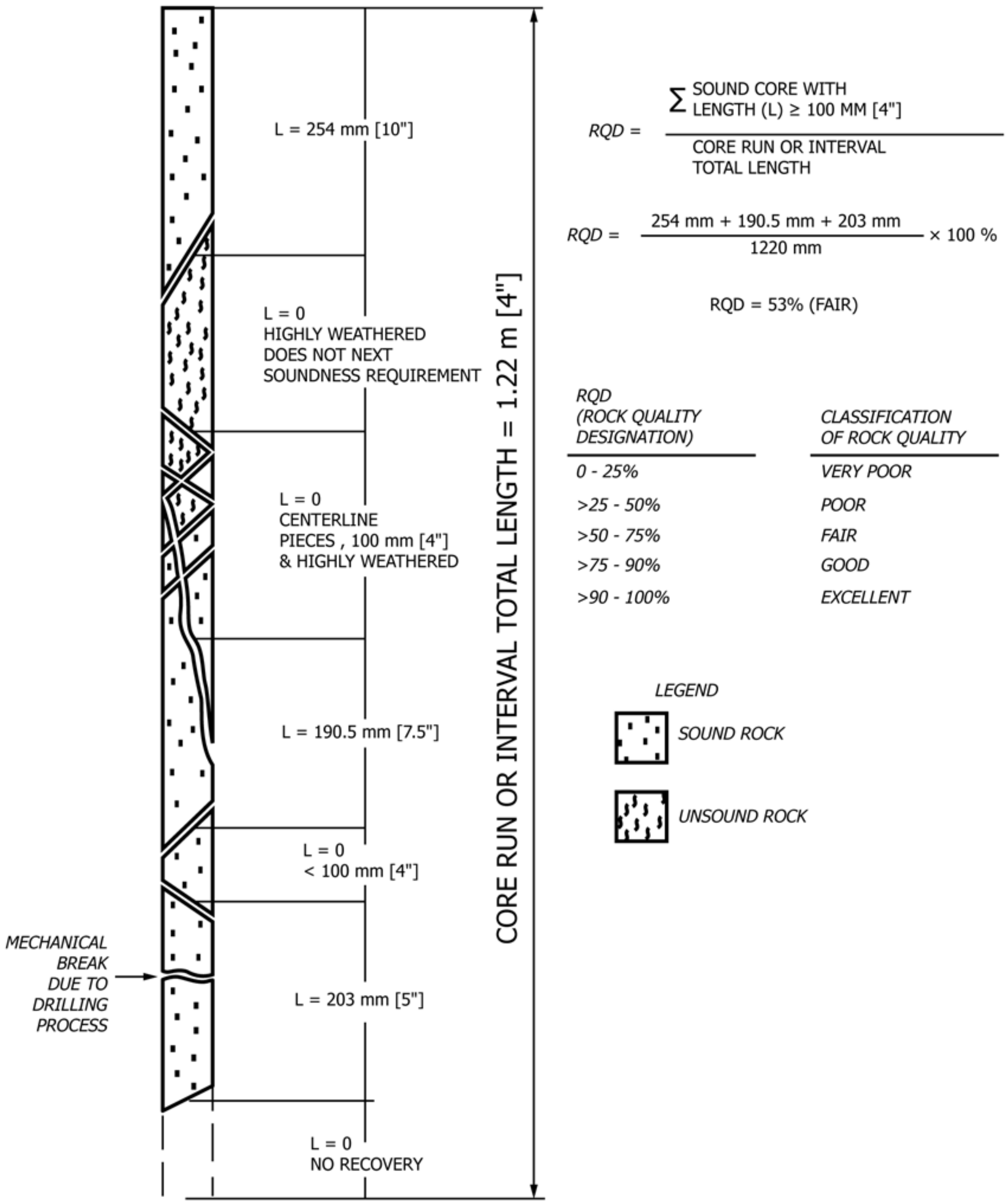

FIG. 1 Example of How RQD Data is Collected for a Core Run or Interval, and Calculated, Using the Centerline Method, and Then Classified. The rock quality classification shown is what was originally proposed by Deere[2,3]. Other rock quality classifications may be used.

potential for material to cave in the hole is greater. This can alter the RQD results and must be anticipated and handled appropriately.

6.5 Measurement of the length of the core pieces by any other method than the centerline method can produce erroneous results (see Appendix X1). Training and of logging personnel is therefore critical and be given consistent advice or training. This means that training and feedback must be given early during the drilling program when the core is still available or with the core photos.

6.6 The RQD index is sensitive to the length of the core run. For example, a 300-mm [11.8-in.] wide, highly fractured zone within a massive rock would result in RQD values of 90 %, 80 %, and 40 %. for respective core run lengths of 3 m [12.9 ft], 1.5 m [4.9 ft], and 0.5 m [1.6 ft]. Thus, the shorter the run length, the greater the sensitivity of the RQD and the lower its value (becoming equal to zero for a 300 mm [11.8 in.] core run encompassing the fractured zone).

6.7 Drill core samples can disc in certain stress conditions. Therefore, the RQD values can be effected by the stresses the drill hole encounter and the drill bit might generate and may need to be accounted for in the calculations as well as the report. These may be natural in situ stresses, manmade stresses due to surface or underground excavations, and/or those by the drilling equipment. Where discing occurs in diamond drill core, there should be no RQD penalty. Discing is a stress phenomenon unrelated to in situ rock.[7]

7. Procedure

7.1 Drilling of the rock core should be done in accordance with Practice D2113. It is important that proper drilling techniques and equipment are used to minimize core breakage or poor core recovery, or both.

7.2 There are several ways to define a core run for calculating RQD. Three of these ways are: (*1*) a core run as defined in this standard; (*2*) a change in formation or rock type could constitute an end of a core run; and (*3*) a core run can be a selected zone or interval of concern. In establishing a core run it is important to be consistent throughout a drill hole and to document how the core run was defined.

7.3 Retrieval, preservation, transportation, storage, and cataloging of the rock core should be done in accordance with Practices D5079. The RQD should be logged and the corresponding intervals photographed on site when the core is retrieved. This is because some rocks can disintegrate, due to poor curatorial handling, slaking, desiccation, stress relief, cracking or swelling, with time. For those rocks that disintegrate it is recommended that the RQD be measured again after 24 h, or as soon as possible thereafter, to assist in determining durability if it could be important to the intended use of the data.

7.4 Close visual examination of core pieces is required for assessing the type of open discontinuity (that is, natural, discing or mechanical break) and need to be properly recorded and marked accordingly.

7.5 Only those pieces of rock formed by natural breaks (that is, joints, shear zones, bedding planes, or cleavage planes that result in surfaces of separation) shall be considered for RQD purposes. Where discing occurs in diamond drill core, there should be no RQD penalty. Discing is a stress phenomenon unrelated to rock fabric. The core pieces on either side of core breaks caused by the drilling process, including where the core catcher may have broken the core, shall be fitted together and counted as one piece. Drilling breaks are usually evident by rough fresh surfaces. In some cases it may be difficult to differentiate between natural and drilling breaks. When in doubt, count as a natural break.

NOTE 3—When there is uncertainty about a break, the reasoning that it should be considered as natural is in order to be conservative in the calculation of RQD.

7.6 If there is not 100 % core recovery for a drill run, the length of any core left in the borehole should be taken into account by adding it to the run in which it was cored rather than the run in which it was retrieved. Thus, if the core recovery is not 100 %, the length of core in adjacent runs should be checked before the difference is attributed to a cavity, core loss or core gain.

NOTE 4—Drill parameter recorders can be a useful tool to use when drilling core to determine the location and reason for any gaps in the core run.

7.7 Record the top and bottom depths of each core run or interval to the nearest 1 cm [0.05 ft or 0.5 in.].

7.8 Measure all core piece lengths that are intact, sound and greater than or equal to 100 mm [4 in.] to the nearest 1 cm [0.05 ft or 0.5 in.] and record the length as well as the depths on a RQD data sheet (Fig. 2). Measure such pieces along the core axis (centerline method) as illustrated in Fig. 1 and Fig. X1.1. No other measurement method, such as tip to tip or fully circular (see Appendix X1), is allowed.

7.8.1 Pieces of core that are from highly weathered to residual soil, contain numerous pores, or are friable, or combination thereof, should not be included in the summation of pieces greater than or equal to 100 mm [4 in.] for the determination of the RQD. However, moderately weathered core that resists hand breakage should be included but an asterisk is used with the reported RQD value (RQD* =).

NOTE 5—The asterisk is what is in all of the references by Deere[2].

7.8.2 If any rejected piece of core is still included as part of the total length of core run or interval it should be noted in the report.

NOTE 6—Centerline measurements ensure that the RQD value resulting from the measurements is not dependent on the core diameter (See Appendix). Centerline measurements also avoid unduly penalizing resulting RQD values for cases where discontinuities parallel the core axis. Any other method used for accounting for fractures parallel to the core axis, while not advocated by this test method and in the literature, must be clearly stated.[2,3].

7.9 After each drill run reconcile the quality of data for the drill run. Determine if the sum of the individual core lengths greater than or equal to 100 mm plus the sum of material (which is <100 mm) plus the core loss (no recovery) does or doesn't equal the drilled run length. If not equal it should be determined if it is due to poor measurement technique or due to not accounting for core left down hole and the data adjusted accordingly. If needed, RQD determination may need to be assessed by looking at adjoining runs (or sometimes beyond adjoining runs) for core left down hole (and that is not washed away).

7.10 Sketch and/or photograph core features such as natural breaks, drilling breaks, lost core, voids, highly weathered pieces, and so forth (see Fig. 1). If possible to identify, any voids, cavities or core loss must be differentiated as such.

7.11 Include remarks concerning judgment decisions such as whether a break in a core is a natural break or a drilling break or why a piece of core longer than 100 mm [4 in.] was not considered to be intact or sound.

7.12 Record the sum of intact and sound core pieces longer than 100 mm [4 in.] long, and calculate the RQD value for the core run or interval being evaluated as shown in Section 8.

[7] *Hard Rock Miner's Handbook, Edition 5*, J.N. de la Vergne, Susan L. Andersen, Editor, 2008, Stantec Consulting Ltd., 10160 – 112 Street, Edmonton, Alberta, Canada.

RQD DATA SHEET	
Project Title:	
Project and drill hole Location:	
Boring Number:	Drill fluid used:
Core Box ID:	Location of drill logs:
Core Diameter, mm (in.)	Date/time sample collected:
Borehole orientation:	Logger(s):
Core barrel used:	Date/time Logged:
Driller(s):	Air Temperature, °C (°F):
Start of core run m (ft):	Checker(s):
End of core run, m (ft):	Date Checked:
Length of core run (interval):	Peer Review/Date
Curatorial History and other information: (Where logged, is this a secondary logging, drill fluid used, etc.)	

Segment	Drill Hole Depth, m (ft)	Length of core segment, mm (inch or ft)	Sound core (yes/no)	> or = 100 mm [4 inch] (yes/no)	Remarks, rock descriptions, core losses, other data and sketches or photographic information
Start					

	Σ length of the sound core segments greater than or equal to 100 mm [4-in.]			
RQD = ...				
	Total length of core run or interval, mm (in.)			
Σ segments	to		of sound core greater than or equal to 100 mm [4-in.]:	
RQD (%) =		Rock Quality Classification[1]:		
•To do RQD calculations for other core segments repeat using above formula and those segments of data.				
		Page	of	
Footnotes	1. Rock Classifications used other than shown in ASTM D6032 should be noted in report and forms.			

FIG. 2 Example RQD Data Sheet

7.13 Indicate the rock quality classification for the core run or interval using the table in Fig. 1 if no other classification system is used.

8. Calculation or Interpretation of Results

8.1 *Calculation:*

8.1.1 Calculate as a percentage, the RQD of a core run or other artificial core run or interval as follows:

$$RQD = \frac{\Sigma \text{ length of the sound core segments} > \text{or} = [4 \quad \text{in.}] \times 100\%}{\text{Total length of core run or interval, mm [in.]}} \quad (1)$$

8.1.2 In accordance with Practice D6026, record the result to the nearest whole percent.

8.2 *Interpretation:*

8.2.1 Determine the rock quality classification for the actual or artificial core run or interval using the table in Fig. 1; which came from the common tunneling classifications may be used if applicable[2,7].

NOTE 7—Even though the table in Fig. 1 comes from a tunneling or underground perspective, and maybe outdated it is still a classification system that is well known and establish and worth reporting. The reason is that in lieu of any additional data it at least gives a rough idea of a starting point of what is there and words that the non-technical person can understand versus just the RQD numbers. Users should realize that other uses for RQD such as for foundation bearing and settlement, slope behavior or excavation evaluation may have different subjective descriptors for particular values of RQD and they should be used in any final reports.

8.2.2 Other rock quality classifications may be used that are more fitting for the project purpose but must be clearly noted in the report and any tables.

9. Report: Test Data Sheet(s)/Form(s)

9.1 A typical report may include the following:

NOTE 8—This section does not purport to list or infer any absolutes for all the information needed for a report. This will vary depending on the project requirements and which should be carefully communicated to all parties prior to the start of the drilling and core logging program. The list shows what is commonly good practice and was based upon case histories where many times it was found to be prudent to have more information rather than to little. It is up to the person recording the data to have everything needed to do the evaluation required.

9.1.1 Source of sample including project name, location, and, if known, date sample was drilled, curatorial history such as storage, shipping, and handling environment. The location may be specified in terms of borehole number and depth of core samples from the collar of the hole.

9.1.2 Description of drilling equipment, method, personnel, and hole orientation.

9.1.3 Physical description of each core run or interval including diameter, rock type and location and orientation of discontinuities, such as, apparent weakness planes, bedding planes, schistosity, and large inclusions or inhomogeneities, if any.

9.1.4 Date(s) of RQD data collection and sketches and/or photographs of core run(s) or interval(s).

9.1.5 General indication of any curatorial issues, drilling conditions, observations, and assumptions relevant to the accuracy of the RQD values or calculations.

9.1.6 A table and/or graphic depiction of RQD values and/or copies of any RQD data forms or sketches.

9.1.7 The rock quality classification for the core run or interval and the source of the classification.

10. Precision and Bias

10.1 *Precision*[8]—A round-robin study of the RQD index of cores of four selected types of sedimentary rock (anhydrite/calcite, calcareous shale, limestone, and anhydrite) with four replications per rock type was conducted in accordance with Practice E691 by eight experienced participants.[9] The repeatability and reproducibility statistics reported in Table 1 refer to within-participant and between-participant precision, respectively. The probability is approximately 95 % that two results obtained by the same participant on the same material will not differ by more than the repeatability limit *r*. Likewise, the probability is approximately 95 % that two results obtained by different participants on the same material will not differ by more than the reproducibility limit *R*. The precision statistics are calculated from the following equation:

$$r = 2\left(\sqrt{2}\right)s_r \quad (2)$$

where s_r = repeatability standard deviation, and

$$R = 2\left(\sqrt{2}\right)s_R \quad (3)$$

where s_R = reproducibility standard deviation.

NOTE 9—Some combinations of the means and *r* and *K* can result in RQD limits that exceed 100 % because the RQD values have been assumed to be normally distributed which may not reflect the actual underlying distribution of the RQD values.

10.2 *Bias*—There is no accepted reference value for this test method; therefore, bias cannot be determined.

11. Keywords

11.1 classification; index; logging; quality; rock; rock core

[8] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:ISRD18-1015.

[9] Pincus, H. J., and Clift, S. J., *Interlaboratory Testing Program for Rock Properties: Repeatability and Reproducibility of RQD Values for Selected Sedimentary Rocks*, PCN: 33-000011-38, ASTM Institute of Standards Research, 1994.

TABLE 1 RQD Index of Cores of Sedimentary Rock

Material (Rock Type)	Mean RQD, $\bar{x}$, %	Repeatability, r, % [A]	Reproducibility, R, % [A]
Anhydrite/calcite	86	28	28
Calcareous shale	60	32	40
Limestone	92	14	14
Anhydrite	86	20	20

[A] The numbers in the *r* and *R* columns are not to be taken as percentages of the means, but are applied as plus or minus terms to the respective means.

APPENDIX

(Nonmandatory Information)

X1. EXAMPLES OF DIFFERENT CORE MEASUREMENT METHODS

Fig. X1.1

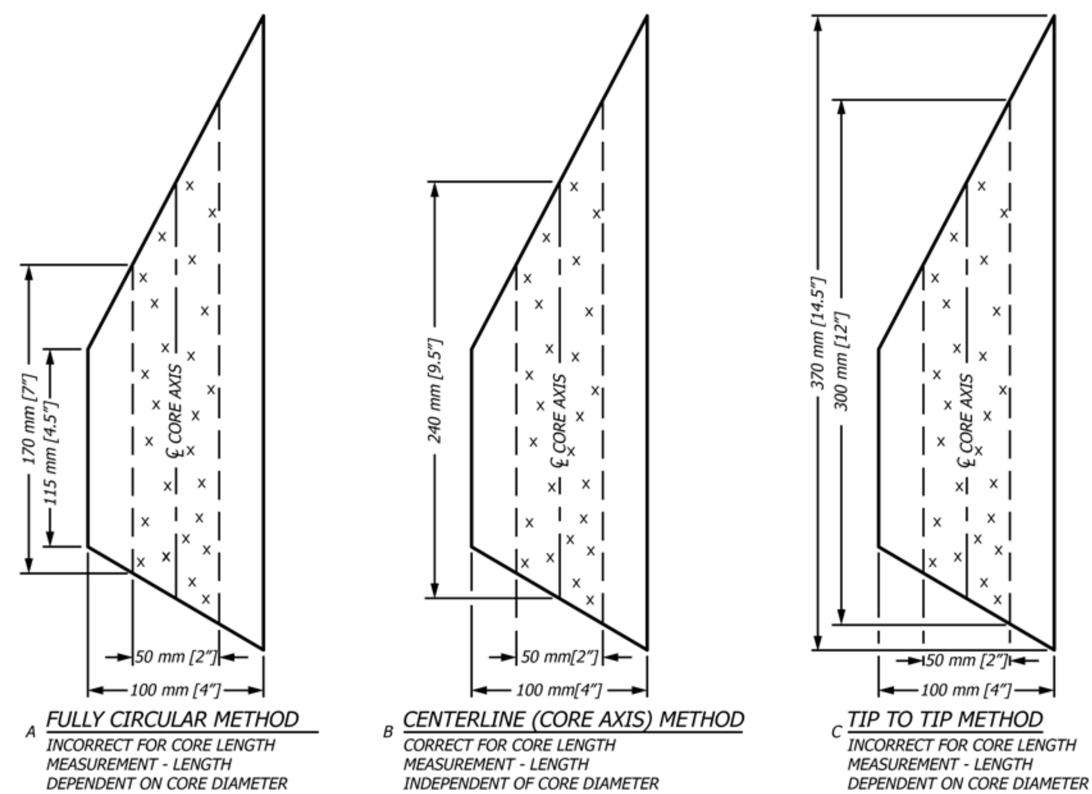

FIG. X1.1 Examples of Different Core Measurement Methods on 2-in. and 4-in. Diameter Cores and Why Only the Centerline Method is Acceptable for This Test Method

SUMMARY OF CHANGES

Committee D18 has identified the location of selected changes to this standard since the last issue (D6032 – 08) that may impact the use of this standard. (March 1, 2017)

(1) Expanded Scope (Section 1) with 1.2 through 1.7 and added footnote references 2 and 3.
(2) Section 1: Updated units caveat and added SI units.
(3) Section 1: Added International caveat.
(4) Section 2: Added ASTM D5878.
(5) Section 3: Updated format for terminology and added 8 definitions specific to this standard.
(6) Section 4: Added a note (Note 1).
(7) Section 4: Original had only one section that was edited and 4.1, 4.2, 4.3.1, and 4.4 were added.
(8) Section 5 was significantly edited and updated.
(9) Fig. 1 was significantly edited and several errors corrected.
(10) An Interference section (Section 6) was added. Some material from other sections was moved that was better suited to be in this section as well.
(11) Footnotes 6 and 7 were added.
(12) Major re-write and expansion of Section 7.
(13) Three notes were added to Procedures section (Section 7).
(14) Expanded the title for the Calculations section (Section 8).
(15) Calculation section: Added more steps, edited formula and added rationalized units.
(16) Added Note 7 to Calculations section (Section 8).
(17) Report section title was edited to conform with blue book format.

(18) Added Note 8 to Report section (Section 9).
(19) Added Appendix X1 with figure showing the different core measurement methods.
(20) Table 1: Format of table was fixed.