



# Standard Test Method for Field Determination of Rapid Specific Gravity of Rock and Manmade Materials for Erosion Control<sup>1</sup>

This standard is issued under the fixed designation D5779/D5779M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This test method covers the determination of the rapid specific gravity of rock or man-made materials for erosion control.

1.2 The values stated in either SI units or inch-pound units 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.

1.3 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this standard.

1.3.1 For purposes of comparing measured or calculated value(s) with specified limits, the measured or calculated value(s) shall be rounded to the nearest decimal or significant digits in the specified limits.

1.3.2 The procedures used to specify how data are collected/recorded or calculated, in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analytical methods for engineering design.

1.4 *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.*

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.17 on Rock for Erosion Control.

Current edition approved Jan. 15, 2014. Published February 2014. Originally approved in 1995. Last previous edition approved in 2008 as D5779 – 08<sup>ε1</sup>. DOI: 10.1520/D5779\_D5779M-14.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- D653 Terminology Relating to Soil, Rock, and Contained Fluids
- D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing
- D4992 Practice for Evaluation of Rock to be Used for Erosion Control
- D6026 Practice for Using Significant Digits in Geotechnical Data
- D6473 Test Method For Specific Gravity And Absorption of Rock For Erosion Control

## 3. Terminology

3.1 *Definitions*—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 *rapid specific gravity*—the ratio of the mass in air of a unit volume of relatively impermeable rock or man-made material, to the mass of an equal volume of water measured under a variety of temperatures.

## 4. Summary of Test Method

4.1 An air-dried specimen (block, chunk, or slab) of rock or manmade material, such as concrete or masonry rubble from paving and building demolition, is weighed in air and then weighed again while immersed in water. Using the masses, the field rapid specific gravity is calculated. The determined specific gravity can then be used to determine a mass per unit volume.

<sup>2</sup> 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.

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

## 5. Significance and Use

5.1 Riprap and armor material are composed of pieces of natural rock or manmade material that are placed on construction projects, shorelines, streambeds, bridge abutments, pilings and other structures to minimize the effects of erosion. The ability of rock or manmade material to withstand deterioration from weathering affects both the effectiveness of the project and its cost. The specific gravity and absorption provide useful information that can be used in evaluating possible deterioration of rock or manmade material.

5.2 Test specimens equal in size to the proposed design size would provide the best correlations between laboratory tests and actual field performance; however, this is usually neither practical nor economically feasible.

5.3 This test method has been used to evaluate different types of rocks and manmade material. There have been rare occasions when test results have provided data that have not agreed with the durability of rock or manmade material under actual field conditions.

5.4 The results of this test is not to be used as the sole basis for determination of durability, but should be used in conjunction with the results of other tests.

NOTE 1—The quality of the result produced by this standard is dependent upon 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 evaluation some of those factors

## 6. Interferences

6.1 The limitations of this test are threefold.

6.1.1 First, this is a field test method using simple apparatus and limited specimen inundation durations to measure rapid specific gravity. Though this method produces test results quickly, the results may not be as accurate as a more highly controlled method. For laboratory determination of specific gravity see Test Method **D6473**.

6.1.2 Second, certain rock types and manmade materials with small, interconnected pore space could internally entrap air when, during rapid total immersion, water migrates from three dimensions. Capillary tension draws the water inward, but as it does so the air may become entrapped preventing the water from migrating into the center of the rock. Incremental submersion or vacuum saturation methods may aid in lessening air entrapment in this type of material and is beyond the scope of this procedure.

6.1.3 Third, the test specimens may not be representative of the quality of the larger rock and manmade material samples used in construction. Careful examination of the source and proper sampling are essential in minimizing this limitation.

## 7. Apparatus

7.1 *Balance*—A balance or scale conforming to the requirements of Guide **D4753** readable (with no estimation) and accurate to 1 % or better of the mass of the test specimen. For masses over 50 kg [110 lb] a load-cell, spring scale, or some

other device accurate to within 1 % of the mass may be used. The balance shall be equipped with suitable apparatus for suspending the sample container in water from the center of the platform or pan of the balance.

7.2 *Specimen Container*—A wire basket, sling, or pan to be attached to the scale and capable of holding the specimen and suspending it in water.

7.3 *Water Bath*—A vessel filled with a volume of water large enough to submerge the specimen and specimen container without touching any of the vessel's sides.

7.4 An example apparatus is shown in **Fig. 1**.

## 8. Sampling

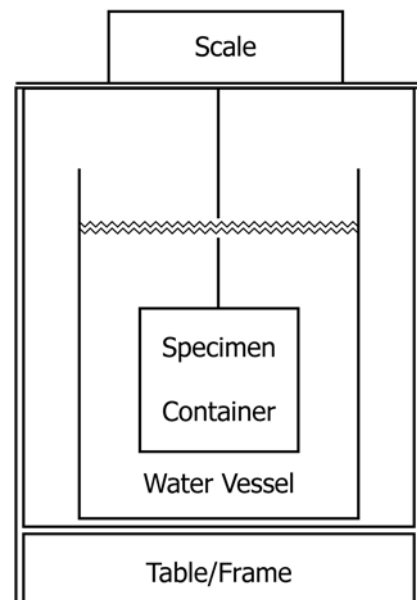
8.1 Rock source sampling shall be guided by Practice **D4992**. Manmade material source sampling shall be guided, where applicable, by the general principles outlined in Practice **D4992**. A source that is macroscopically uniform in color, texture, mineralogy, or some other visual property shall be represented by a sample consisting of a minimum of five specimens. A macroscopically non-uniform source shall be represented by a minimum of eight specimens.

8.2 Rock and manmade material types that comprise less than 5 % of the total source, as determined from their macroscopic properties, may be ignored, unless their presence will greatly affect the test results and subsequent proposed use.

8.3 Sample the rock or man-made material types in their approximate proportion to the types that occur at the source.

## 9. Specimens

9.1 Specimens shall be clean and without soil particles or other adherent materials. Specimens shall have all loose parts and adherent material removed by brushing with a stiff brush (including the use of water, as necessary) and shall be allowed to air dry until all surfaces are visually dry.



**FIG. 1** Example Apparatus

9.2 Air dry specimens until all surfaces are visually dry.

9.3 Each specimen shall be a minimum of 2.2 kg [5.0 lb] in mass. The maximum mass shall be limited only by the capacity of the scale and the size of the water-filled tank. Small pieces of rock and manmade material shall be combined to produce a specimen having a minimum of 2.2 kg [5.0 lb] mass.

NOTE 2—Evaluation of the properties of rock and manmade materials are best performed by testing the largest possible specimens.

## 10. Procedure

10.1 Perform the test in the field at any temperature above the freezing temperature of water.

10.2 Determine the air-dry mass of each specimen and record its mass to the nearest 1 %.

10.3 Determine the tare value of the specimen container while the container is immersed in water without the specimen.

10.4 Determine the mass of each air dried specimen and record the mass to the nearest 1 %.

10.5 Place each test specimen, one at a time, in the suspended specimen container ensuring it is completely immersed in water. Take care to remove all entrapped air before determining its mass in water by shaking the immersed container.

10.6 Determine the mass of each immersed specimen and record the mass to the nearest 1 %. The specimen container shall be immersed to the same level (depth) as when determining the tare value to reduce error caused by the mass of the equipment above and below the water level.

NOTE 3—Care should be taken to ensure that any material detached from its parent specimen during the immersion process shall remain with its parent specimen throughout the balance of testing. The detached material shall be treated and its mass determined, as with the parent specimen.

NOTE 4—Specific gravities of large specimens can be made using power equipment, slings, and load cells or some other means of determining its mass.

## 11. Calculation

11.1 *Rapid Specific Gravity*—Calculate the air-dried rapid specific gravity for each specimen of rock or manmade material to the nearest 0.1 as follows:

$$\text{Rapid Specific Gravity} = \frac{\text{Mass in Air}}{\text{Mass in Air} - \text{Mass in Water}} \quad (1)$$

NOTE 5—For those circumstances requiring results reportable to 0.01 specific gravity unit, a laboratory determination using Test Method [D6473](#) may be used.

11.2 *Average Rapid Specific Gravity*—Calculate the average rapid specific gravity of the rock or manmade material source, sample, or both, to the nearest 0.1 as follows:

$$\text{Average Rapid Specific Gravity} = \frac{\text{Summation of Specific Gravities}}{\text{Number of Tested Specimens}} \quad (2)$$

NOTE 6—The average specific gravity may be calculated for a specimen of combined small pieces. The specific gravity of individual pieces shall not be required.

## 12. Report: Test Data Sheet(s)/Form(s)

12.1 Record the following information:

12.1.1 Source of the samples, its location, the date sampled and tested, and the geological formation if known,

12.1.2 Description and type of materials,

12.1.3 Name of the individuals performing the test,

12.1.4 Rapid specific gravities of all specimens to the nearest 0.1 specific gravity unit,

12.1.5 Average rapid specific gravity for the source to the nearest 0.1 specific gravity unit,

12.1.6 The range in test values if multiple tests are made on the same specimens or samples,

12.1.7 Type of equipment used to perform the test, that is, balance with basket in tank, crane with sling and load cell, and so forth, and

12.1.8 Photograph of specimens and equipment used in testing. This is optional.

## 13. Precision and Bias<sup>3</sup>

13.1 *Precision*—The following estimates of precision are based on the results of testing conducted by six laboratories on five different kinds of dolomite and limestone.

13.1.1 *Single-Operator Precision*—The single-operator standard deviation of a single test result has been found to be 0.008.<sup>4</sup> Therefore, results of two properly conducted tests by the same operator should not differ by more than 0.02.<sup>4</sup>

13.1.2 *Multilaboratory Precision*—The multilaboratory standard deviation of a single test result has been found to be 0.027.<sup>4</sup> Therefore, results of two properly conducted tests in different laboratories on the same material should not differ by more than 0.08.<sup>4</sup>

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

## 14. Keywords

14.1 riprap; rock; rock material properties; specific gravity

<sup>3</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D18-1006. Contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org).

<sup>4</sup> These numbers represent, respectively, the (1s) and (d2s) limits as described in Practice [C670](#).

**SUMMARY OF CHANGES**

Committee D18 has identified the location of selected changes to this standard since the last issue (D5779 – 08<sup>e1</sup>) that may impact the use of this standard. (Approved Jan. 15, 2014.)

- (1) Revised the title to better reflect content.
- (2) Revised the standard into a dual measurement system with the units of measurement now stated in either inch-pound units or SI units.
- (3) Revised Sections 5, 7, 8, 9, and 10 for clarity.
- (4) Revised **Note 1** to conform to D18 policy.
- (5) Added Section 6.
- (6) Updated Section 11 and 12 for wording.
- (7) Revised **Fig. 1** for clarity.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; <http://www.copyright.com/>*