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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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# Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions[1]

This standard is issued under the fixed designation D 5313; 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 procedures for evaluating the durability of rock for erosion control when exposed to wetting and drying conditions.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *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.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

D 4992 Practice for Evaluation of Rock to be Used for Erosion Control[2]

D 5121 Practice for the Preparation of Rock Slabs for Durability Testing[2]

## 3. Significance and Use

3.1 Rock used for erosion control may consist of several types, depending on potential use. One type may be armor stone weighing from one to three tons or breakwater stone weighing three to twenty tons placed along shorelines or in jetties to protect the shoreline from erosion due to the action of large waves. Another type may be riprap usually weighing less than a ton and placed along river banks or on the slopes of dams to prevent erosion due to run-off, wave action or stream-flow. A third type may be gabion-fill weighing less than fifty pounds and placed in baskets of wire or other suitable material. These baskets are then tied together to form an integral structure designed to resist erosion along stream banks and around bridge piers. No matter what form it takes, rock for erosion control consists of individual pieces of natural stone. The ability of these individual pieces of stone to resist deterioration due to weathering action affects the stability of the integral placement of rock for erosion control and hence, the stability of construction projects, shorelines, and stream-banks.

3.2 This test method is designed to determine the effects on the individual pieces of rock for erosion control of wetting and drying action and the resistance of the rock to deterioration. This test method was developed to be used in conjunction with additional test methods listed in Practice D 4992. This test method does not provide an absolute value but rather an indication of the resistance to wetting and drying; therefore, the results of this test method are not to be used as the sole basis for the determination of rock durability.

## 4. Apparatus

4.1 *Diameter Circular Diamond Saw*, 14 in. (355.60 mm) capable of sawing rock, of the type required for Practice D 5121.

4.2 *Containers*, to hold the specimens fully immersed in potable water. These containers must be non-reactive and unbreakable.

4.3 *Oven*, capable of drying the specimen to a constant mass at a temperature of 110 ± 5°C.

4.4 *Drying Apparatus*, such as infra-red heat lamps (150 W) or oven set at 65 ± 5°C.

4.5 *Stereomicroscope*, or other suitable magnifying device capable of at least 20× magnification will be required for examination of the specimen prior to and after testing.

4.6 *Balance*, capable of determining the mass of the specimen to the nearest 0.1 % of the total mass will be required.

4.7 *Camera*, capable of producing good quality, color photographs will be required for “before” and “after” photographs.

## 5. Sampling, Test Specimens, and Test Units

5.1 The number and variety of samples from a source will be dependent on the geological complexity of that source and will be left to the judgment of the individual doing the sampling; however, in no case shall the number of samples be less than five per lithologic (rock) unit. Each piece will be of a size such that testing may proceed without further mechanical crushing; however, the pieces chosen shall be as large as the testing laboratory can handle but in no case shall the specimen be less than 125 mm (5 in.) on a side. In all cases, the sample will be representative of the various rock types found at the source.

## 6. Preparation of Test Specimens

6.1 Saw each specimen in accordance with Practice D 5121.

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[1] This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.17 on Rock for Erosion Control.

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

Each specimen will be 64 ± 6 mm (2.5 ± 0.25 in.) thick and cut normal to bedding or any potential planes of weakness that may be observed in the samples. In no case will the size of the slab be less than 125 mm (5 in.) on a side, excluding the thickness. Prepare a separate specimen for each orientation of the various planes of weakness unless all such planes can be intersected with one orientation. Planes of weakness will be included in each sample such that a determination may be made as to the durability of the various planes of weakness and their effect on the overall durability of a rock mass that would contain these planes of weakness.

NOTE 1—Test specimens may also be prepared by cutting a 64 mm (2.5 in.) thick slab from a 6-in. (152.40 mm) diameter diamond drill core such that any apparent zones of weakness are included.

NOTE 2—The best estimates of rock durability are the result of tests performed on the largest possible slabs of rock.

## 7. Procedure

7.1 Examine each slab macroscopically and under a minimum of 20× magnification. Note the presence of bedding planes, microfractures, and other planes of weakness and their condition. Describe each slab as indicated in Practice D 5121.

7.2 Label each specimen with a suitable marker. Photograph each test specimen using color film and in such a way that the specimen covers most of the photograph (wet or partially wet specimens usually show more detail). A scale will be included in all photographs.

7.3 Dry each slab in an oven to a constant mass (± 0.1 % of the total mass) at 110 ± 5°C (230 ± 9°F) and record.

7.4 Place each specimen (sawed surface down) in a container on a thin layer (6 mm (¼ in.)) of plus No. 8 size sand. Add enough potable water to the container such that the specimen is fully immersed and let stand for a minimum of 12 h.

7.5 Decant the water and place the container under an infrared heat lamp such that the rock surface is between 40 and 50 cm (16 to 20 in.) from the lamp. As an alternative, the sample may be dried in an oven at a temperature of 60 to 70°C (140 to 160°F). Thoroughly dry the specimen for a minimum of 6 h. At the end of the workday once again fill the container with potable water and allow the specimen to soak overnight.

7.6 Repeat the process of setting and drying for a total of 80 cycles.

7.7 Examine the specimen every few days for any changes in the specimen's condition and photograph as needed.

## 8. Quantitative Examination

8.1 For each slab perform the following calculation:

$$\textit{percent loss} = (A - B)/A \times 100 \quad (1)$$

where:

$A$ = oven dried mass of the specimen prior to testing, and
$B$ = oven dried mass of the largest remaining piece of each slab after testing.

## 9. Qualitative Examination

9.1 Visually examine the slab every six cycles for any changes that have taken place over the duration of the test and describe the changes. Identify the type of deterioration (spalling, splitting, disintegration, slaking, and other types of deterioration). Note and describe any changes to previously noted planes of weakness.

9.2 Take color photographs of each slab at the completion of testing. Provide close-ups of any unusual features. Include a scale for all photographs.

## 10. Report

10.1 Report in writing the following information:

10.1.1 Identification number,

10.1.2 Sample source location,

10.1.3 Location of intended use,

10.1.4 Rock type.

10.1.5 The results of the quantitative examination required in 8.1, and reported to the nearest 0.1 percent,

10.1.6 A written description of the qualitative examination and the findings of this exam, and

10.1.7 "Before" and "After" color photographs.

10.2 The following items are optional for the report:

10.2.1 Geological formation name, and

10.2.2 Geological setting of the source with pertinent information on planes of weakness noted in the field.

## 11. Precision and Bias

11.1 *Precision*—Due to the nature of the rock materials tested by this test method, it is, at this time, either not feasible or too costly to produce multiple specimens that have uniform physical properties. Since specimens that would yield the same test results cannot be tested, Subcommittee D18.17 cannot determine the variation between tests since any variation observed is just as likely to be due to specimen variation as to operator or laboratory testing variation. Subcommittee D18.17 welcomes proposals to resolve this problem that would allow for the development of a valid precision statement.

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

## 12. Keywords

12.1 armor stone; breakwater stone; climatic setting; erosion control; gabion-fill; laboratory testing; riprap; rock; rock material properties; wetting-drying