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Standard Test Method for Testing Rock Slabs to Evaluate Soundness of Riprap by Use of Sodium Sulfate or Magnesium Sulfate¹

This standard is issued under the fixed designation D 5240; 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 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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1. Scope*

1.1 This test method covers test procedures for evaluating the soundness of riprap by the effects of a sodium or magnesium sulfate solution on slabs of rock.

1.2 The values stated in either SI or inch-pound 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:*²

C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C 295 Practice for Petrographic Examination of Aggregates for Concrete

D-4753—Specification 653 Terminology Relating to Soil, Rock, and Contained Fluids

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and rock as Used in Engineering Design and Construction

D 4753 Specification for Evaluating, Selecting, and Specifying Balances and Scales for Use in Soil and Rock Testing

D 4992 Practice for Evaluation of Rock to Be Used for Erosion Control

D 5121 Practices for Preparation of Rock Slabs for Durability Testing

D 6026 Practice for Using Significant Digits in Geotechnical Data

3. Significance and Use

~~3.1 Rock riprap is composed~~ Terminology

~~3.1 Definitions of pieces of natural rock that words are placed on construction projects to minimize the effects of erosion. The ability of riprap to withstand deterioration from weathering affects both the effectiveness of the project and its cost. The sodium sulfate or magnesium sulfate soundness test is one method by which to estimate qualitatively the durability of rock under weathering conditions.~~

~~3.2 The results of this test method are not to be used as the sole basis for determination of rock durability, but rather should always be used in conjunction accordance with the results of other tests.~~

~~3.3 This test method has been used to evaluate many different types of rocks. There have been occasions when test results have provided data that have not agreed with the durability of rock under actual field conditions; samples yielding a low soundness loss have disintegrated in actual usage, and the reverse has been true. Terminology D 653.~~

4. Significance and Use

4.1 Rock riprap is composed of pieces of natural rock that are placed on construction projects to minimize the effects of erosion. The ability of riprap to withstand deterioration from weathering affects both the effectiveness of the project and its cost. The sodium sulfate or magnesium sulfate soundness test is one method by which to estimate qualitatively the durability of rock under weathering conditions.

² 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*, Vol 04.02, volume information, refer to the standard's Document Summary page on the ASTM website.

NOTE 1—The quality of results produced by this standard is dependent on the competence of the personnel performing it and suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D 3740 are generally considered capable of competent and objective testing. Reliable results depend on many factors and Practice D 3740 provides a means of evaluating some of them.

4.2 The results of this test method are not to be used as the sole basis for determination of rock durability, but rather should always be used in conjunction with the results of other tests.

4.3 This test method has been used to evaluate many different types of rocks. There have been occasions when test results have provided data that have not agreed with the durability of rock under actual field conditions; samples yielding a low soundness loss have disintegrated in actual usage, and the reverse has been true.

5. Apparatus

45.1 Circular Diamond Saw, 14-in. (360-mm) diameter, capable of sawing rock, of the type required for Practices D 5121.

45.2 Apparatus, as required by Test Method C 88, with the following exception: sieves are not required, and the balance shall meet the requirements of Class GP 10 in Specification D 4753 and be accurate within 5 g.

5. Special Solutions Required

~~5.1 The solutions required in this test method shall be the sodium or magnesium sulfate solutions required by Test Method C 88, and they shall be prepared and used in the same manner.~~

6. Samples

~~6.1 A source of rock to be sampled, shall be guided by Practice D 4992 (mine, quarry, outcrop, or field boulders) that is macroscopically uniform~~Special Solutions Required

~~6.1 The solutions required in color, texture, mineralogy, or some other visual property this test method shall be represented the sodium or magnesium sulfate solutions required by a sample consisting of a minimum of five pieces of rock, Test Method C 88, and a macroscopically nonuniform source they shall be represented by a minimum of eight pieces of rock. Each piece of rock shall be of a size such that testing can proceed without further mechanical crushing. In all cases, the pieces shall be chosen to provide a visually unbiased sample of the majority of rocks present at a source. Rock types, as determined from their macroscopic properties, that comprise less than 5 % of the source may be ignored unless their presence prepared and used in a sample will greatly affect the test results and subsequent proposed use of the rock. same manner.~~

7. Samples

7.1 A source of rock to be sampled, shall be guided by Practice D 4992 (mine, quarry, outcrop, or field boulders) 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 pieces of rock, and a macroscopically nonuniform source shall be represented by a minimum of eight pieces of rock. Each piece of rock shall be of a size such that testing can proceed without further mechanical crushing. In all cases, the pieces shall be chosen to provide a visually unbiased sample of the majority of rocks present at a source. Rock types, as determined from their macroscopic properties, that comprise less than 5 % of the source may be ignored unless their presence in a sample will greatly affect the test results and subsequent proposed use of the rock.

8. Preparation of Test Specimen

78.1 Saw the sample as indicated in Practices D 5121. Cut at least one slab (specimen) from each sample for subsequent testing. Make the first cut at a point between 1/3 and 1/2 of the distance from the edge to the middle of the piece.

78.2 Make each specimen 64 ± 6 mm (2.5 ± 1/4 in.) thick. Slab heights (the distance above the saw table) and lengths shall be a minimum of 125 mm (5 in.). The length will normally be greater than the height.

78.3 Due to internal defects, in certain cases a slab will break during the sawing process. Do not test this slab or any fragments that break off the slab. The percent loss of breakage shall be estimated visually and noted in the report.

~~NOTE 12—The best estimates of rock durability are made from the results of tests performed on the largest possible slabs of rock that include the typical textures found in the rock.~~

8. Procedure

~~8.1 Describe each slab as indicated in Practices D 5121.~~

~~8.2 Dry each slab in an oven to a constant mass at 110 ± 5°C (230 ± 9°F), and record the mass.~~

~~8.3 Place each slab in an individual basket and test it in a sulfate solution, according to the procedure of 8 of Test Method C 88.~~

~~8.4 Repeat the process of immersion and drying for a total of five cycles.~~

9. Procedure

9.1 Describe each slab as indicated in Practice D 5121.

9.2 Dry each slab in an oven to a constant mass at 110 ± 5°C (230 ± 9°F), and record the mass. In most cases, drying slabs overnight (12 to 16 h) is sufficient. In cases where there is doubt concerning the adequacy of drying, drying should be continued until the change in mass after two time intervals (greater than 1 h) of drying is less than about 1 %.

9.3 Place each slab in an individual basket and immerse it in a sulfate solution, according to the procedure of 9 of Test Method C 88.

9.4 Repeat the process of immersion and drying for a total of five cycles.

10. Quantitative Examination

910.1 Perform the following calculation for each slab:

$$\% \text{ soundness loss} = (A - B)/A \times 100 \quad (1)$$

where:

A = oven-dried mass of the slab prior to testing, and

B = oven-dried mass of the largest remaining piece of each slab after testing.

910.2 Determine the percent loss for all slabs from the cumulative initial and final masses.

$$\% \text{ average soundness loss} = (C - D)/C \times 100 \quad (2)$$

where:

C = oven-dried cumulative mass of all slabs prior to testing, and

D = oven-dried cumulative mass of the largest remaining pieces of all slabs after testing.

10. Report

10.1 Report the following information:

10.1.1 Identification number.

10.1.2 Sample location (source).

10.1.3 Type of rock.

10.1.4 Type of solution used in the soundness test.

10.1.5 Description and visual estimation of the percent of any fragments broken off the slab during the sawing process that are not tested.

10.1.6 Initial oven dry mass of each slab prior to testing, and its percent soundness loss after testing, plus the average percent loss after testing.

10.1.7 Description of any deterioration suffered by the slab during testing, noting any cracks, flaking, or disintegration.

10.1.8 Any uncertainty with the test results arising from sampling or test conditions.

10.2 The following report items are optional:

10.2.1 Geological formation name of the rock source.

10.2.2 Photograph of the slab before and after testing, with a scale indicating the specimen size.

11. PReport

11.1 Report the following information:

11.1.1 Identification number.

11.1.2 Sample location (source).

11.1.3 Type of rock.

11.1.4 Type of solution used in the soundness test.

11.1.5 Description and Bias

~~11.1.5 Due to visual estimation of the nature percent of any fragments broken off the rock materials tested by this test method, it is not possible to produce multiple specimens slab during the sawing process that have uniform physical properties. ASTM Subcommittee D18.17 is instituting a program are not tested.~~

~~11.1.6 Initial oven dry mass of specimen testing each slab prior to testing, and its percent soundness loss afterm testineg, plus the feasibility percent average soundness loss after testing.~~

~~11.1.7 Description of precision measurements and welcomes proposals that would allow any deterioration suffered by the slab during testing, noting any cracks, flaking, or disintegration.~~

~~11.1.8 Any uncertainty with the test results arising from sampling or test conditions.~~

~~11.1.9 Report results to 1 decimal place. Refer to Practice D 6026 for guidance concerning significant digits.~~

11.2 The following report items are optional:

11.2.1 Geological formation name of the development rock source.

~~11.2.2 Photograph of the slab before and after testing, with a valid precision statement. No accepted reference value exists for this test method; therefore, bias cannot be determined. scale indicating the specimen size.~~

12. Precision and Bias

~~12.1 Due to the nature of the rock materials tested by this test method, it is not possible to produce multiple specimens that have uniform physical properties. ASTM Subcommittee D18.17 is instituting a program of specimen testing to determine the feasibility of precision measurements and welcomes proposals that would allow for the development of a valid precision statement. No accepted reference value exists for this test method; therefore, bias cannot be determined.~~

13. Keywords

123.1 riprap; rock defects; rock durability; rock weathering; soundness of riprap

SUMMARY OF CHANGES

In accordance with Committee D18 policy, this section identifies the location of changes to the standard since the last edition that may impact the use of this standard.

- (1) Added Terminology D 653 and Practices D 3740 and D 6026 to Section 2.
- (2) Added Terminology section.
- (3) Added new note 1 to Section 4.
- (4) Added new sentence to end of 9.2.
- (5) Changed “test” to immerse in 9.3.
- (6) Changed “average percent loss” to “percent average soundness loss” in 11.1.6.
- (7) Added new 11.1.9.

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