



# Standard Test Method for Materials Finer than 75- $\mu\text{m}$ (No. 200) Sieve in Mineral Aggregates by Washing<sup>1</sup>

This standard is issued under the fixed designation C 117; 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.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope

1.1 This test method covers the determination of the amount of material finer than a 75- $\mu\text{m}$  (No. 200) sieve in aggregate by washing. Clay particles and other aggregate particles that are dispersed by the wash water, as well as water-soluble materials, will be removed from the aggregate during the test.

1.2 Two procedures are included, one using only water for the washing operation, and the other including a wetting agent to assist the loosening of the material finer than the 75- $\mu\text{m}$  (No. 200) sieve from the coarser material. Unless otherwise specified, Procedure A (water only) shall be used.

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

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.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates<sup>2</sup>

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials<sup>2</sup>

C 702 Practice for Reducing Field Samples of Aggregate to Testing Size<sup>2</sup>

D 75 Practice for Sampling Aggregates<sup>3</sup>

E 11 Specification for Wire Cloth and Sieves for Testing Purposes<sup>4</sup>

<sup>1</sup> Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001.

This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.20 on Normal Weight Aggregates.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 04.02.

<sup>3</sup> Annual Book of ASTM Standards, Vol 04.03.

<sup>4</sup> Annual Book of ASTM Standards, Vol 14.02.

### 2.2 AASHTO Standard:

T11 Method of Test for Amount of Material Finer than 0.075-mm Sieve in Aggregate<sup>5</sup>

## 3. Summary of Test Method

3.1 A sample of the aggregate is washed in a prescribed manner, using either plain water or water containing a wetting agent, as specified. The decanted wash water, containing suspended and dissolved material, is passed through a 75- $\mu\text{m}$  (No. 200) sieve. The loss in mass resulting from the wash treatment is calculated as mass percent of the original sample and is reported as the percentage of material finer than a 75- $\mu\text{m}$  (No. 200) sieve by washing.

## 4. Significance and Use

4.1 Material finer than the 75- $\mu\text{m}$  (No. 200) sieve can be separated from larger particles much more efficiently and completely by wet sieving than through the use of dry sieving. Therefore, when accurate determinations of material finer than 75  $\mu\text{m}$  in fine or coarse aggregate are desired, this test method is used on the sample prior to dry sieving in accordance with Test Method C 136. The results of this test method are included in the calculation in Test Method C 136, and the total amount of material finer than 75  $\mu\text{m}$  by washing, plus that obtained by dry sieving the same sample, is reported with the results of Test Method C 136. Usually, the additional amount of material finer than 75  $\mu\text{m}$  obtained in the dry sieving process is a small amount. If it is large, the efficiency of the washing operation should be checked. It could also be an indication of degradation of the aggregate.

4.2 Plain water is adequate to separate the material finer than 75  $\mu\text{m}$  from the coarser material with most aggregates. In some cases, the finer material is adhering to the larger particles, such as some clay coatings and coatings on aggregates that have been extracted from bituminous mixtures. In these cases, the fine material will be separated more readily with a wetting agent in the water.

<sup>5</sup> Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001.

## 5. Apparatus and Materials

5.1 *Balance*—A balance or scale readable and accurate to 0.1 g or 0.1 % of the test load, whichever is greater, at any point within the range of use.

5.2 *Sieves*—A nest of two sieves, the lower being a 75- $\mu$ m (No. 200) sieve and the upper a 1.18-mm (No. 16) sieve, both conforming to the requirements of Specification E 11.

5.3 *Container*—A pan or vessel of a size sufficient to contain the sample covered with water and to permit vigorous agitation without loss of any part of the sample or water.

5.4 *Oven*—An oven of sufficient size, capable of maintaining a uniform temperature of  $110 \pm 5^\circ\text{C}$  ( $230 \pm 9^\circ\text{F}$ ).

5.5 *Wetting Agent*—Any dispersing agent, such as liquid dishwashing detergents, that will promote separation of the fine materials.

NOTE 1—The use of a mechanical apparatus to perform the washing operation is not precluded, provided the results are consistent with those obtained using manual operations. The use of some mechanical washing equipment with some samples may cause degradation of the sample.

## 6. Sampling

6.1 Sample the aggregate in accordance with Practice D 75. If the same test sample is to be tested for sieve analysis according to Test Method C 136, comply with the applicable requirements of that test method.

6.2 Thoroughly mix the sample of aggregate to be tested and reduce the quantity to an amount suitable for testing using the applicable methods described in Practice C 702. If the same test sample is to be tested according to Test Method C 136, the minimum mass shall be as described in the applicable sections of that method. Otherwise, the mass of the test sample, after drying, shall conform with the following:

| Nominal Maximum Size          | Minimum Mass, g |
|-------------------------------|-----------------|
| 4.75 mm (No. 4) or smaller    | 300             |
| 9.5 mm (3/8 in.)              | 1000            |
| 19.0 mm (3/4 in.)             | 2500            |
| 37.5 mm (1 1/2 in.) or larger | 5000            |

If the nominal maximum size of the aggregate to be tested is not listed above, the next larger size listed shall be used to determine sample size.

## 7. Selection of Procedure

7.1 Procedure A shall be used, unless otherwise specified by the Specification with which the test results are to be compared, or when directed by the agency for which the work is performed.

## 8. Procedure A—Washing with Plain Water

8.1 Dry the test sample to constant mass at a temperature of  $110 \pm 5^\circ\text{C}$  ( $230 \pm 9^\circ\text{F}$ ). Determine the mass to the nearest 0.1 % of the mass of the test sample.

8.2 If the applicable specification requires that the amount passing the 75- $\mu$ m (No. 200) sieve shall be determined on a portion of the sample passing a sieve smaller than the nominal maximum size of the aggregate, separate the sample on the designated sieve and determine the mass of the material passing the designated sieve to 0.1 % of the mass of this portion of the test sample. Use this mass as the original dry mass of the test sample in 10.1.

NOTE 2—Some specifications for aggregates with a nominal maximum size of 50 mm or greater, for example, provide a limit for material passing the 75- $\mu$ m (No. 200) sieve determined on that portion of the sample passing the 25.0-mm sieve. Such procedures are necessary since it is impractical to wash samples of the size required when the same test sample is to be used for sieve analysis by Test Method C 136.

8.3 After drying and determining the mass, place the test sample in the container and add sufficient water to cover it. No detergent, dispersing agent, or other substance shall be added to the water. Agitate the sample with sufficient vigor to result in complete separation of all particles finer than the 75- $\mu$ m (No. 200) sieve from the coarser particles, and to bring the fine material into suspension. Immediately pour the wash water containing the suspended and dissolved solids over the nested sieves, arranged with the coarser sieve on top. Take care to avoid, as much as feasible, the decantation of coarser particles of the sample.

8.4 Add a second charge of water to the sample in the container, agitate, and decant as before. Repeat this operation until the wash water is clear.

NOTE 3—If mechanical washing equipment is used, the charging of water, agitating, and decanting may be a continuous operation.

8.5 Return all material retained on the nested sieves by flushing to the washed sample. Dry the washed aggregate to constant mass at a temperature of  $110 \pm 5^\circ\text{C}$  ( $230 \pm 9^\circ\text{F}$ ) and determine the mass to the nearest 0.1 % of the original mass of the sample.

NOTE 4—Following the washing of the sample and flushing any material retained on the 75- $\mu$ m (No. 200) sieve back into the container, no water should be decanted from the container except through the 75- $\mu$ m sieve, to avoid loss of material. Excess water from flushing should be evaporated from the sample in the drying process.

## 9. Procedure B—Washing Using a Wetting Agent

9.1 Prepare the sample in the same manner as for Procedure A.

9.2 After drying and determining the mass, place the test sample in the container. Add sufficient water to cover the sample, and add wetting agent to the water (Note 5). Agitate the sample with sufficient vigor to result in complete separation of all particles finer than the 75- $\mu\text{m}$  (No. 200) sieve from the coarser particles, and to bring the fine material into suspension. Immediately pour the wash water containing the suspended and dissolved solids over the nested sieves, arranged with the coarser sieve on top. Take care to avoid, as much as feasible, the decantation of coarser particles of the sample.

NOTE 5—There should be enough wetting agent to produce a small amount of suds when the sample is agitated. The quantity will depend on the hardness of the water and the quality of the detergent. Excessive suds may overflow the sieves and carry some material with them.

9.3 Add a second charge of water (without wetting agent) to the sample in the container, agitate, and decant as before. Repeat this operation until the wash water is clear.

9.4 Complete the test as for Procedure A.

## 10. Calculation

10.1 Calculate the amount of material passing a 75- $\mu\text{m}$  (No. 200) sieve by washing as follows:

$$A = [(B - C)/B] \times 100 \quad (1)$$

where:

A = percentage of material finer than a 75- $\mu\text{m}$  (No. 200) sieve by washing,

B = original dry mass of sample, g, and

C = dry mass of sample after washing, g.

## 11. Report

11.1 Report the following information:

11.1.1 Report the percentage of material finer than the 75- $\mu\text{m}$  (No. 200) sieve by washing to the nearest 0.1 %, except if the result is 10 % or more, report the percentage to the nearest whole number.

11.1.2 Include a statement as to which procedure was used.

## 12. Precision and Bias

12.1 *Precision*—The estimates of precision of this test method listed in Table 1 are based on results from the AASHTO Materials Reference Laboratory Proficiency Sample Program, with testing conducted by this test method and AASHTO Method T 11. The significant differences between the methods at the time the data were acquired is that Method T 11 required, while Test Method C 117 prohibited, the use of a wetting agent. The data are based on the analyses of more than 100 paired test results from 40 to 100 laboratories.

12.1.1 The precision values for fine aggregate in Table 1 are based on nominal 500-g test samples. Revision of this test method in 1994 permits the fine aggregate test sample size to be 300 g minimum. Analysis of results of testing of 300-g and 500-g test samples from Aggregate Proficiency Test Samples 99 and 100 (Samples 99 and 100 were essentially identical) produced the precision values in Table 2, which indicates only minor differences due to test sample size.

NOTE 6—The values for fine aggregate in Table 1 will be revised to reflect the 300-g test sample size when a sufficient number of Aggregate Proficiency Tests have been conducted using that sample size to provide reliable data.

12.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for the procedure in this test method, no statement on bias is made.

## 13. Keywords

13.1 aggregate; coarse aggregate; fine aggregate; grading; loss by washing; 75  $\mu\text{m}$  (No. 200) sieve; size analysis

**TABLE 1 Precision**

|                                     | Standard Deviation (1s) <sup>A</sup> , % | Acceptable Range of two Results (d2s) <sup>A</sup> , % |
|-------------------------------------|--|--|
| <i>Coarse Aggregate<sup>B</sup></i> |  |  |
| Single-Operator Precision           | 0.10                                     | 0.28   |
| Multilaboratory Precision           | 0.22                                     | 0.62   |
| <i>Fine Aggregate<sup>C</sup></i>   |  |  |
| Single-Operator Precision           | 0.15                                     | 0.43   |
| Multilaboratory Precision           | 0.29                                     | 0.82   |

<sup>A</sup> These numbers represent the (1s) and (d2s) limits as described in Practice C 670.

<sup>B</sup> Precision estimates are based on aggregates having a nominal maximum size of 19.0 mm (¾ in.) with less than 1.5% finer than the 75- $\mu\text{m}$  (No. 200) sieve.

<sup>C</sup> Precision estimates are based on fine aggregates having 1.0 to 3.0% finer than the 75- $\mu\text{m}$  (No. 200) sieve.

**TABLE 2 Precision Data for 300-g and 500-g Test Samples**

| Test Result   | Fine Aggregate Proficiency Sample |             |         | Within Laboratory |      | Between Laboratory |      |
|---|-----------------------------------|-------------|---------|-------------------|------|--------------------|------|
|   | Sample Size                       | No. of Labs | Average | 1s                | d2s  | 1s                 | d2s  |
| AASHTO T11/ASTM C117                                    | 500 g                             | 270         | 1.23    | 0.08              | 0.24 | 0.23               | 0.66 |
| Total material passing the No. 200 sieve by washing (%) | 300 g                             | 264         | 1.20    | 0.10              | 0.29 | 0.24               | 0.68 |

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