Standard Method of Test for

Clay Lumps and Friable Particles in Aggregate

AASHTO Designation: T 112-23[1]

Technically Revised: 2023

Technical Subcommittee: 1c, Aggregates

ASTM Designation: C142/C142M-17

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1. SCOPE

1.1. This method covers the approximate determination of clay lumps and friable particles in aggregates. This method is intended for evaluating aggregates that are nominally smaller than 2 in.

Note 1—It is intended that this procedure will be conducted concurrently with T 27, when results from both procedures are desired. If that option is elected, additional sieves to those required in Section 6.3 will need to be incorporated; however, all of the material passing the 4.75 mm (No. 4) sieve at the completion of initial sieving and separation will be recombined prior to continuation of this procedure.

1.2. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to its use.*

1.3. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 6, Fine Aggregate for Hydraulic Cement Concrete
- M 80, Coarse Aggregate for Hydraulic Cement Concrete
- M 231, Weighing Devices Used in the Testing of Materials
- M 339M/M 339, Thermometers Used in the Testing of Construction Materials
- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 76, Reducing Samples of Aggregate to Testing Size
- R 90, Sampling Aggregate Products
- T 11, Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
- T 27, Sieve Analysis of Fine and Coarse Aggregates

- T 255, Total Evaporable Moisture Content of Aggregate by Drying

2.2. *ASTM Standards*:

- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
- E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standard*:

- IEC 60584-1:2013, Thermocouples - Part 1: EMF Specifications and Tolerances

3. SIGNIFICANCE AND USE

3.1. This test method is of primary significance in determining the acceptability of aggregate with respect to the requirements of M 6 and M 80.

4. APPARATUS

4.1. *Balance*—The balance shall have sufficient capacity, be readable to 0.1 percent of the sample mass or better, and conform to the requirements of M 231.

4.2. *Containers*—Rust-resistant containers of a size and shape that will permit the spreading of the sample on the bottom in a single layer.

4.3. *Sieves*—Sieves conforming to ASTM E11.

4.4. *Oven*—An oven providing free circulation of air and capable of maintaining a temperature of 110 ± 5°C (230 ± 9°F). Oven(s) for heating and drying shall be capable of operation at the temperatures required, between 100 to 120°C (212 to 248°F), within ±5°C (±9°F), as corrected, if necessary, by standardization. More than one oven may be used, provided each is used within its proper operating temperature range. The thermometer for measuring the temperature, regardless of drying apparatus used, shall meet the requirements of M 339M/M 339 with a temperature range of at least 90 to 130°C (194 to 266°F), and an accuracy of ±1.25°C (±2.25°F) (see Note 2).

Note 2—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E2877 digital metal stem thermometer; ASTM E230/E230M thermocouple thermometer, Type J or K, Special Class, Type T any Class; IEC 60584 thermocouple thermometer, Type J or K, Class 1, Type T any Class; or dial gauge metal stem (bi-metal) thermometer.

5. SAMPLES

5.1. Sample the aggregate in accordance with R 90. The mass of the field sample shall be the mass shown in R 90 or four times the mass required in Sections 5.3 and 5.4, whichever is greater.

5.2. Thoroughly mix the sample and reduce it to an amount suitable for testing using the applicable procedures described in R 76. The sample for testing shall meet the minimum mass required by Table 1 when dry and shall be the end result of the reduction. Reduction to an exact predetermined mass shall not be permitted.

5.3. *Fine Aggregate*—For a fine aggregate sample, only the material coarser than 1.18 mm (No. 16) sieve shall be tested. The size of the test sample of aggregate, after drying, shall be a minimum of 300 g.

5.4. *Coarse Aggregate or Coarse and Fine Aggregates Mixtures*—The approximate sample mass shall be determined by choosing the largest sieve to retain greater than 5 percent from the results of T 27. The mass of the test sample of aggregate shall conform with the requirements of Table 1.

Table 1—Test Sample Minimum Mass by Sieve Size

Retained Sieve Size	Minimum Mass of Starting Test Sample (g)
37.5 mm (1 1/2 in.)	10000
19.0 mm (3/4 in.)	5000
12.5 mm (1/2 in.)	2000
9.5 mm (3/8 in.)	1000
4.75 mm (No. 4)	750
1.18 mm (No. 16)	300

5.5. Wash the sample according to T 11 to remove fines. Avoid excess agitation during washing.

Note 3—Excess agitation may lead to an incorrect result of the test method due to potentially breaking down clay lumps and friable particles that would otherwise be identified in this test method.

5.6. Dry the sample to constant mass according to T 255 at a 110 ± 5°C (230 ± 9°F).

6. PROCEDURE

6.1. Separate the test sample into different sizes using the following sieves: 37.5 mm (1 1/2 in.), 12.5 mm (1/2 in.), 4.75 mm (No. 4) and 1.18 mm (No. 16).

6.2. Each separated portion may then be reduced again, according to the procedures described in R 76. After reduction, each portion shall weigh not less than indicated in Table 2. If the separating of the original sample provides less than the amount indicated in Table 2 for any separated portion, no reduction is allowed for that portion.

Table 2—Mass of Reduced Test Portion by Gradation

Size of Particles Making Up Test Sample Portion	Mass of Reduced Test Portion (min. to max.) (g)
Over 37.5 mm (Over 1 1/2 in.)	3000 to 3100
37.5 to 12.5 mm (1 1/2 to 1/2 in.)	1500 to 1600
12.5 to 4.75 mm (1/2 in. to No. 4)	750 to 800
Under 4.75 mm (Under No. 4)	300 to 325

Note 4—These ranges may be exceeded provided the test portion represents a minimum of 10 percent of the original sample as determined in Section 5.3 or 5.4. If less than 10 percent, there is no need to continue testing.

6.3. After separating, weigh each individual test sample portion of material to be used in testing and record to the nearest 0.1 g.

6.3.1. Determine the sum of all test sample portions to be tested and record as "*M*" to the nearest 0.1 g.

6.4. Using individual containers for each separated portion, spread each in a single layer of particles on the bottom of the container. Then cover it with potable water at least $^1/_4$ in. above the material and soak it for a period of 24 ± 4 h.

Note 5—If testing large aggregate (>1 in.), multiple pans may be used to adequately cover the large sample size with water to achieve a single layer.

6.4.1. For larger particles that are either soft and/or easily deformed when applying light pressure between two fingers, pick and remove these into a separate pan and retain.

6.4.2. Once all large particles are removed per Section 6.4.1, roll and squeeze each remaining individual particle between the thumb and forefinger to attempt to break the particle into smaller sizes. Do not press particles against each other or a hard surface and, additionally, refrain from using the fingernails to break apart particles.

For all portions, once the clay lumps and friable particle have been broken down, separate the undersized or softened material from the remainder of the sample by wet sieving over the sieve prescribed in Table 3.

Table 3—Sieve Required for Removal of Under-Sized Material by Wet Sieving

Size of Particles Making Up Test Sample Portion	Sieve Required for Removal of Undersized Material
Over 37.5 mm (Over $1^1/_2$ in.)	9.5 mm ($^3/_8$ in.)
37.5 to 25.0 mm ($1^1/_2$ to 1 in.)	9.5 mm ($^3/_8$ in.)
25.0 to 12.5 mm (1 to $^1/_2$ in.)	4.75 mm (No. 4)
12.5 to 4.75 mm ($^1/_2$ in. to No. 4)	2.36 mm (No. 8)
Under 4.75 mm (Under No. 4)	850-µm (No. 20)

6.4.3. Perform the wet sieving by passing potable water over the sample through the sieve while manually agitating the sieve until all undersize material has been removed.

6.5. Remove the retained particles carefully from the sieve and recombine into a separate container.

6.5.1. Allow to cool, and determine the mass. Record mass to nearest 0.1 g as "*R*".

7. CALCULATION

7.1. Calculate the percent of clay lumps and friable particles in aggregate as follows:

$$P = \left[(M - R)/M \right] \times 100 \qquad (1)$$

where:

P = percent of clay lumps and friable particles;

M = mass of test sample (this includes fine, coarse, or the combined fine and coarse aggregate samples

R = mass of particles retained, including the fine aggregate sample if tested

8. REPORT

8.1. Record the percent of clay lumps and friable particles to the nearest 0.1 percent.

9. PRECISION AND BIAS

9.1. There is currently no precision and bias for this test method.

10. KEYWORDS

10.1. Aggregate; clay lumps; friable.

[1] Similar but not identical to ASTM C142/C142M-17.