

CLAY LUMPS AND FRIABLE PARTICLES IN AGGREGATE

AASHTO T 112

SCOPE

To ensure the aggregate used performs as intended for highway construction, several tests are performed to determine the physical characteristics of the material. One of these tests is the determination of Clay Lumps and Friable Particles in Aggregate.

Excessive clay lumps in a processed aggregate intended for use in a Portland Cement or Hot Mix Asphalt may interfere with the bonding between the aggregate and cementitious material. This will result in spalling, raveling, or stripping and create weak points and pop-outs if the material is incorporated into the pavement or structure.

Aggregate intended to perform as a drainable base or subbase may also be adversely affected when excess amounts of clay and friable particles are present. This type of material tends to fill the void spaces intended for drainability, eventually contributing to pavement failure.

Attaining a reasonably accurate determination of the amount of clay lumps and friable particles in the processed aggregate is dependent on properly obtained representative samples.

SUMMARY OF TEST

There are two test methods for determining the clay lumps and friable particles in aggregates. There is a method for coarse aggregate and one for fine aggregate. The test methods are similar, but there are differences, so always be sure to follow the correct method for the type of aggregate being tested.

The material is sampled, dried, and soaked according to testing instructions. The clay lumps and friable particles are broken down by manipulation, using the thumb and forefinger. The material is washed, dried, and sieved according to the correct test procedure.

The materials are weighed and the calculations for the percent of clay lumps and friable particles are performed.

FINE AGGREGATE

Apparatus

Balance, sufficient capacity to determine the weight of the test samples, accurate to 0.1 percent of the weight of the sample to be tested, and conforms to the requirements of AASHTO M 231.

Containers, rust-resistant of a size and shape that will permit the spreading of the sample on the bottom in a thin layer.

Sieves, conforming to AASHTO M 92.

Oven, capable of providing free circulation of air and of maintaining a temperature of $230^{\circ} \pm 9^{\circ}\text{F}$ ($110^{\circ} \pm 5^{\circ}\text{C}$).

Sample Preparation

First subject the test sample to AASHTO T 11, Amount of Material Finer Than the No. 200 (75 μm) Sieve in Aggregate.

The sample shall be dried to a constant dry weight at a temperature of $230^{\circ} \pm 9^{\circ}\text{F}$ ($110^{\circ} \pm 5^{\circ}\text{C}$).

Remove the material smaller than No. 16 (1.18 mm) sieve by thoroughly sieving the original sample over the No. 16 (1.18 mm) sieve. The weight retained on this sieve is the test sample and must be at least 25 grams.

Procedure

1. Weigh the test sample and spread the sample in a thin layer on the bottom of an appropriately sized, rust-resistant container, cover the sample with distilled water and allow the sample to soak for a period of 24 ± 4 hours.
2. Decant the excess water from the sample after soaking. Roll and squeeze individual particles between the thumb and forefinger to attempt to break the particle into smaller pieces. Do not use fingernails, nor press the particles against hard surfaces or each other in the attempt to break the particles.
3. After all discernable clay lumps and friable particles have been broken, sieve the sample on a No. 20 (850 μm) sieve and then place the sample in a suitable drying pan. Dry the sample to a constant dry weight at a temperature of $230^{\circ} \pm 9^{\circ}\text{F}$ ($110^{\circ} \pm 5^{\circ}\text{C}$). Allow the sample to cool and weigh the sample to the required accuracy specified for the balance in AASHTO M 231.

Calculations

Calculate the percent of clay lumps and friable particles in fine aggregate using the following formula:

$$P = \frac{M-R}{M} \times 100$$

Where:

P = percent of clay lumps and friable particles

M = weight of test sample retained on the No. 16 (1.18 mm) sieve

R = weight of material retained on the No. 20 (850 μm) sieve

COARSE AGGREGATES

Apparatus

The same apparatus is used for the coarse aggregate test method that is used for the fine aggregate test method.

Sample Preparation

Subject the sample to be tested to AASHTO T 11, Amount of Material Finer Than No. 200 (75 μ m) Sieve.

The aggregate sample shall be dried to a constant weight at a temperature of $230^{\circ} \pm 9^{\circ}\text{F}$ ($110^{\circ} \pm 5^{\circ}\text{C}$).

Separate the coarse aggregate sample into individual fractions using the following sieves to obtain the minimum weights as shown in Table 1:

Table 1

Sizes of Particles Making Up Test Sample	Min. Weight of Individual Test Sample, Grams
No. 4 to 3/8 in. (4.75 mm to 9.5 mm)	1000
3/8 in. to 3/4 in. (9.5 mm to 19.0 mm)	2000
3/4 in. to 1 1/2 in. (19.0 mm to 37.5 mm)	3000
Over 1 1/2 in. (37.5 mm)	5000

Note: To provide the minimum required individual weight as indicated in Table 1, combining the material from more than one test by AASHTO T 11 may be necessary. If the original grading of the sample has less than 5% of material retained on any of the above individual sizes, do not test that size.

Procedure

1. Weigh each fraction size and spread the individual samples in rust-resistant pans to form a thin layer. Cover the samples with distilled water and soak for 24 ± 4 hours (Figure 1).

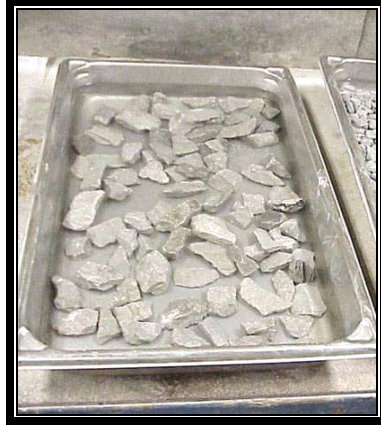


Figure 1
Sample Soaking

2. After soaking, decant the excess water from the samples. Roll and squeeze suspect particles between the thumb and forefinger to attempt to break the particles into smaller sizes (Figure 2). Do not use fingernails to break the particles, or press the particles against a hard surface or each other.



Figure 2
Attempting to Break Particles

3. After all recognizable clay lumps and friable particles have been broken, remove the undersized material from each tested fraction by wet-sieving. The wet-sieving is to be accomplished by placing the sample on the appropriate size sieve for the size of the individual fraction (Table 2) and passing water over the sample while manually agitating the sieve, until all undersize material has passed the required sieve.

Table 2

Size of Particles Making Up the Sample	Sieve Size for Removing Residue of Clay Lumps and Friable Particles
No. 4 to 3/8 in. (4.75 mm to 9.5 mm)	No. 8 (2.36 mm)
3/8 in. to 3/4 in. (9.5 mm to 19.0 mm)	No. 4 (4.75 mm)
3/4 in to 1 1/2 in. (19.0 mm to 37.5 mm)	No. 4 (4.75 mm)
1 1/2 in. (Over 37.5 mm)	No. 4 (4.75 mm)

The material that can be broken down and removed from the sample by wet-sieving is classified as clay lumps and friable particles.

4. Remove the retained particles carefully from the sieve. Dry the sample to a constant dry weight at $230^{\circ} \pm 9^{\circ}\text{F}$ ($110^{\circ} \pm 5^{\circ}\text{C}$), and allow the material to cool.
5. Weigh the record the weight of the material to the accuracy specified for the balance in AASHTO M 231.

Note: Combined aggregates (those containing a substantial amount of coarse and fine material) are separated into two fractions using the No. 4 (4.75 mm) sieve and then prepared as appropriate for the correct size of the material (i.e., coarse or fine aggregate).

In most cases, only the plus No. 4 (4.75 mm) fraction of coarse aggregate is required to be evaluated by this test method regardless of the amount of minus No. 4 (4.75 mm) material present. However, the amount of material between the No. 16 (1.18 mm) and No. 4 (4.75 mm) sieves is included in the weight of the test sample when calculating the percent of clay lumps and friable particles.

Calculations

Calculate the percent of clay lumps and friable particles in the individual sizes as follows:

$$P = \frac{M-R}{M} \times 100$$

where:

P = percent of clay lumps and friable particles

M = weight of test sample (this is the weight of each size increment prepared for test)

Note: include the weight of the plus No. 16 (1.18 mm) to minus No. 4 (4.75 mm) when needed, if the aggregate contains both coarse and fine particles.

R = Weight of particles retained on a designated sieve

The percent of clay lumps and friable particles in coarse aggregate is an average based on the percent of clay lumps and friable particles in each sieve size fraction weighed in accordance with the grading of the original sample, or preferably the average grading of the entire lot. When the sample contains less than 5 % of the total material in a given size, based on the original grading of the aggregate sample, the increment is considered to have the same percent of clay lumps and friable particles as the next larger or smaller fraction, whichever is present (see Table 3).

Table 3

Particle Size	Original Sample Percent Retained	Percent Clay Lumps and Friable Particles	Weighted Average Percent
No. 4 to 3/8 in. (4.75 mm to 9.5 mm)	24	13	3.12
3/8 in. to 3/4 in. (9.5 mm to 19.0 mm)	15	8	1.20
3/4 in. to 1 1/2 in. (19.0 mm to 37.5 mm)	4	8*	0.32
Total Percent in aggregate			4.64
* the percent of material retained on the fraction from 3/4 in. (19.0 mm) to 1 1/2 in. (37.5mm) is less than 5 %, therefore the percent of clay lumps and friable particles found to be in the next smaller size increment (8 %) is used in the weighted average.			