Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

ASTM D6928 - 17

5. Significance and Use

5.1 The Micro-Deval abrasion test is a test of coarse aggregate to determine abrasion loss in the presence of water and an abrasive charge. Many aggregates are more susceptible to abrasion when wet than dry, and the use of water in this test incorporates this reduction in resistance to degradation in contrast to some other tests, which are conducted on dry aggregate. The test results are helpful in evaluating the toughness/abrasion resistance of coarse aggregate subject to abrasion when adequate information is not available from service records.

5.2 The Micro-Deval abrasion test is useful for detecting changes in properties of aggregate produced from an aggregate source as part of a quality control or quality assurance process.

6. Apparatus

6.1 *Micro-Deval Abrasion Machine,* a jar rolling mill capable of running at 100 ± 5 rpm (Fig. 1 of the ASTM) ...._______

NOTE 1—Micro-Deval abrasion machine fitted with a counter may be used if the test is conducted on the basis of number of revolutions (see 9.3.2).

6.2 *Containers,* stainless steel Micro-Deval abrasion jars having an approximate 5-L capacity, a locking cover and gasket capable of sealing the jar and making it watertight.._______

External diameter of the abrasion jar shall be 194 mm to 202 mm.._______

And the internal height shall be 170 mm to 177 mm..._______

The inside and outside surfaces of the jars shall be smooth and have no significant ridges or indentations (Fig. 1) ...._______

6.3 *Abrasive Charge*—Magnetic stainless steel balls are required. These shall have a diameter of 9.5 ± 0.5 mm.._______

Each jar requires a charge of 5000 ± 5 g of balls.._______

6.4 *Sieves,* with square openings, and of the following sizes conforming to Specification E11 specifications: 19.0 mm, 16.0 mm, 12.5 mm, 9.5 mm, 6.7 mm, 6.3 mm, 4.75 mm, and 1.18 mm...._______

6.5 *Oven,* capable of maintaining a temperature of 110 ± 5 °C.._______

6.6 *Balance,* or scale accurate to 1.0 g.._______

7. Supplies

7.1 *Reference Aggregate*—An adequate supply of aggregate, established by the laboratory to use for verification of the consistency of the test method (see 11.1) ...._______

8. Test Sample

8.1 The test sample shall be washed and oven dried at 110 ± 5 °C to constant mass, separated into individual size fractions in accordance with Test Method C136, and recombined to meet the grading as shown in 8.2, 8.3, or 8.4.._______

In sections 8.3 and 8.4, the 6.7-mm sieve can be used in place of the 6.3-mm sieve when specified______

8.2 Aggregate for the test sample shall consist of material passing the 19.0-mm sieve, retained on the 9.5-mm sieve..._______

Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus ASTM D6928 - 17

An oven-dried sample of 1500 ± 5 g shall be prepared as follows: ...._______

Passing	Retained	Mass
19.0-mm	16.0-mm	375 g
16.0-mm	12.5-mm	375 g
12.5-mm	9.5-mm	750 g

8.3 In a case where the maximum nominal size of the coarse aggregate is 12.5 mm, a sample of 1500 ± 5 g shall be prepared as follows: ...._______

Passing	Retained	Mass
12.5-mm	9.5-mm	750 g
9.5-mm	6.3-mm	375 g
6.3-mm	4.75-mm	375 g

8.4 In a case where the maximum nominal size of the coarse aggregate is 9.5 mm or less, a sample 1500 ± 5 g shall be prepared as follows: ...._______

Passing	Retained	Mass
9.5-mm	6.3-mm	750 g
6.3-mm	4.75-mm	750 g

9. Test Procedure

9.1 Prepare a representative 1500 ± 5-g test sample. Weigh the sample and record the mass, *A*, to the nearest 1.0 g..._______

9.2 Immerse the test sample in 2.0 ± 0.05 L of tap water at a temperature of 20 ± 5 °C for a minimum of 1 h either in the Micro-Deval container or some other suitable container....................................._______

9.3 Place the test sample in the Micro-Deval abrasion container with 5000 ± 5 g steel balls and the water used in 9.2 to immerse the sample..._______

Install the cover and place the Micro-Deval container on the machine..._______

9.3.1 Run the machine at 100 ± 5 rpm for 2 h ± 1 min for the grading shown in 8.2......................._______

For the grading shown in 8.3, run the machine for 105 ± 1 min.._______

For the grading shown in 8.4, run the machine for 95 ± 1 min.._______

9.3.2 If a revolution counter is available, run the machine for 12 000 ± 100 revolutions for the grading shown in 8.2.._______

For the grading shown in 8.3, run the machine for 10 500 ± 100 revolutions.................................._______

For the grading shown in 8.4, run the machine for 9500 ± 100 revolutions...................................._______

9.4 Carefully pour the test sample and the steel balls over a 4.75-mm sieve superimposed on a 1.18-mm sieve..._______

Take care to remove the entire test sample from the stainless steel jar.._______

Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus ASTM D6928 - 17

Wash and manipulate the retained material on the sieve with water using a hand-held water hose and the hand until the washings are clear and material smaller than 1.18 mm passes that sieve.........._______
Discard material smaller than 1.18 mm.._______
Remove the stainless steel balls as described in 9.5.._______
9.5 Remove the steel balls using one of the following options:
9.5.1 *Option 1, Wet Method for Removing Steel Balls from Sample*.._______
Remove the stainless steel balls from the sample immediately after washing using a magnet or other suitable means, being careful not to lose any material.._______
Combine the material retained on the 4.75-mm and 1.18-mm sieves.._______
Oven dry the test sample to a constant mass at 110 ± 5 °C.._______
9.5.2 *Option 2, Dry Method for Removing Steel Balls from Sample*.._______
Combine the material retained on the 4.75-mm and 1.18-mm sieves and steel balls, being careful not to lose any material.._______
Oven dry the test sample and steel balls to a constant mass at 110 ± 5 °C...................................._______
Remove the steel balls from the dry sample using a magnet or other suitable means...................._______
NOTE 2—Extreme care must be taken if using the wet method for removing the steel balls. The surface tension of the water may cause small pieces of the aggregate to adhere to the balls. The wet method for removal is allowed to expedite additional testing for laboratories with a limited supply of balls. Otherwise, the dry method may be used to eliminate this potential source of error. However, care should still be taken when removing the balls to avoid loss of aggregate.
9.6 Oven dry the test sample to constant mass at 110 ± 5 °C.._______
9.7 Weigh the test sample to the nearest 1.0 g. Record the mass, *B*..._______

10. Calculation

10.1 Calculate the Micro-Deval abrasion loss, as follows, to the nearest 0.1 %..............................._______

11. Use of the Reference Aggregate

11.1 *Reference Aggregate*—The laboratory will establish an adequate supply of material to use for verification of the consistency of the test method.._______
A suitable material with a loss of between 10 and 25 % shall be established................................._______
From this material ten samples shall be taken randomly and tested.._______
At any time a new supply of the reference aggregate (7.1) is required, this procedure shall be conducted. ...._______
11.1.1 The mean value and range (±2 standard deviations) obtained from the supply of the reference aggregate shall be determined from the ten samples.._______
11.1.2 When test data of the reference aggregate is outside the range, an investigation as to the probable cause shall be conducted.._______
The equipment shall be re-calibrated and the testing technique re-examined to detect nonconformance with the test procedure.._______
11.2 Every ten samples, but at least every week in which a sample is tested, a sample of the reference aggregate shall also be tested.._______

Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus ASTM D6928 - 17

The material shall be taken from a stock supply and prepared according to 8.2.............................______
When 20 samples of calibration material have been tested, and the results show satisfactory variation, the frequency of testing may be changed to a minimum of one sample every month....................______
11.3 *Trend Chart Use*—The percent loss of the last 20 samples of reference material shall be plotted on a trend chart in order to monitor the variation in results (Fig. 2 of the ASTM) ....______

12. Report

12.1 The report shall include the following:
12.1.1 The maximum size of the aggregate tested and the grading used..______
12.1.2 The percent loss of the test sample to one decimal place...______
12.1.3 The percent loss of the calibration aggregate, tested closest to the time at which the aggregate was tested, to the nearest 0.1 %...______
12.1.4 The percent loss of the last 20 samples of calibration aggregate on a trend chart................______

Comments