THE RESISTANCE OF COARSE AGGREGATE TO DEGRADATION BY ABRASION IN THE MICRO-DEVAL APPARATUS

LS-618 R33

1. SCOPE

This method covers the testing of coarse aggregates to determine their abrasion loss in the presence of water and an abrasive charge. It furnishes information helpful in judging the suitability of coarse aggregate subject to weathering action when adequate information is not available from service records.

3. APPARATUS

3.1 MICRO-DEVAL ABRASION MACHINE: A jar rolling mill capable of running at 100 ± 5 rpm (Figure 1 of the LS) ..... _____

3.2 CONTAINERS: Stainless steel, micro-Deval abrasion jars having a 5 L capacity with a rubber ring in the rotary locking cover..... _____

External diameter = 194-202 mm, internal height = 170-177 mm..... _____

The inside and outside surfaces of the jars shall be smooth and have no observable ridges or indentations..... _____

Note 1: Occasionally, concentric grooves may be worn into the inside of the jar by the steel balls. These grooves are not objectionable provided that the distance between crest and trough is not more than 3 mm and the control aggregate test data meets the requirements given below.

3.3 ABRASION CHARGE: 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..... _____

3.4 SIEVES: Sieves with square openings, and of the following sizes conforming to ASTM E11:..... _____

19.0 mm, 16.0 mm,
13.2 mm, 9.5 mm,
6.7 mm, 4.75 mm,
1.18 mm

3.5 OVEN: An oven capable of maintaining a temperature of 110 ± 5°C..... _____

3.6 BALANCE: A balance or scale accurate to 1.0 g..... _____

3.7 LABORATORY CONTROL AGGREGATE: A supply of reference aggregates is available from the Soils and Aggregates Section of the Materials Engineering and Research Office at the Ministry of Transportation (soils-aggregates@ontario.ca)..... _____

4. PREPARATION OF TEST SAMPLE

4.1 Prepare the coarse aggregate in accordance with LS-600, the Method for Preparation of Coarse Aggregate, to meet either Grading A, B, or C..... _____

4.2 Grading A: Aggregate for the test shall normally consist of material passing the 19.0 mm sieve, retained on the 9.5 mm sieve..... _____

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

Passing	Retained	Mass
19.0 mm	16.0 mm	375 g
16.0 mm	13.2 mm	375 g
13.2 mm	9.5 mm	750 g
	Total	1500 g

4.3 Grading B: In cases where the maximum nominal size of the coarse aggregate is less than 16.0 mm, a sample of 1500 ± 5 g shall be prepared as follows: .....

Passing	Retained	Mass
13.2 mm	9.5 mm	750 g
9.5 mm	4.75 mm	750 g
	Total	1500 g

4.4 Grading C: In cases where the maximum nominal size of the coarse aggregate is less than 13.2 mm, a sample of 1500 ± 5 g shall be prepared as follows: .....

Passing	Retained	Mass
9.5 mm	4.75 mm	1500 g
	Total	1500 g

Note 2: In cases where it is desired to test material that is substantially coarser than 19 mm (for instance, 37.5 mm concrete paving aggregate), the material can be crushed, sieved, and prepared to the A grading. Care will need to be taken that the material is not crushed so much that substantial amounts pass the 4.75 mm sieve. Care should also be taken that the crusher reduction ratio selected does not produce excessive amounts of flat and elongated or flakey particles. Such particles will give a material a higher loss in this test than when cubical particles of the same material are tested. When reporting results obtained from such aggregate, note the method of preparation and report the percent flat and elongated particles using a 4:1 ratio in LS-608.

5. TEST PROCEDURE

5.1 Wash the sample.....

5.2 Oven-dry the sample to constant mass. A constant mass will be considered achieved when further heating of the sample causes, or would cause, less than 0.1% additional loss in mass.....

The time required to obtain constant mass will vary depending on numerous factors. The influence of these factors generally can be established by good judgement, and experience with the materials being tested and the apparatus being used.....

5.3 Prepare a representative 1500 ± 5 g sample. Record the Mass 'A' to the nearest 1.0 g.....

5.4 Saturate the sample in 2.0 ± 0.05 L tap water (temperature 20 ± 5°C) for a minimum of 1 h...

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5.5 Place the sample in the micro-Deval abrasion container with 5000 ± 5 g of steel balls and the water..... _____
Place the micro-Deval container on the machine..... _____
Note 3: It is permissible to saturate the sample in the water within the micro-Deval abrasion container rather than in a separate container.
5.6 Run the machine at 100 ± 5 rpm for the following times based on the preparation of the test sample (refer to Para. 4.2, 4.3, or 4.4): ..... _____

Time	Test Sample
120 ± 1 min	Grading A
105 ± 1 min	Grading B
95 ± 1 min	Grading C

5.7 Carefully pour the sample over 2 superimposed sieves: 4.75 mm and 1.18 mm. Take care to remove the entire sample from the stainless steel jar..... _____
Wash the retained material with water (a hand-held spray will be found useful) until the washings are clear..... _____
Remove the stainless steel balls using a magnet or other suitable means..... _____
5.8 Combine the material retained on the 4.75 mm and 1.18 mm sieves, being careful not to lose any material..... _____
5.9 Oven-dry the sample to constant mass at 110 ± 5°C..... _____
5.10 Weigh the sample to the nearest 1.0 g. Record the Mass 'B'..... _____

6. CALCULATIONS

Calculate the micro-Deval abrasion loss, as follows, to the nearest 0.1%..... _____

$$\text{Percent Loss} = \frac{A - B}{A} \times 100$$

7. USE OF LABORATORY CONTROL AGGREGATE

7.1 Every 10 samples, but at least every week in which a sample is tested, a sample of the standard reference aggregate shall also be tested..... _____
The material shall be taken from a stock supply and prepared according to 4.2..... _____
7.2 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..... _____
7.3 The mean loss of the control aggregate is provided on the label..... _____

8. REPORT

The report shall include the following:
8.1 The percent loss of the test sample to 1 decimal place; ..... _____
8.2 The maximum size of the aggregate tested; ..... _____

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8.3 The percent loss of the reference sample, tested closest to the time at which the aggregate sample was tested, to 1 decimal place;..... _____

8.4 The percent loss of the last 20 samples of reference material on a control chart..... _____

COMMENTS