
Standard Method of Test for Aggregate Durability Index

AASHTO Designation: T 210-22¹

Technically Revised: 2022

Technical Subcommittee: 1c, Aggregates

ASTM Designation: D3744/D3744M-11a



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1. SCOPE

- 1.1. This method describes the procedure for determining the durability of aggregates. The durability index is a value indicating the relative resistance of an aggregate to produce detrimental claylike fines when subjected to the prescribed mechanical methods of degradation.
- 1.2. The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.
- 1.3. *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 procedure to consult with establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to its use.* Use of chemicals must conform to the requirements of 29 CFR 1910.1200.
- 1.4. *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.*
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2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- 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 27, Sieve Analysis of Fine and Coarse Aggregates
 - T 85, Specific Gravity and Absorption of Coarse Aggregate
 - T 176, Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test

- 2.2. *ASTM Standards:*
- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
 - 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. *Federal Standard:*
- Fed. Std. No. 29, CFR 1910.1200 OSHA Hazard Communication Standard; see also Permissible Exposure Limits—Annotated Tables, available from <https://www.osha.gov/dsg/annotated-pels/>
- 2.4. *International Electrotechnical Commission Standard:*
- IEC 60584-1:2013, Thermocouples - Part 1: EMF Specifications and Tolerances
- 2.5. *Other Documents:*
- Hamilton, R. D., R. E. Smith, and G. B. Sherman. Factors Influencing the Durability of Aggregates. Research Report 633476. State of California, Division of Highways, Materials and Research Department, June 1971.
 - Hveem, F. N., and T. N. Smith. Durability of Aggregates. Research Report. State of California, Division of Highways, Materials and Research Department, June 1971.

3. SUMMARY OF METHOD

- 3.1. This method was developed to permit prequalification of aggregates proposed for use in the construction of transportation facilities. The test establishes an aggregate's resistance to generating fines when agitated in the presence of water. Separate and different test procedures are used to evaluate the coarse and the fine portions of a material.
- 3.2. A sample of coarse aggregate is prepared to a specific grading and then washed in a mechanical washing vessel for a 2-min agitation time. After discarding the minus 4.75-mm (No. 4) material, the washed test sample is dried and prepared to the final test grading.
- 3.3. The coarse aggregate test sample is then agitated in the mechanical washing vessel for a period of 10 min. A representative portion of the resulting wash water and minus 75- μ m (No. 200) size fines are collected and mixed with a stock calcium chloride solution and placed in a plastic cylinder. After a 20-min sedimentation time, the level of the sediment column is read. The height of the sediment value is then used to calculate the durability index of the coarse aggregate (D_c).
- 3.4. The fine aggregate sample is prepared by washing a specific quantity of the material in the mechanical washing vessel for a 2-min agitation period. All minus 75- μ m (No. 200) size material is washed from the sample through a 75- μ m (No. 200) sieve and discarded. The plus 75- μ m (No. 200) fraction is dried.
- 3.5. The fine aggregate test sample is tested by T 176 except for a modification to the duration of the shaking time. The mechanical shaker method is required. A shaking time of 10 min instead of 45 s is used.
- 3.6. This method includes procedures for testing aggregates exhibiting a wide range in specific gravity, including lightweight and porous coarse aggregates, and also procedures for testing small

maximum-size aggregate that is too fine to test as a coarse aggregate and too coarse to consider as a fine aggregate, such as a pea gravel or a very coarse sand.

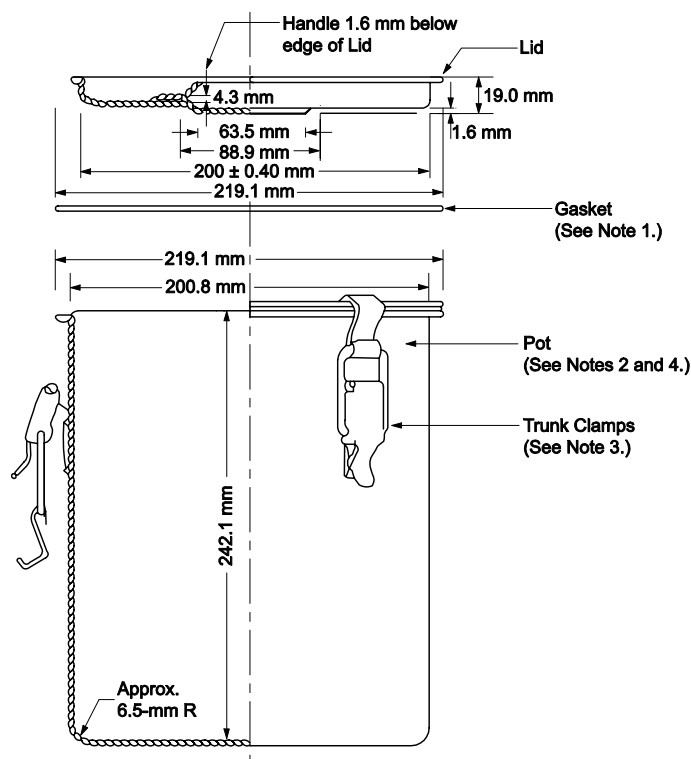
- 3.7. The durability index for coarse aggregate (D_c) or for fine aggregate (D_f) is calculated, as applicable, by appropriate equations presented in the method. The durability index of a well-graded aggregate containing both coarse and fine fractions is defined as the lowest of the two values, D_c or D_f , obtained by the test. This value is recommended to be the controlling value for specification purposes.

4. SIGNIFICANCE AND USE

- 4.1. This test assigns an empirical value to the relative amount, fineness, and character of claylike material that may be generated in an aggregate when subjected to mechanical degradation.
- 4.2. The procedure has been used in limited geographical areas of the United States and the results have been correlated with aggregate performance in various construction applications, including: aggregate base, permeable material for backfill, fine concrete aggregate, and riprap for rock slope protection (Hamilton et al., 1971; Hveem and Smith, 1971).
- 4.3. A minimum durability index is permitted to be specified to prohibit the use of an aggregate that is prone to degradation and will result in generation of claylike fines in various construction applications.
- 4.4. This method provides a rapid test for evaluation of the quality of a new aggregate source. Research has indicated it may also be suitable for use instead of the sodium sulfate soundness test for evaluating the durability characteristics of fine aggregate for use in portland cement concrete, thereby reducing the need for time-consuming and expensive soundness tests.²
- 4.5. Although the application of this method has been limited to aggregates for specific construction uses, the possibility exists for expanding the application of this method to control the quality of aggregates used in other areas of construction, such as aggregates for use in bituminous paving mixtures, coarse aggregate for use in portland cement concrete, and aggregate for use as railroad ballast.

5. APPARATUS

- 5.1. *Mechanical Washing Vessel (Pot)*—A flat-bottomed, straight-sided cylindrical vessel conforming to the specifications and dimensions shown in Figure 1.



Dimensional Equivalents

mm	in.	mm	in.	mm	in.
242.1	9 ¹⁷ / ₃₂	199.2	7 ²⁷ / ₃₂	6.4	¹ / ₄
219.1	8 ⁵ / ₈	88.9	3 ¹ / ₂	1.6	¹ / ₁₆
216.3	8 ³³ / ₆₄	63.5	2 ¹ / ₂	0.8	¹ / ₃₂
200.8	7 ²⁹ / ₃₂	19.0	³ / ₄	0.40	¹ / ₆₄
200.0	7 ⁷ / ₈	14.3	⁹ / ₁₆		

Notes:

1. The gasket will be 3.2-mm (¹/₈-in.) neoprene rubber, having an inside diameter of 199.23 ± 0.40 mm (7²⁷/₃₂ ± ¹/₆₄ in.) and an outside diameter of 216.30 ± 0.40 mm (8³³/₆₄ ± ¹/₆₄ in.).
2. The pot shall be a flat bottom, straight-sided, cylindrical vessel with a capacity of approximately 7 L (2 gal). The top edge shall be flared outward to form a seal for the gasket and lid.
3. Three trunk clamps are required and shall be placed at one-third intervals. The clamps shall be attached to the pot by rivets or welds so that the pot remains watertight. When fitted with the 3.2-mm (¹/₈-in.) gasket and clamped in place, the lid shall form a watertight seal with the flared edge of the pot.
4. The vessel shall be 0.9-mm (20-gauge) stainless steel, unless otherwise noted. All dimensions shall be within ±0.8 mm (±¹/₃₂ in.), unless otherwise noted.

Figure 1—Mechanical Washing Vessel

- 5.2. **Collection Pan**—A round pan at least 250 mm (10 in.) in diameter and at least 100 mm (4 in.) deep, suitable to collect the wash water from the washed sample. The pan shall have vertical or nearly vertical sides and shall be equipped as necessary to hold the wire mesh of a 203-mm (8-in.) diameter sieve at least 76 mm (3 in.) above the bottom. An adaptor that will not allow loss of fines or wash water may be used to nest the sieve with the container, or the sieve may be nested with a blank sieve frame resting in the bottom of the pan.
- 5.3. **Agitator**—A mechanical device designed to hold the wash vessel in an upright position while subjecting it to a lateral reciprocating motion at a rate of 285 ± 10 complete cycles per minute. The reciprocating motion shall be produced by means of an eccentric in the base of the carrier and the length of the stroke shall be 45 ± 0.6 mm (1.75 ± 0.25 in.). The clearance between the cam and follower of the eccentric shall be 0.25 to 1.02 mm (0.001 to 0.004 in.).