
Standard Method of Test for Grain-Size Analysis of Granular Soil Materials

AASHTO Designation: T 311-20

**Technical Subcommittee: 1a, Soil and Unbound Recycled
Materials**

Release: Group 3 (July)



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1. SCOPE

- 1.1. This method covers the determination of the particle size distribution of granular soil material. This method utilizes the 6.3-mm sieve size for separation purposes. However, the sample tester may use an alternative sieve size (i.e., 4.75 mm, 2.00 mm). In this case, the alternative sieve size used must replace the 6.3-mm size throughout this procedure.
- 1.2. Specifications for granular soil material, which reference this method, usually contain grading requirements that include both coarse and fine fractions in sizes between 100 mm and 0.075 mm.
- 1.3. *The 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 use.*

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
 - M 231, Weighing Devices Used in the Testing of Materials
 - R 90, Sampling Aggregate Products
 - PP 97, Determination of Constant Mass
- 2.2. *ASTM Standards:*
 - E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
 - E29, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

3. SUMMARY OF METHOD

- 3.1. A weighed sample of dry granular soil material is separated through a series of sieves with progressively smaller openings. Particle size distribution is determined by weighing the material retained on each of the sieves and dividing these weights by the total dry weight of the sample. This method requires drying, washing, and a series of separations.

4. SIGNIFICANCE AND USE

- 4.1. This method is used primarily to determine the gradation of granular soil material for use as fill material in subbase, pipe, or structural backfill. Granular soil material used in these applications generally necessitates a well graded material. This results in samples that contain material that is retained on a wide range of sieve sizes. The results are used to determine the compliance of grain size distribution of granular soil material with applicable specification requirements, and to provide the necessary data in order to determine the acceptability of this select granular material for the stated uses (see ASTM E29). This procedure is intended for use in quality assurance testing where large numbers of samples are processed.

5. APPARATUS

- 5.1. *Platform Scale*—The platform scale shall conform to the requirements of M 231 for the class of general-purpose scale required for the principal sample weight being tested.
- 5.2. *Balance*—The balance shall conform to the requirements of M 231 for the class of general-purpose balance required for the sample weight of fine granular material being tested.
- 5.3. *Sieves*—The sieves shall be mounted on substantial frames constructed in a manner that will prevent loss of material during sieving. Suitable sieve sizes shall be selected to furnish the information required by the specifications covering the material to be tested. The sieves shall conform to ASTM E11 (Note 1).
Note 1—It is recommended that sieves mounted in frames larger than standard 203-mm-diameter frames be used for testing coarse aggregate. Also, it may be desirable to use a heavy-duty screen meeting the required opening tolerances but with a larger wire diameter.
- 5.4. *Mechanical Sieve Shaker*—A mechanical sieve shaker, if used, shall impact a vertical or lateral and vertical motion to the sieve, causing the particles thereon to bounce and turn so as to present different orientations to the sieving surface. The sieving action shall be such that the criterion for adequacy of sieving described in Section 7.4 is met in a reasonable time period.
Note 2—Use of a mechanical sieve shaker is recommended when the size of the sample is 20 kg or greater, and may be used for smaller samples, including fine granular material. Excessive time (more than approximately 5 min) to achieve adequate sieving may result in degradation of the sample. The same mechanical sieve shaker may not be practical for all sizes of samples, since the large sieving area needed for practical sieving of a large nominal size coarse granular material very likely could result in loss of a portion of the sample if used for a smaller sample of coarse granular or fine granular material.
- 5.5. *Oven*—An oven of appropriate size capable of maintaining a uniform temperature of $110 \pm 5^\circ\text{C}$.
- 5.6. *Miscellaneous*—Spoons, spatulas, brushes, and containers (noncorroding and not subject to weight change).

6. SAMPLING AND PREPARATION

- 6.1. Sample the aggregate in accordance with R 90.
- 6.2. *Sample Size*:
- 6.2.1. For granular construction items, the sample(s) shall be transported to the testing facility in a clean, approved container. Assure that the sample size meets a minimum mass requirement of 20 kg.