
Standard Method of Test for

Uncompacted Void Content of Coarse Aggregate (As Influenced by Particle Shape, Surface Texture, and Grading)

AASHTO Designation: TP 56-03¹



1. SCOPE

- 1.1. This method describes the determination of the loose uncompacted void content of a sample of coarse aggregate. When measured on any aggregate of a known grading, void content provides an indication of the aggregate's angularity, sphericity, and surface texture compared with other coarse aggregates tested in the same grading.
- 1.2. Three procedures are included for the measurement of void content. Two use graded coarse aggregate (standard grading or as-received grading), and the other uses several individual size fractions for void content determinations:
- 1.2.1. *Standard Graded Sample (Method A)*—This method uses a standard coarse aggregate grading that is obtained by combining individual sieve fractions from the maximum density curve drawn from the maximum coarse aggregate size. See the section on Preparation of Test Samples for the grading.
- 1.2.2. *Individual Size Fractions (Method B)*—This method uses each of three coarse aggregate size fractions: (a) 19 mm ($3/4$ in.) to 12.5 mm ($1/2$ in.); (b) 12.5 mm ($1/2$ in.) to 9.5 mm ($3/8$ in.); (c) 9.5 mm ($3/8$ in.) to 4.75 mm (No. 4). For this method, each size is tested separately.
- 1.2.3. *As-Received Grading (Method C)*—This method uses that portion of the coarse aggregate retained on the 4.75-mm (No. 4) sieve.
- 1.3. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulation limitations prior to its use.*

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- M 231, Weighing Devices Used in the Testing of Materials
 - T 2, Sampling of Aggregates
 - T 11, Materials Finer Than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
 - T 19/T 19M, Bulk Density ("Unit Weight") and Voids in Aggregate
 - T 27, Sieve Analysis of Fine and Coarse Aggregates

- T 85, Specific Gravity and Absorption of Coarse Aggregate
- T 248, Reducing Samples of Aggregate to Testing Size

3. SUMMARY OF TEST METHODS

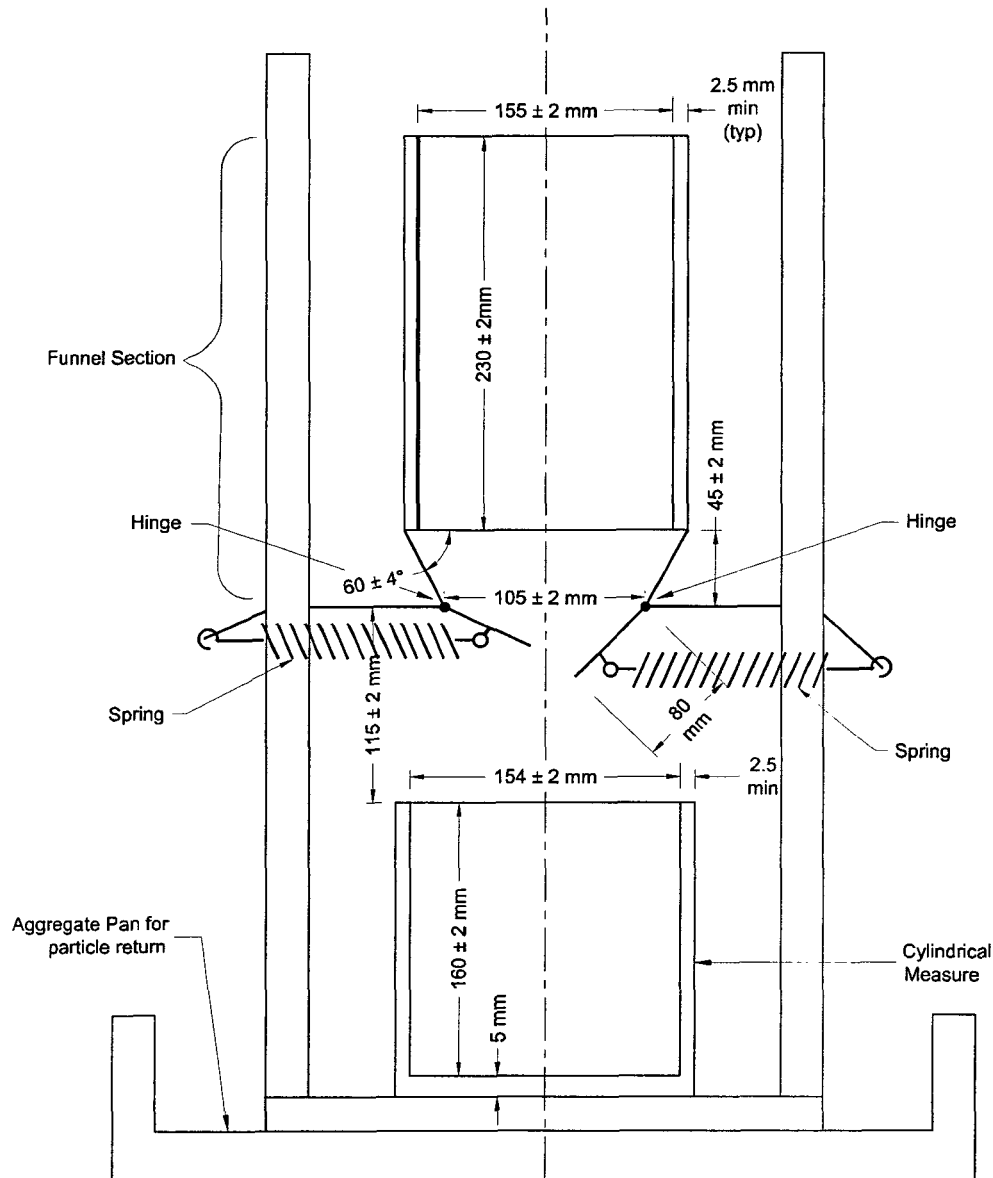
- 3.1. A calibrated cylindrical measure is filled with coarse aggregate of prescribed grading by allowing the sample to flow through a funnel from a fixed height into the measure. The coarse aggregate is struck off, and its mass is determined by weighing. Uncompacted void content is calculated as the difference between the volume of the cylindrical measure and the absolute volume of the coarse aggregate collected in the measure. Uncompacted void content is calculated using the bulk dry specific gravity of the coarse aggregate as received without special grading except as noted in Section 4.3.1. Two runs are made on each sample and the results are averaged.
- 3.1.1. For a graded sample (Test Method A or C) the percent void content is determined directly, and the average value from two runs is reported.
- 3.1.2. For the individual size fractions (Test Method B), the mean percent void content is calculated using the results from tests of each of the three individual size fractions.

4. SIGNIFICANCE AND USE

- 4.1. Methods A and B provide percent void content determined under standardized conditions, which depends on the particle shape and texture of a coarse aggregate. An increase in void content by these procedures indicates greater angularity, less sphericity, or rougher surface texture, or some combination of the three factors. A decrease in void content results is associated with more rounded, spherical, or smooth-surfaced coarse aggregates, or a combination of these factors.
- 4.2. Method C measures the uncompacted void content of the fraction retained on a 4.75-mm (No. 4) sieve of the as-received material. This void content depends on grading as well as particle shape and texture.
- 4.3. The void content determined on the standard graded sample (Method A) is not directly comparable with the average void content of the three individual size fractions from the same sample tested separately (Method B). A sample consisting of single size particles will have a higher void content than a graded sample. Therefore, use either one method or the other as a comparative measure of shape and texture, and identify which method has been used to obtain the reported data. Method C does not provide an indication of shape and texture directly if the grading from sample to sample changes.
- 4.3.1. The bulk dry specific gravity of the coarse aggregate determined by T 85 is used in calculating the void content. The effectiveness of these methods of determining void content and its relationship to particle shape and texture depends on the bulk specific gravity of various size fractions being equal, or nearly so. The void content is actually a function of the volume of each size fraction. If the type of rock or minerals, or its porosity, in any of the size fractions varies markedly, it may be necessary to determine the specific gravity of the size fractions used in the test.

APPARATUS

- 5.1. *Cylindrical Measure*—A cylindrical metal measure shall be watertight, with the top and bottom true and even, preferably machined to accurate dimensions on the inside and sufficiently rigid to retain its form under rough usage. The top rim shall be smooth and plane within 0.25 mm and shall be parallel to the bottom within 0.5 degrees. The inside diameter shall be 154 ± 2 mm and the inside height shall be 160 ± 2 mm. See Figure 1 for nominal dimensions.



Note: Figure is not to scale.

Figure 1—Test Apparatus