Designation: D 3398 – 00

Standard Test Method for Index of Aggregate Particle Shape and Texture[1]

This standard is issued under the fixed designation D 3398; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope *

1.1 This test method covers the determination of the particle index of aggregate as an overall measure of particle shape and texture characteristics.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses may be approximate, except with regard to sieve size and size of aggregate, the standard SI designations shown in parentheses are the standard as stated in Specification E 11.

1.3 *This standard does not purport to address all of the safety concerns, 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 regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate[2]

C 128 Test Method for Specific Gravity and Absorption of Fine Aggregate[2]

C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates[2]

C 702 Practice for Reducing Field Samples of Aggregate to Testing Size[2]

D 75 Practice for Sampling Aggregates[3]

D 1883 Test Method for Bearing Ratio of Laboratory-Compacted Soils[4]

D 3665 Practice for Random Sampling of Construction Materials[3]

D 4753 Specification for Evaluating, Selecting, and Specifying Balances and Scales for Use in Testing Soil, Rock, and Related Construction Materials[4]

E 11 Specification for Wire-Cloth and Sieves for Testing Purposes[5]

3. Significance and Use

3.1 This test method provides an index value to the relative particle shape and texture characteristics of aggregates. This value is a quantitative measure of the aggregate shape and texture characteristics that may affect the performance of road and paving mixtures. This test method has been successfully used to indicate the effects of these characteristics on the compaction and strength characteristics of soil-aggregate and asphalt concrete mixtures.[6,7,8,9]

4. Apparatus

4.1 *Cylindrical Molds*—Cylindrical molds for determining voids in aggregate, in accordance with the procedure described in this test method, shall be machined to accurate dimensions on the inside, and sufficiently rigid to retain their forms under rough usage. The dimensions of the molds shall conform to the limits in Table 1.

4.2 *Tamping Rods*—Round, straight, steel tamping rods, having the tamping end rounded to a hemispherical tip, shall be enclosed in a loose-fitting steel sleeve as shown in Fig. 1, to control the height of drop to exactly 2 in. (50 mm). The dimensions and mass of the tamping rods shall conform to the limits in Table 2.

4.3 *Balance*—A balance having a minimum capacity of 15 kg and meeting the requirements of Specification D 4753, Class GP5.

[1] This test method is under the jurisdiction of ASTM Committee D04 on Roads and Paving Materials and is the direct responsibility of Subcommittee D04.51 on Aggregate Tests.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.03.

[4] *Annual Book of ASTM Standards*, Vol 04.08.

[5] *Annual Book of ASTM Standards*, Vol 14.02.

[6] Huang, E. Y., "A Test for Evaluating the Geometric Characteristics of Coarse Aggregate Particles," *ASTM Proceedings*, Vol 62, 1962, pp. 1223–1242.

[7] Huang, E. Y., Auer, A., and Triffo, R. P., "Effect of Geometric Characteristics of Coarse Aggregates on Strength of Soil-Aggregate Mixtures," *ASTM Proceedings*, Vol 64, 1964, pp. 922–933.

[8] McLeod, Norman W., and McLean, J. A., "A Laboratory Investigation of the Compaction of Dense Graded Asphalt Concrete," paper presented at the 19th Annual Conference of the Canadian Technical Asphalt Association, Regina Saskatchewan, Canada, 1974.

[9] McLeod, Norman W., and Davidson, J. Keith, "Particle Index Evaluation of Aggregate Paving Mixtures," *Proceedings*, Association of Asphalt Paving Technologies, Vol 50, 1981, pp. 251–290.

***A Summary of Changes section appears at the end of this standard.**

TABLE 1 Dimensions of Cylindrical Molds

Mold Designation[A,B]	Inside Diameter, in. (mm)	Inside Height, in. (mm)	Min Thickness of Metal, in. (mm)		For Testing Aggregate	
			Bottom	Wall	Passing, in. (mm)	Retained, in. (mm)
A	8.00 ± 0.01	9.33 ± 0.01	0.24	0.24	1½	1
	(203.2 ± 0.2)	(237.0 ± 0.2)	(6.1)	(6.1)	(38.1)	(25.4)
B[C]	6.00 ± 0.01	7.00 ± 0.01	0.24	0.24	1 (25.4)	¾ (19.0)
	(152.40 ± 0.2)	(177.8 ± 0.2)	(6.1)	(6.1)	¾ (19.0)	½ (12.7)
C	4.00 ± 0.01	4.6 ± 0.01	0.20	0.20	½ (12.7)	⅜ (95)
	(101.6 ± 0.1)	(118.5 ± 0.2)	(5.1)	(5.1)	⅜ (9.5)	No. 4 (4.75)
D	3.00 ± 0.01	3.50 ± 0.01	0.16	0.16	No. 4 (4.75)	No. 8 (236)
	(76.2 ± 0.2)	(88.9 ± 0.2)	(4.1)	(4.1)	No. 8 (2.36)	No. 16 (118)
					No. 16 (1.18)	No. 3 (600 µm)
E	2.00 ± 0.01	2.33 ± 0.01	0.15	0.15	No. 30 (600 µm)	No. 50 (300 µm)
	(50.8 ± 0.2)	(59.3 ± 0.2)	(3.8)	(3.8)	No. 50 (300 µm)	No. 100 (150 µm)
					No. 100 (150 µm)	No. 200 (175 µm)

[A] A cylindrical mold with a given designation must be used with the tamping rod having the same designation.
[B] A mold designated for testing a given aggregates size fraction may also be used to test any smaller size fraction.
[C] The mold specified in Test Method D 1883 is the same size.

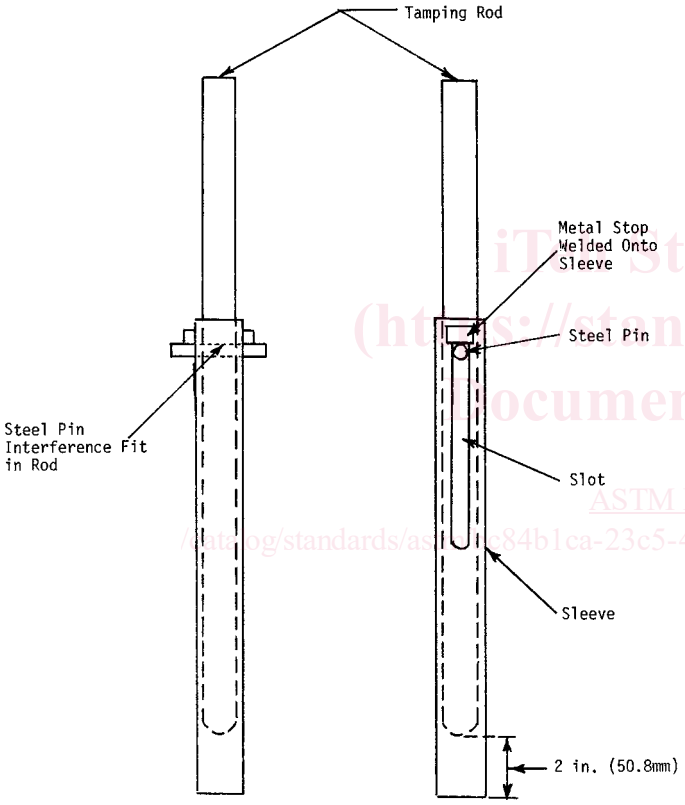

FIG. 1 Tamping Rod and Sleeve

TABLE 2 Dimensions and Mass of Tamping Rods

Rod Designation[A]	Diameter, in. (mm)	Length, in. (mm)	Mass, g
A	0.83 ± 0.01	32.0 ± 0.01	2204 ± 10
	(21.2 ± 0.2)	(814.0 ± 0.2)	
B	0.63 ± 0.1	24.0 ± 0.01	930 ± 10
	(15.9 ± 0.2)	(610.0 ± 0.2)	
C	0.42 ± 0.01	16.0 ± 0.01	276 ± 3
	(10.6 ± 0.2)	(406.9 ± 0.2)	
D	0.31 ± 0.01	12.0 ± 0.01	116 ± 1
	(7.9 ± 0.2)	306.0 ± 0.2)	
E	0.21 ± 0.01	7.9 ± 0.01	34 ± 0.5
	(5.3 ± 0.2)	(201.7 ± 0.2)	

[A] A tamping rod with a given designation must be used with a mold having the same designation.

5. Sampling

5.1 Sample the aggregate to be tested in accordance with Practices D 75 and D 3665, and reduce to the appropriate test sample size in accordance with Practice C 702.

6. Calibration of Mold

6.1 Determine the volume of the mold in millilitres as described below at least two times, and use the average volume in the calculation of the percentage of voids in 8.2.

6.1.1 Fill the mold with water at room temperature and cover with a piece of plate glass in such a way as to eliminate bubbles and excess water.

6.1.2 Determine the mass of water in the mold to an accuracy of 4 g or less.

6.1.3 Measure the temperature of the water and determine the volume of the mold by multiplying the mass of the water by the corresponding specific volume of water given in Table 4 for the temperature involved.

7. Test Specimen Preparation

7.1 Obtain a sample that yields at least the mass required for the mold being used (see Table 3) for each size fraction to be tested. Test each size fraction, listed in 7.2, when present in the aggregate in amounts of 10 % or more.

7.2 Wash the sample of aggregate by decantation of the wash water through the No. 200 (75-µm) sieve or through a sieve at least one size smaller than that which is to be the lower limit of the smallest sieve-size fraction to be tested. Continue the washing and decanting operation until the wash water is clear. Then flush the residue on the sieve back into the aggregate sample. Dry the sample to constant weight at a

TABLE 3 Aggregate Specimen Size for Test Using Various Molds

Mold Designation	Aggregate Specimen Size, lb (kg)
A	30 (13.6)
B	13 (5.9)
C	4 (1.8)
D	2 (0.9)
E	0.6 (0.3)