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Designation: C 128 – 01$^{\epsilon 1}$

Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate[1]

This standard is issued under the fixed designation C 128; 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.

This standard has been approved for use by agencies of the Department of Defense.

ϵ^1 NOTE—Table 1 was revised editorially in August 2003 to correct a typographical error in a value.

1. Scope*

1.1 This test method covers the determination of the average density of a quantity of fine aggregate particles (not including the volume of voids between the particles), the relative density (specific gravity), and the absorption of the fine aggregate. Depending on the procedure used, the density, in kg/m^3(lb/ft^3) is expressed as oven-dry (OD), saturated-surface-dry (SSD), or as apparent density. Likewise, relative density (specific gravity), a dimensionless quality, is expressed as OD, SSD, or as apparent relative density (apparent specific gravity). The OD density and OD relative density are determined after drying the aggregate. The SSD density, SSD relative density, and absorption are determined after soaking the aggregate in water for a prescribed duration.

1.2 This test method is used to determine the density of the essentially solid portion of a large number of aggregate particles and provides an average value representing the sample. Distinction is made between the density of aggregate particles as determined by this test method, and the bulk density of aggregates as determined by Test Method C 29/C 29M, which includes the volume of voids between the particles of aggregates.

1.3 This test method is not intended to be used for lightweight aggregates.

1.4 The values stated in SI units are to be regarded as the standard for conducting the tests. The test results for density shall be reported in either SI units or inch-pound units, as appropriate for the use to be made of the results.

1.5 The text of this test method references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this test method.

1.6 *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:*

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[1] This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.20 on Normal Weight Aggregates.

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

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C 29/C 29M Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate[2]
C 70 Test Method for Surface Moisture in Fine Aggregate[2]
C 125 Terminology Relating to Concrete and Concrete Aggregates[2]
C 127 Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate[2]
C 188 Test Method for Density of Hydraulic Cement[3]
C 566 Test Method for Total Evaporable Moisture Content of Aggregate by Drying[2]
C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[2]
C 702 Practice for Reducing Samples of Aggregate to Testing Size[2]
D 75 Practice for Sampling Aggregates[4]

2.2 *AASHTO Standard:*

AASHTO No. T 84 Specific Gravity and Absorption of Fine Aggregates[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *absorption*, *n*—the increase in mass of aggregate due to water penetrating into the pores of the particles, during a prescribed period of time but not including water adhering to the outside surface of the particles, expressed as percentage of the dry mass.

3.1.2 *oven-dry (OD)*, *adj— related to aggregate particles*, the condition in which the aggregates have been dried by heating in an oven at 110 ± 5°C for sufficient time to reach a constant mass.

3.1.3 *saturated-surface-dry (SSD)*, *adj—related to aggregate particles*, the condition in which the permeable pores of aggregate particles are filled with water to the extent achieved by submerging in water for the prescribed period of time, but without free water on the surface of the particles.

3.1.4 *density*, *n*—the mass per unit volume of a material, expressed as kilograms per cubic metre (pounds per cubic foot).

3.1.4.1 *density (OD), n*—the mass of oven-dry aggregate particles per unit volume of aggregate particles, including the volume of permeable and impermeable pores within particles, but not including the voids between the particles.

3.1.4.2 *density (SSD)*, *n*—the mass of saturated-surface-dry aggregate per unit volume of the aggregate particles, including the volume of impermeable voids and water-filled pores within the particles, but not including the pores between the particles.

3.1.4.3 *apparent density*, *n*—the mass per unit volume of the impermeable portion of the aggregate particles.

3.1.5 *relative density (specific gravity)*, *n*—the ratio of the density of a material to the density of water at a stated temperature; the values are dimensionless.

3.1.5.1 *relative density (specific gravity), (OD), n*—the ratio of the density (OD) of the aggregate to the density of water at a stated temperature.

3.1.5.2 *relative density (specific gravity), (SSD)*, *n*—The ratio of the density (SSD) of the aggregate to the density of water at a stated temperature.

3.1.5.3 *apparent relative density (apparent specific gravity)*, *n*—the ratio of the apparent density of aggregate to the density of water at a stated temperature.

3.1.6 For definitions of other terms related to aggregates see Terminology C 125.

4. Summary of Test Method

4.1 A sample of aggregate is immersed in water for 24 ± 4 h to essentially fill the pores. It is then removed from the water, the water is dried from the surface of the particles, and the mass determined. Subsequently, the sample (or a portion of it) is placed in a graduated container and the volume of the sample is determined by the gravimetric or volumetric method. Finally, the sample is oven-dried and the mass determined again. Using the mass values thus obtained and formulas in this test method, it is possible to calculate density, relative density (specific gravity), and absorption.

5. Significance and Use

5.1 Relative density (specific gravity) is the characteristic generally used for calculation of the volume occupied by the aggregate in various mixtures containing aggregate including portland cement concrete, bituminous concrete, and other mixtures that are proportioned or analyzed on an absolute volume basis. Relative density (specific gravity) is also used in the computation of voids in aggregate in Test Method C 29/C 29M. Relative density (specific gravity) (SSD) is used in the determination of surface moisture on fine aggregate by displacement of water in Test Method C 70. Relative density (specific gravity) (SSD) is used if the aggregate is wet, that is, if its absorption has been satisfied. Conversely, the density or relative density (specific gravity) (OD) is used for computations when the aggregate is dry or assumed to be dry.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.
[3] *Annual Book of ASTM Standards*, Vol 04.01.
[4] *Annual Book of ASTM Standards*, Vol 04.03.
[5] Available from American Association of State Highway and Transportation Officials, 444 North Capitol St. N.W., Suite 225, Washington, DC 20001.

5.2 Apparent density and apparent relative density (apparent specific gravity) pertain to the solid material making up the constituent particles not including the pore space within the particles that is accessible to water. This value is not widely used in construction aggregate technology.

5.3 Absorption values are used to calculate the change in the mass of an aggregate material due to water absorbed in the pore spaces within the constituent particles, compared to the dry condition, when it is deemed that the aggregate has been in contact with water long enough to satisfy most of the absorption potential. The laboratory standard for absorption is that obtained after submerging dry aggregate for a prescribed period of time. Aggregates mined from below the water table commonly have a moisture content greater than the absorption determined by this test method, if used without opportunity to dry prior to use. Conversely, some aggregates which have not been continuously maintained in a moist condition until used are likely to contain an amount of absorbed moisture less than the 24-h soaked condition. For an aggregate that has been in contact with water and that has free moisture on the particle surfaces, the percentage of free moisture is determined by deducting the absorption from the total moisture content determined by Test Method C 566 by drying.

5.4 The general procedures described in this test method are suitable for determining the absorption of aggregates that have had conditioning other than the 24-h soak, such as boiling water or vacuum saturation. The values obtained for absorption by other test methods will be different than the values obtained by the prescribed 24-h soak, as will the density (SSD) or relative density (specific gravity (SSD).

5.5 The pores in lightweight aggregates are not necessarily filled with water after immersion for 24 h. In fact, the absorption potential for many such aggregates is not satisfied after several days immersion in water. Therefore, this test method is not intended for use with lightweight aggregate.

6. Apparatus

6.1 *Balance*—A balance or scale having a capacity of 1 kg or more, sensitive to 0.1 g or less, and accurate within 0.1 % of the test load at any point within the range of use for this test method. Within any 100-g range of test load, a difference between readings shall be accurate within 0.1 g.

6.2 *Pycnometer (for Use with Gravimetric Procedure)*—A flask or other suitable container into which the fine aggregate test sample can be readily introduced and in which the volume content can be reproduced within ± 0.1 cm^3. The volume of the container filled to mark shall be at least 50 % greater than the space required to accommodate the test sample. A volumetric flask of 500-cm^3 capacity or a fruit jar fitted with a pycnometer top is satisfactory for a 500-g test sample of most fine aggregates.

6.3 *Flask (for Use with Volumetric Procedure)*—A Le Chatelier flask as described in Test Method C 188 is satisfactory for an approximately 55-g test sample.

6.4 *Mold and Tamper for Surface Moisture Test*—The metal mold shall be in the form of a frustum of a cone with dimensions as follows: 40 ± 3-mm inside diameter at the top, 90± 3-mm inside diameter at the bottom, and 75 ± 3 mm in height, with the metal having a minimum thickness of 0.8 mm. The metal tamper shall have a mass of 340 ± 15 g and a flat circular tamping face 25 ± 3 mm in diameter.

7. Sampling

7.1 Sample the aggregate in accordance with Practice D 75. Thoroughly mix the sample and reduce it to obtain a test specimen of approximately 1 kg using the applicable procedures described in Practice C 702.

8. Preparation of Test Specimen

8.1 Dry the test specimen in a suitable pan or vessel to constant mass at a temperature of 110 ± 5°C. Allow it to cool to comfortable handling temperature, cover with water, either by immersion or by the addition of at least 6 % moisture to the fine aggregate, and permit to stand for 24 ± 4 h.

8.1.1 Where the absorption and relative density (specific gravity) values are to be used in proportioning concrete mixtures in which the aggregates will be in their naturally moist condition, the requirement in 8.1 for initial drying is optional, and, if the surfaces of the particles in the sample have been kept continuously wet until tested, the requirement in 8.1 for 24 ± 4 h soaking is also optional.

NOTE 1—Values for absorption and for relative density (specific gravity) (SSD) may be significantly higher for aggregate not oven dried before soaking than for the same aggregate treated in accordance with 8.1.

8.2 Decant excess water with care to avoid loss of fines, spread the sample on a flat nonabsorbent surface exposed to a gently moving current of warm air, and stir frequently to secure homogeneous drying. Employ mechanical aids such as tumbling or stirring to assist in achieving the saturated surface-dry condition, if desired. Continue this operation until the test specimen approaches a free-flowing condition. Follow the procedure in 8.3 to determine if surface moisture is still present on the constituent fine aggregate particles. Make the first trial for surface moisture when there is still some surface water in the test specimen. Continue drying with constant stirring and test at frequent intervals until the test indicates that the specimen has reached a surface-dry condition. If the first trial of the surface moisture test indicates that moisture is not present on the surface, it has been dried past the saturated surface-dry condition. In this case, thoroughly mix a few millilitres of water with the fine aggregate and permit the specimen to stand in a covered container for 30 min. Then resume the process of drying and testing at frequent intervals for the onset of the surface-dry condition.

8.3 *Test for Surface Moisture*—Hold the mold firmly on a smooth nonabsorbent surface with the large diameter down. Place a portion of the partially dried fine aggregate loosely in the mold by filling it to overflowing and heaping additional material above the top of the mold by holding it with the cupped fingers of the hand holding the mold. Lightly tamp the fine aggregate into the mold with 25 light drops of the tamper. Start each drop approximately 5 mm above the top surface of the fine aggregate. Permit the tamper to fall freely under gravitational attraction on each drop. Adjust the starting height to the new surface elevation after each drop and distribute the drops over the surface. Remove loose sand from the base and lift the mold vertically. If surface moisture is still present, the fine aggregate will retain the molded shape. Slight slumping of the molded fine aggregate indicates that it has reached a surface-dry condition.

8.3.1 Some fine aggregate with predominately angular-shaped particles or with a high proportion of fines does not slump in the cone test upon reaching the surface-dry condition. Test by dropping a handful of the fine aggregate from the cone test onto a surface from a height of 100 to 150 mm, and observe for fines becoming airborne; presence of airborne fines indicates this problem. For these materials, consider the saturated surface-dry condition as the point that one side of the fine aggregate slumps slightly upon removing the mold.

NOTE 2—The following criteria have also been used on materials that do not readily slump:

(1) Provisional Cone Test—Fill the cone mold as described in 8.3 except only use 10 drops of the tamper. Add more fine aggregate and use 10 drops of the tamper again. Then add material two more times using 3 and 2 drops of the tamper, respectively. Level off the material even with the top of the mold, remove loose material from the base; and lift the mold vertically.

(2) Provisional Surface Test—If airborne fines are noted when the fine aggregate is such that it will not slump when it is at a moisture condition, add more moisture to the sand, and at the onset of the surface-dry condition, with the hand lightly pat approximately 100 g of the material on a flat, dry, clean, dark or dull nonabsorbent surface such as a sheet of rubber, a worn oxidized, galvanized, or steel surface, or a black-painted metal surface. After 1 to 3 s, remove the fine aggregate. If noticeable moisture shows on the test surface for more than 1 to 2 s then surface moisture is considered to be present on the fine aggregate.

(3) Colorimetric procedures described by Kandhal and Lee, Highway Research Record No. 307, p. 44.

(4) For reaching the saturated surface-dry condition on a single size material that slumps when wet, hard-finish paper towels can be used to surface dry the material until the point is just reached where the paper towel does not appear to be picking up moisture from the surfaces of the fine aggregate particles.

9. Procedure

9.1 Test by either the gravimetric procedure in 9.2 or the volumetric procedure in 9.3. Make all determinations of mass to 0.1 g.

9.2 *Gravimetric (Pycnometer) Procedure* :

9.2.1 Partially fill the pycnometer with water. Introduce into the pycnometer 500 ± 10 g of saturated surface-dry fine aggregate prepared as described in Section 8, and fill with additional water to approximately 90 % of capacity. Agitate the pycnometer as described in 9.2.1.1 (manually) or 9.2.1.2 (mechanically).

9.2.1.1 Manually roll, invert, and agitate the pycnometer to eliminate all air bubbles.

NOTE 3—About 15 to 20 min are normally required to eliminate the air bubbles by manual methods. Dipping the tip of a paper towel into the pycnometer has been found to be useful in dispersing the foam that sometimes builds up when eliminating the air bubbles. Optionally, a small amount of isopropyl alcohol may be used to disperse the foam.

9.2.1.2 Mechanically agitate the pycnometer by external vibration in a manner that will not degrade the sample. A level of agitation adjusted to just set individual particles in motion is sufficient to promote de-airing without degradation. A mechanical agitator shall be considered acceptable for use if comparison tests for each six-month period of use show variations less that the acceptable range of two results (d2s) indicated in Table 1 from the results of manual agitation on the same material.

9.2.2 After eliminating all air bubbles, adjust the temperature of the pycnometer and its contents to 23.0 ± 2.0°C if necessary by partial immersion in circulating water, and bring the water level in the pycnometer to its calibrated capacity. Determine the total mass of the pycnometer, specimen, and water.

9.2.3 Remove the fine aggregate from the pycnometer, dry to constant mass at a temperature of 110 ± 5°C, cool in air at room temperature for 1 ± ½ h, and determine the mass.

9.2.4 Determine the mass of the pycnometer filled to its calibrated capacity with water at 23.0 ± 2.0°C.

9.3 *Volumetric (Le Chatelier Flask) Procedure*:

9.3.1 Fill the flask initially with water to a point on the stem between the 0 and the 1-mL mark. Record this initial reading with flask and contents within the temperature range of 23.0 ± 2.0°C. Add 55 ± 5 g of fine aggregate in the saturated surface-dry condition (or other measured quantity as necessary). After all fine aggregate has been introduced, place the stopper in the flask and roll the flask in an inclined position, or gently whirl it in a horizontal circle so as to dislodge all entrapped air, continuing until no further bubbles rise to the surface (Note 4). Take a final reading with the flask and contents within 1°C of the original temperature.

NOTE 4—A small measured amount (not to exceed 1 mL) of isopropyl alcohol may be used to eliminate foam appearing on the water surface. The volume of alcohol used must be subtracted from the final reading (R_2).

TABLE 1 Precision

	Standard Deviation (1s)[A]	Acceptable Range of Two Results (d2s)[A]
Single-Operator Precision:		
Density (OD), kg/m^3	11	13
~~Density (SSD), kg/m^2~~	~~9.5~~	~~27~~
Density (SSD), kg/m^3 [B†]	9.5	27
Apparent density, kg/m^3	9.5	27
Relative density (specific gravity) (OD)	0.011	0.032
Relative density (specific gravity) (SSD)	0.0095	0.027
Apparent relative density (apparent specific gravity)	0.0095	0.027
~~Absorption[B], %~~	~~0.11~~	~~0.31~~
Absorption[C], %	0.11	0.31
Multilaboratory Precision:		
Density (OD), kg/m^3	23	64
Density (SSD), kg/m^3	20	56
Apparent density, kg/m^3	20	56
Relative density (specific gravity) (OD)	0.023	0.066
Relative density (specific gravity) (SSD)	0.020	0.056
Apparent relative density (apparent specific gravity)	0.020	0.056
~~Absorption[B], %~~	~~0.23~~	~~0.66~~
Absorption[C], %	0.23	0.66

[A] These numbers represent, respectively, the (1s) and (d2s) limits as described in Practice C 670. The precision estimates were obtained from the analysis of combined AASHTO Materials Reference Laboratory proficiency sample data from laboratories using 15 to 19-h saturation times and other laboratories using 24 ± 4-h saturation time. Testing was performed on normal weight aggregates, and started with aggregates in the oven-dry condition.

~~[B†] Revised editorially to correct a typographical error in August 2003.~~

[C] Precision estimates are based on aggregates with absorptions of less than 1 % and may differ for manufactured fine aggregates and the aggregates having absorption values greater than 1 %.

9.3.2 For determination of the absorption, use a separate 500 ± 10-g portion of the saturated surface-dry fine aggregate, dry to constant mass, and determine the dry mass.

10. Calculations

10.1 *Symbols*:

A = mass of oven dry specimen, g

B = mass of pycnometer filled with water, to calibration mark, g

C = mass of pycnometer filled with specimen and water to calibration mark, g

R_1= initial reading of water level in Le Chatelier flask, mL

R_2= final reading of water in Le Chatelier flask, mL

S = mass of saturated surface-dry specimen (used in the gravimetric procedure for density and relative density (specific gravity), or for absorption with both procedures), g

S_1= mass of saturated surface-dry specimen (used in the volumetric procedure for density and relative density (specific gravity)), g

10.2 *Relative Density (Specific Gravity)*:

10.2.1 *Relative Density (Specific Gravity) (Oven dry)*—Calculate the relative density (specific gravity) on the basis of oven-dry aggregate as follows:

10.2.1.1 *Gravimetric Procedure*:

$$\text{Relative density (specific gravity) (OD)} = A/(B + S - C) \quad (1)$$

10.2.1.2 *Volumetric Procedure*:

$$\text{Relative density (specific gravity) (OD)} = [S_1\ (A/S)]/[0.9975\ (R_2 - R_1)] \quad (2)$$

10.2.2 *Relative Density (Specific Gravity) Saturated Surface-dry)*—Calculate the relative density (specific gravity) on the basis of saturated surface-dry aggregate as follows:

10.2.2.1 *Gravimetric Procedure*:

$$\text{Relative density (specific gravity) (SSD)} = S/(B + S - C) \quad (3)$$

10.2.2.2 *Volumetric Procedure*:

$$\text{Relative density (specific gravity) (SSD)} = S_1/[0.9975\ (R_2 - R_1)] \quad (4)$$

10.2.3 *Apparent Relative Density (Apparent Specific Gravity)*—Calculate the apparent relative density (apparent specific gravity) as follows:

10.2.3.1 *Gravimetric Procedure*:

$$\text{Apparent relative density (apparent specific gravity)} = A/(B + A - C) \tag{5}$$

10.2.3.2 *Volumetric Procedure*:

$$\text{Apparent relative density (apparent specific gravity)} = \frac{S_1\,(A/S)}{0.9975\,(R_2 - R_1) - [(S_1/S)(S - A)]} \tag{6}$$

10.3 *Density*:

10.3.1 *Density (Oven-dry)*—Calculate the density on the basis of oven-dry aggregates as follows:

10.3.1.1 *Gravimetric Procedure*:

$$\text{Density (OD), kg/m}^3 = 997.5\,A/(B + S - C) \tag{7}$$

$$\text{Density (OD), lb/ft}^3 = 62.27\,A/(B + S - C) \tag{8}$$

10.3.1.2 *Volumetric Procedure*:

$$\text{Density (OD), kg/m}^3 = 997.5\,S_1\,(A/S)/[0.9975\,(R_2 - R_1)] \tag{9}$$

$$\text{Density (OD), lb/ft}^3 = 62.27\,S_1\,(A/S)/[0.9975\,(R_2 - R_1)] \tag{10}$$

NOTE 5—The constant values used in the calculations in 10.3.1-10.3.3 (997.5 kg/m^3 and 62.27 lb/ft^3) are the density of water at 23°C. Some authorities recommend using the density of water at 4°C (1000 kg/m^3 or 1000 Mg/m^3 or 62.43 lb/ft^3) as being sufficiently accurate.

10.3.2 *Density (Saturated surface-dry)* —Calculate the density on the basis of saturated surface-dry aggregate as follows:

10.3.2.1 *Gravimetric Procedure*:

$$\text{Density (SSD), kg/m}^3 = 997.5\,S/(B + S - C) \tag{11}$$

$$\text{Density (SSD), lb/ft}^3 = 62.27\,S/(B + S - C) \tag{12}$$

10.3.2.2 *Volumetric Procedure*:

$$\text{Density (SSD), kg/m}^3 = 997.5\,S_1/[0.9975\,(R_2 - R_1)] \tag{13}$$

$$\text{Density (SSD), lb/ft}^3 = 62.27\,S_1/[0.9975\,(R_2 - R_1)] \tag{14}$$

10.3.3 *Apparent Density*— Calculate the apparent density as follows:

10.3.3.1 *Gravimetric Procedure*:

$$\text{Apparent density (SSD), kg/m}^3 = 997.5\,A/(B + A - C) \tag{15}$$

$$\text{Apparent density (SSD), lb/ft}^3 = 62.27\,A/(B + A - C) \tag{16}$$

10.3.3.2 *Volumetric Procedure*:

$$\text{Apparent density (SSD), kg/m}^3, = \frac{997.5\,S_1\,(A/S)}{0.9975\,(R_2 - R_1) - [(S_1/S)(S - A)]} \tag{17}$$

$$\text{Apparent density (SSD), lb/ft}^3, = \frac{62.27\,S_1\,(A/S)}{0.9975\,(R_2 - R_1) - [(S_1/S)(S - A)]} \tag{18}$$

10.4 *Absorption*—Calculate the percentage of absorption as follows:

$$\text{Absorption, \%} = 100\,[(S - A)/A] \tag{19}$$

11. Report

11.1 Report density results to the nearest 10 kg/m^3, or 0.5 lb/ft^3, relative density (specific gravity) results to the nearest 0.01, and indicate the basis for density or relative density (specific gravity), as either oven-dry (OD), saturated-surface-dry (SSD), or apparent.

11.2 Report the absorption result to the nearest 0.1 %.

11.3 If the density and relative density (specific gravity) values were determined without first drying the aggregate, as permitted in 8.2, note that fact in the report.

12. Precision and Bias

12.1 *Precision*—The estimates of precision of this test method (listed in Table 1) are based on results from the AASHTO Materials Reference Laboratory Proficiency Sample Program, with testing conducted by this test method and AASHTO Method T 84. The significant difference between the methods is that Test Method C 128 requires a saturation period of 24 ± 4 h, and AASHTO Test Method T 84 requires a saturation period of 15 to 19 h. This difference has been found to have an insignificant effect on the precision indices. The data are based on the analyses of more than 100 paired test results from 40 to 100 laboratories. The precision estimates for density were calculated from values determined for relative density (specific gravity), using the density of water at 23°C for the conversion.

12.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for this test method, no statement on bias is being made.

13. Keywords

13.1 absorption; aggregate; aparent density; apparent relative density; density; fine aggregate; relative density; specific gravity

APPENDIX

(Nonmandatory Information)

X1. INTERRELATIONSHIPS BETWEEN RELATIVE DENSITIES (SPECIFIC GRAVITIES) AND ABSORPTION AS DEFINED IN TEST METHODS C 127 AND C 128

X1.1 This appendix gives mathematical interrelationships among the three types of relative densities (specific gravities) and absorption. These may be useful in checking the consistency of reported data or calculating a value that was not reported by using other reported data.

X1.2 Where:

S_d = relative density (specific gravity) (OD),
S_s = relative density (specific gravity) (SSD),
S_a = apparent relative density (apparent specific gravity), and
A = absorption, in %.

Calculate the values of each as follows:

$$S_s = (1 + A/100)S_d \tag{X1.1}$$

$$S_s = \frac{1}{\frac{1}{S_d} - \frac{A}{100}} = \frac{S_d}{1 - \frac{AS_d}{100}} \tag{X1.2}$$

$$\text{or } S_a = \frac{1}{\frac{1 + A/100}{S_s} - \frac{A}{100}} \tag{X1.3}$$

$$= \frac{S_s}{1 = \frac{A}{100}(S_s - 1)}$$

$$A = \left(\frac{S_s}{S_d} - 1\right)100 \tag{X1.4}$$

$$A = \left(\frac{S_a - S_s}{S_a(S_s - 1)}\right)100 \tag{X1.5}$$

SUMMARY OF CHANGES

This section identifies the location of changes to this test method that have been incorporated since the last issue.

(1) Entire standard was rewritten.

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