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Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures¹

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

1. Scope

1.1 This specification covers crushed stone, crushed hydraulic-cement concrete, crushed blast-furnace slag, crushed gravel, crushed expanded shale, crushed expanded clay, and crushed expanded slate suitable for use in bituminous paving mixtures, as described in Specifications D 3515 or D 4215.

NOTE 1—Other slags having demonstrated a satisfactory service record may be used.

1.2 The values stated in SI units are to be regarded as standard. Inch-pound units, shown in parentheses, are for information only.

1.3 The text of this standard 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 the standard.

2. Referenced Documents

2.1 ASTM Standards:

- C 29/C 29M Test Method for Unit Weight and Voids in Aggregate²
- C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate²
- C 125 Terminology Relating to Concrete and Concrete Aggregates²
- C 131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine²
- C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates²
- C 294 Descriptive Nomenclature of Constituents of Natural Mineral Aggregates²
- D 8 Terminology Relating to Materials for Roads and Pavements³

- D 75 Practice for Sampling Aggregates³
- D 448 Classification for Sizes of Aggregate for Road and Bridge Construction³
- D 3319 Test Method for Accelerated Polishing of Aggregates Using the British Wheel³
- D 3515 Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures³
- D 3665 Practice for Random Sampling of Construction Materials³
- D 4215 Specification for Cold-Mixed, Cold-Laid Bituminous Paving Mixtures³
- D 5821 Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate³

3. Terminology

3.1 Definitions:

- 3.1.1 For defining aggregate types, see Descriptive Nomenclature C 294, and Terminology D 8 and C 125.
- 3.1.2 *expanded shale, n; expanded clay, n; expanded slate, n*—the product resulting from the expanding of selected materials (shale, clay, or slate) in a rotary kiln at temperatures over 1000°C.

4. Ordering Information

- 4.1 Orders for the material under this specification shall include the following information:
 - 4.1.1 The specification designation and year of issue.
 - 4.1.2 The size to be furnished (see 5.2).
 - 4.1.3 The quantity required.
 - 4.1.4 Use of the coarse aggregate, whether for conventional mixtures or open-graded friction course mixtures (see 5.4), and whether for surface courses or base courses (see 5.7).
 - 4.1.5 In the case of sulfate soundness tests (5.6), which salt is to be used.
 - 4.1.6 Any special requirements.

5. Physical Requirements

- 5.1 *General*—The coarse aggregate shall consist of hard, strong, durable pieces, free of coherent coatings and conforming to the requirements of this specification.
- 5.2 *Grading*:

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

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

5.2.1 The coarse aggregate grading shall conform to the requirements of Classification D 448 for the size number designated, or to another grading as stated in the order (see Note 2).

NOTE 2—The coarse aggregate grading to be furnished is dependent upon the desired composition of the paving mixture, and whether the grading to be used in the mixture is achieved with or without blending. Other coarse aggregate gradings may be used provided that the combined aggregate and filler, when used, will produce a paving mixture that provides the desired characteristics.

5.2.2 The size to be used is dependent upon the desired composition of the paving mixture, and the required size or sizes either before or after blending as specified.

5.3 Density:

5.3.1 *Slag*—Air-cooled blast-furnace-slag coarse aggregate, when tested in size No. 57 or No. 8, shall have a minimum density of 1120 kg/m^3 (70 lb/ft^3) as determined in accordance with Test Method C 29/C 29M, rodding procedure.

5.3.2 *Expanded Shale, Expanded Clay, Expanded Slate*—The coarse aggregate, when tested in size No. 57 or No. 8, shall have a minimum density of 500 kg/m^3 (31 lb/ft^3) as determined in accordance with Test Method C 29/C 29M, shoveling procedure.

5.4 *Crushed Pieces in Aggregate*—Orders for materials under this specification shall state the appropriate requirements for crushed pieces, (Test Method D 5821).

5.4.1 *Conventional Mixtures*—Not less than 40 %, by mass, of the aggregate pieces retained on the 4.75-mm (No. 4) sieve shall have at least one fractured face (see Notes 3 and 4).

5.4.2 *Open Graded Friction Course Mixtures*—Of the aggregate pieces retained on the 4.75-mm (No. 4) sieve, not less than 90 %, by mass, shall have one or more fractured faces and 75 %, by mass, two or more fractured faces.

NOTE 3—Attention is called to the distinction between conventional (dense mixtures or open mixtures) and open-graded friction course mixtures in Specification D 3515.

NOTE 4—Some sources of aggregate contain angular particles that will perform similarly to a mechanically crushed particle. Where laboratory tests or service records indicate this to be true, such angular particles may be considered as crushed.

5.5 *Polishing Characteristics*—The coarse aggregates, or the coarsest fraction of the aggregate for use in surface course mixtures, shall be of a type known to possess adequate resistance to the polishing action of the anticipated traffic. (see Note 5)

NOTE 5—No standard ASTM method has been recognized to be capable of defining adequate resistance to the polishing action of specific traffic conditions. Test Method D 3319 has been found useful in evaluating the relative polish resistance between samples of different aggregates or mixtures containing different aggregates.

5.6 *Soundness*—The coarse aggregate, when subjected to five cycles of the soundness test, shall have a weighted loss not greater than 12 % when sodium sulfate is used or 18 % when magnesium sulfate is used. (see Note 6). If the salt is not designated by the purchaser, the aggregate will be acceptable if it meets the indicated limit for the salt used.

5.7 *Degradation*—The aggregate (with the exception of crushed blast-furnace slag) when subjected to testing in accordance with Test Method C 131 shall have a loss not greater than 40 % for surface courses or 50 % for base courses (see Note 6).

NOTE 6—Coarse aggregate (other than crushed hydraulic-cement concrete) failing to meet the requirements of 5.6 or 5.7, may be considered for use provided that (a) similar aggregates from the same source or geologic formation have been shown by experience to result in satisfactory pavements and (b) the results of other tests suggest that the desired performance can be obtained. Aggregate from a new source (including crushed hydraulic-cement concrete) that fails the requirements of 5.6 or 5.7 and for which no experience exists, may be considered provided the results of the other tests suggest that the desired performance can be obtained. Crushed hydraulic-cement concrete may chemically react with Na_2SO_4 or MgSO_4 , giving higher results which may not reflect the aggregate's freeze-thaw properties. Additional tests may be required.

6. Methods of Sampling and Testing

6.1 Sample the aggregates and determine the properties enumerated in this specification in accordance with the following methods:

6.1.1 *Sampling*—Practice D 75 and Practice D 3665.

6.1.2 *Grading*—Test Method C 136.

6.1.3 *Bulk Density of Aggregate*—Test Method C 29/C 29M.

6.1.4 *Soundness*—Test Method C 88.

6.1.5 *Degradation*—Test Method C 131.

7. Keywords

7.1 aggregate; bituminous paving; coarse aggregate; open graded friction; paving mixtures

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