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# Standard Specification for Steel Slag Aggregates for Bituminous Asphalt Paving Mixtures<sup>1</sup>

This standard is issued under the fixed designation D5106; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

## 1. Scope

1.1 This specification covers crushed steel slag coarse and fine aggregates suitable for use in bituminous asphalt paving mixtures.

1.2 Steel slag coarse and fine aggregates are currently being used entirely (**Note 1**) or combined with other mineral aggregates, such as those covered in Specification ~~D692~~D692/D692M or D1073, to produce paving mixtures similar to those described in Specification D3515 or D4215.

NOTE 1—When 100 % of the coarse aggregate in a bituminous asphalt mixture is steel slag, the amount of steel slag fines in that mixture may be limited to prevent bulking.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

NOTE 2—Sieve size is identified by its standard designation in Specification E11. The alternative designation given in parentheses is for information only and does not represent a different standard sieve size.

1.4 The text of this specification 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.

1.5 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

~~E88~~C88/C88M Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C117 Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing

C125 Terminology Relating to Concrete and Concrete Aggregates

~~E131~~C131/C131M Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

~~E136~~C136/C136M Test Method for Sieve Analysis of Fine and Coarse Aggregates

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.50 on Aggregate Specifications.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[C142C142/C142M](#) Test Method for Clay Lumps and Friable Particles in Aggregates  
 D8 Terminology Relating to Materials for Roads and Pavements  
[D75D75/D75M](#) Practice for Sampling Aggregates  
 D448 Classification for Sizes of Aggregate for Road and Bridge Construction  
[D692D692/D692M](#) Specification for Coarse Aggregate for Asphalt Paving Mixtures  
 D1073 Specification for Fine Aggregate for Asphalt Paving Mixtures  
 D3319 Practice for the Accelerated Polishing of Aggregates Using the British Wheel  
 D3515 Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures (Withdrawn 2009)<sup>3</sup>  
 D3665 Practice for Random Sampling of Construction Materials  
 D4215 Specification for Cold-Mixed, Cold-Laid Asphalt Paving Mixtures  
 D4318 Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils  
[D4792D4792/D4792M](#) Test Method for Potential Expansion of Aggregates from Hydration Reactions  
[D4867/D4867M](#) Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures  
 D5711 Test Method for Determining the Adherent Coating on Coarse Aggregates (Withdrawn 2012)<sup>3</sup>  
 D5821 Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate  
 E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves  
 2.2 *Federal Registrar*:<sup>4</sup>  
 SW846 1311 EPA Test Method, Toxicity Characteristic Leaching Procedure

### 3. Terminology

#### 3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *steel slag, n*—the nonmetallic product, consisting essentially of calcium silicates and ferrites combined with fused and mineralogically combined oxides of iron, aluminum, manganese, calcium, and magnesium, that is developed simultaneously with steel in basic oxygen, electric, or open-hearth furnaces.

3.1.2 Other terms used in this specification are defined in Terminologies [C125](#) and [D8](#).

3.1 For definitions of terms used in this specification, refer to Terminologies [C125](#) and [D8](#).

### 4. Ordering Information

4.1 Orders for the material under this specification shall include the following information:

4.1.1 The name of material (steel slag coarse aggregate and/or steel slag fine aggregate).

4.1.2 The specification designation and year of issue.

4.1.3 The grading of the aggregate to be furnished, by reference to a size number in Classification [D448](#) for coarse aggregate, grading number in Specification [D1073](#) for fine aggregate, or other grading as specified by the purchaser.

4.1.4 The quantity required.

4.1.5 For coarse aggregate, whether the intended use is for conventional mixtures or open-graded friction course mixtures (see [6.1.2](#)), and whether for surface courses or base courses (see [6.1.3](#)).

4.1.6 For sulfate soundness tests, which salt is to be used in Test Method [C88C88/C88M](#) and whether soundness requirements are applicable for the fine aggregate.

4.1.7 Any special requirements.

### 5. General Characteristics

5.1 The coarse and fine aggregates shall consist of hard, tough, durable pieces of steel slag as defined in [slag, 3.1.1](#). The aggregates shall be ~~processed~~ processed as necessary to meet the requirements of this specification, by crushing or screening, or both, and

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from the Department of Commerce, National Technical Information Center, 5285 Port Royal Road, Springfield, VA 22151. Order Number: EPAW-846.3.3.

magnetic separation for the removal of metallics. At the time of delivery, the aggregates shall not contain injurious amounts of foreign materials such as clay, loam, wood, tramp metal, unhydrated lime, or other deleterious materials.

## 6. Physical Requirements

### 6.1 Coarse Aggregate:

6.1.1 *Grading*—The coarse aggregate grading shall conform to the requirements of Classification **D448** for the size number designated, or to another grading as stated in the order (**Note 3**).

**NOTE 3**—The coarse aggregate grading to be furnished is dependent upon the desired composition of the paving ~~mixture~~, 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 aggregates and filler, when used, will produce a paving mixture that provides the desired characteristics.

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

6.1.2 *Fractured Particles in Coarse Aggregate*—Orders for material under this specification shall state the appropriate requirements for percentage of fractured particles.

6.1.2.1 Conventional mixtures, not less than 40 % by ~~mass~~, mass of the aggregate particles retained on the ~~4.75-mm~~ 4.75 mm (No. 4) sieve, shall have at least one fractured face (**Notes 4 and 5**).

6.1.2.2 ~~Open-graded~~ Open-graded friction course ~~mixtures~~, mixtures of the aggregate particles retained on the ~~4.75-mm~~ 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 4**—Attention is called to the distinction between conventional (dense mixtures or open mixtures) and open-graded friction course mixtures in Specification **D3515**.

**NOTE 5**—Some sources of aggregate contain angular particles that will perform similarly to a mechanically fractured particle. Where laboratory tests or service records indicate this to be true, such angular particles may be considered as fractured.

6.1.3 *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 polishing action of the anticipated traffic (**Note 6**).

**NOTE 6**—No ASTM standard has been recognized to be capable of defining adequate resistance to the polishing action of specific traffic conditions. Test Method **D3319** has been found useful in evaluating the relative polish resistance between samples of different aggregates or mixtures containing different aggregates.

6.1.4 *Soundness*—The coarse aggregate, when subjected to five cycles of the soundness test (see Test Method ~~E88~~**C88/C88M**), shall have a mass loss not greater than 12 % when sodium sulfate is used or 18 % when magnesium sulfate is used. If the salt is not designated by the purchaser, the aggregate shall be acceptable if it meets the indicated limit for either salt used.

6.1.5 *Degradation*—Aggregate subjected to testing in accordance with Test Method ~~E13~~**C131/C131M** shall have a loss not greater than 40 % for surface courses or 50 % for base courses.

### 6.2 Fine Aggregate:

6.2.1 The fine aggregate grading shall conform to the requirements of Specification **D1073** for the size number designated, or to another grading as designated in the order (**Note 7**).

**NOTE 7**—The fine aggregate grading to be furnished is dependent upon the desired composition of the paving ~~mixture~~, mixture and whether the grading to be used in the mixture is achieved with or without blending. Other fine aggregate gradings may be used provided that the combined aggregates and filler, when used, will produce a paving mixture that provides the desired characteristics.

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