



# Standard Practice for Selection and Use of Emulsified Asphalts<sup>1</sup>

This standard is issued under the fixed designation D 3628; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers the selection of emulsified asphalts for various paving and allied uses.

1.2 *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:

- D 8 Terminology Relating to Materials for Roads and Pavements<sup>2</sup>
- D 977 Specification for Emulsified Asphalt<sup>2</sup>
- D 2397 Specification for Cationic Emulsified Asphalt<sup>2</sup>
- D 3515 Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures<sup>2</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *bituminous-aggregate applications*—applications of bituminous material to a prepared aggregate base or pavement surface followed by the application of aggregate.

3.1.2 *bituminous-aggregate mixtures*—a combination of bituminous material and aggregate that is physically mixed by mechanical means, spread on the job site, and compacted.

3.1.3 *bituminous applications*—the application of sprayed bituminous coatings not involving the use of aggregates.

3.1.4 *crack filler*—the bituminous material used to fill and seal cracks in existing pavements.

3.1.5 *dense-graded aggregate*—aggregate that is graded from the maximum size, down to and including filler, with the object of obtaining a bituminous mix with a controlled void content and high stability.

3.1.6 *dust binder*—a light application of bituminous material for the express purpose of laying and bonding loose dust.

3.1.7 *fog seal*—a light spray application of asphalt to an existing pavement as a seal to inhibit raveling, or seal the surface, or both.

3.1.8 *graded aggregate seal, n*—a single surface treatment in which the aggregate is graded with little or no mineral filler, typically with a nominal maximum size of about 19 mm, and containing sufficient sand that the bituminous material will be required to penetrate upward into the aggregate cover; the nominal maximum aggregate size may vary depending on the course thickness desired and aggregate availability. It is an application method used in lieu of a chip seal to provide a lower cost road.

3.1.8.1 *Discussion*—In this case, nominal maximum size refers to the definition in Terminology D 8

3.1.9 *maintenance mix*—a mixture of bituminous material and mineral aggregate applied at ambient temperature for use in patching holes, depressions, and distress areas in existing pavements, using appropriate hand or mechanical methods in placing and compacting the mix. These mixes may be designed for immediate use or for use out of a stockpile at a later date without further processing.

3.1.10 *mixed-in-place*—the procedures by which the bituminous material and mineral aggregate are mixed on the job site by means of travel plants, blade mixing, or other special road-mixing equipment.

3.1.11 *mulch treatment*—a spray application of bituminous material used to temporarily stabilize a recently seeded area. The bituminous material can be applied to the soil or to a straw or hay mulch as a tie-down.

3.1.12 *multiple surface treatment*—two or more single surface treatments placed one on the other. The maximum aggregate size of each successive treatment is usually one half that of the previous one, and the total thickness is about the same as the nominal maximum size aggregate particles of the first course.

3.1.13 *open-graded aggregate*—aggregate containing little or no mineral filler and in which the void spaces in the compacted aggregate are relatively large.

3.1.14 *pavement bases and surfaces*—the lower or underlying pavement course atop the subbase or subgrade and the top or wearing course. Cold-laid mixtures that are bound together with liquid bitumens use either open or dense aggregate gradations.

3.1.15 *penetration macadam*—pavement construction using essentially one-size coarse aggregate which is penetrated in place by an application of high viscosity bituminous material followed by an application of smaller one-size coarse aggregate and thoroughly rolled. Procedure may be progressively

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.41 on Emulsified Asphalt Specifications.

Current edition approved Aug. 10, 1997. Published April 1998. Originally published as D 3628 – 78. Last previous edition D 3628 – 93a.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.03.

repeated to reduce surface voids as desired.

3.1.16 *plant mix (cold)*—a mixture of bituminous material and mineral aggregate prepared in a central mixing plant and spread and compacted at the job site when the mixture is at or near ambient temperature.

3.1.17 *plant mix (hot)*—a mixture of bituminous material and mineral aggregate usually prepared in a conventional hot-mix plant or drum mixer at a temperature of not more than 127°C and spread and compacted at the job site at a temperature above 93°C.

3.1.18 *prime coat*—an application of low-viscosity bituminous material to an absorptive surface designed to penetrate, bond, and stabilize this existing surface and to promote adhesion between it and the new super-imposed construction.

3.1.19 *sand*—a mineral aggregate material consisting of particles of rock passing a 4.75-mm sieve and only about 5 % passing the 75- $\mu$ m sieve.

3.1.20 *sand seal*—a bituminous-sand application to an existing pavement surface to seal the surface and to function as a light-wearing course.

3.1.21 *sandy soil*—a material consisting essentially of fine aggregate particles smaller than 2.00-mm sieve and usually containing material passing a 75- $\mu$ m sieve. This material usually exhibits plasticity characteristics.

3.1.22 *single-surface treatment (chip seal)*—a wearing surface of bituminous material and aggregate in which the aggregate is placed uniformly over the applied bituminous material in a single layer, the thickness of which approximates the nominal maximum size of the aggregate used.

3.1.23 *slurry seal*—a uniform application of a mixture of emulsified asphalt, fine aggregate, mineral filler, and water to an existing pavement. Single or multiple applications may be used.

3.1.24 *tack coat*—an application of bituminous material

applied to an existing, relatively nonabsorbent surface to provide a thorough bond between old and new surfacing.

3.1.25 *treatments and seals*—a bituminous aggregate application to any type of road or pavement surface for the purpose of providing a wearing course, or a surface seal, or both.

#### **4. Significance and Use**

4.1 As indicated by Specifications D 977 and D 2397, emulsified asphalts are classified by type (rapid medium or slow setting) and by grade within type (viscosity in the case of the rapid-setting type or characteristic of the residual asphalt in the case of the medium and slow-setting types). Selection for use of a particular type and grade is controlled by type of construction (whether an application or a mix type), properties of the mineral aggregate (both grading and mineral composition), and environmental conditions during construction. For surface treatments and seals, emulsions are formulated to set rapidly upon contact with the mineral aggregate or pavement surface. When used in mix types, slower breaking is required to allow time for mixing and laydown. If the mix aggregate is open graded without appreciable fines, a medium-setting emulsion may be used that deposits a relatively hard asphalt. If the aggregate is dense-graded but does not contain a large amount of very fine material (dust), a medium-setting emulsion with a soft residue may be a good choice. However, if the dense-graded aggregate contains a large amount of very fine mineral matter, a slow-setting emulsion may be required.

4.2 The recommendations in Table 1 should be considered only as a general guide for the selection of an emulsion for use. If the user is uncertain as to which to select for an intended use, the emulsion supplier should be contacted.

#### **5. Keywords**

5.1 emulsified asphalt; emulsion

**TABLE 1 General Uses of Emulsified Asphalt**

NOTE 1—Only those grades of emulsified asphalt in general use have been indicated herein. It is possible that under certain variations of aggregates, or climatic conditions, or both, additional selections might be appropriate. Where the use of emulsified asphalt for applications other than those listed in the table are contemplated, the emulsion supplier should be consulted.

Type of Construction <sup>A</sup>	Specification D 977							Specification D 2397 (Cationic)							
	RS-1 <sup>B</sup>	RS-2	HFRS-2	MS-1, HFMS-1	MS-2, HFMS-2	MS-2h, HFMS-2h	HFMS-2s	SS-1	SS-1h	CRS-1 <sup>B</sup>	CRS-2	CMS-2	CMS-2h	CSS-1	CSS-1h
<i>Bituminous-aggregate mixtures:</i>															
For pavement bases and surfaces:															
Plant mix (hot) (D 3515)	...	...	...	...	...	X <sup>C</sup>	...	...	...	...	...	...	...	...	...
Plant mix (cold)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Open-graded aggregate	...	...	...	...	X	X	...	...	...	...	X	X	...	...	
Dense-graded aggregate	...	...	...	...	...	...	X	X	X	...	...	...	X	X	
Sand	...	...	...	...	...	...	X	X	X	...	...	...	X	X	
Mixed-in-place:															
Open-graded aggregate	...	...	...	X	X	X	...	...	...	...	X	X	...	...	
Dense-graded aggregate	...	...	...	...	...	...	X	X	X	...	...	...	X	X	
Sand	...	...	...	...	...	...	X	X	X	...	...	...	X	X	
Sandy soil	...	...	...	...	...	...	...	X	X	...	...	...	X	X	
Slurry seal	...	...	...	...	...	...	...	X	X	...	...	...	X	X	
<i>Bituminous-aggregate applications:</i>															
Treatments and seals:															
Single surface treatment	X	X	X	...	...	...	...	...	...	X	X	...	...	...	...
(Chip Seal)															
Multiple surface treatment	X	X	X	...	...	...	...	...	...	X	X	...	...	...	...
Graded Aggregate Seal	...	...	...	...	...	...	X	...	...	...	...	...	...	...	
Sand seal	X	X	X	X	...	...	X	...	...	X	X	...	...	...	
Penetration macadam:															
Large voids	...	X	X	...	...	...	...	...	...	...	X	...	...	...	
Small voids	X	...	...	...	...	...	...	...	...	X	...	...	...	...	
<i>Bituminous applications:</i>															
Fog seal	...	...	...	X <sup>D</sup>	...	...	...	X <sup>E</sup>	X <sup>E</sup>	...	...	...	...	X <sup>E</sup>	X <sup>E</sup>
Prime coat-penetrable surface	...	...	...	...	...	...	...	X <sup>E</sup>	X <sup>E</sup>	...	...	...	...	X <sup>E</sup>	X <sup>E</sup>
Tack coat															
Dust binder	...	...	...	X <sup>D</sup>	...	...	...	X <sup>E</sup>	X <sup>E</sup>	...	...	...	...	X <sup>E</sup>	X <sup>E</sup>
Mulch treatment	...	...	...	...	...	...	...	X <sup>E</sup>	X <sup>E</sup>	...	...	...	...	X <sup>E</sup>	X <sup>E</sup>
Crack filler	...	...	...	...	X	X	X	X	X	...	...	X	X	X	X
<i>Maintenance mix:</i>															
Immediate use	...	...	...	X	X	X	X	...	...	...	...	X	X	...	...
Stockpile	...	...	...	...	...	...	X	...	...	...	...	...	...	...	...

<sup>A</sup> For definitions of terms used in this table, refer to Section 3.

<sup>B</sup> RS-1 and CRS-1 may be used as a tack coat in special cases where night construction or high humidity exists.

<sup>C</sup> Specification D 3515 permits the use of other emulsion grades by note, "Grades of emulsion other than MS-2h may be used where experience has shown that they give satisfactory performance."

<sup>D</sup> Diluted with water by the manufacturer.

<sup>E</sup> Diluted with water.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).