



## Standard Specification for Cold-Mixed, Cold-Laid Bituminous Paving Mixtures<sup>1</sup>

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### 1. Scope

1.1 This specification covers cold-mixed, cold-laid and recycled cold-mixed, cold-laid bituminous paving mixtures for base, binder, leveling, and surface courses.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- C 127 Test Method for Density, Relative Density, (Specific Gravity) and Absorption of Coarse Aggregate<sup>2</sup>
- C 128 Test Method for Density, Relative Density (Specific Gravity) and Absorption of Fine Aggregate<sup>2</sup>
- C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates<sup>2</sup>
- D 8 Terminology Relating to Materials for Roads and Pavements<sup>3</sup>
- D 75 Practice for Sampling Aggregates<sup>3</sup>
- D 140 Practice for Sampling Bituminous Materials<sup>3</sup>
- D 242 Specification for Mineral Filler for Bituminous Paving Mixtures<sup>3</sup>
- D 448 Classification for Sizes of Aggregate for Road and Bridge Construction<sup>3</sup>
- D 490 Specification for Road Tar<sup>3</sup>
- D 546 Test Method for Sieve Analysis of Mineral Filler for Bituminous Paving Materials<sup>3</sup>
- D 692 Specification for Coarse Aggregate for Bituminous Paving Mixtures<sup>3</sup>
- D 977 Specification for Emulsified Asphalt<sup>3</sup>
- D 979 Practice for Sampling Bituminous Paving Mixtures<sup>3</sup>
- D 1073 Specification for Fine Aggregate for Bituminous Paving Mixtures<sup>3</sup>
- D 2026 Specification for Cutback Asphalt (Slow-Curing Type)<sup>3</sup>
- D 2027 Specification for Cutback Asphalt (Medium-Curing Type)<sup>3</sup>
- D 2028 Specification for Cutback Asphalt (Rapid-Curing Type)<sup>3</sup>
- D 2172 Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures<sup>3</sup>

- D 2397 Specification for Cationic Emulsified Asphalt<sup>3</sup>
- D 2399 Practice for Selection of Cutback Asphalts<sup>3</sup>
- D 2489 Test Method for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures<sup>3</sup>
- D 2728 Practice for Paving Uses and Application Temperatures for Road Tars<sup>3</sup>
- D 3515 Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures<sup>3</sup>
- D 3628 Practice for Selection and Use of Emulsified Asphalts<sup>3</sup>
- D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils<sup>4</sup>
- E 145 Specification for Gravity-Convection and Forced-Ventilation Ovens<sup>5</sup>

### 3. Terminology

3.1 Definitions are in accordance with Terminology D 8.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cold-mixed, cold-laid bituminous paving mixtures*—mixtures of coarse and fine aggregates, or coarse or fine aggregate alone, with or without mineral filler, uniformly mixed and laid at or near ambient temperature.

3.2.2 *cold-mixed, cold-laid recycled bituminous paving mixtures*—mixtures of bitumen aggregate for recycling with additional mineral aggregate as necessary, with or without mineral filler, mixed at or near ambient temperatures with additional bitumen.

3.2.3 *bitumen-aggregate for recycling*—bituminous pavement or paving mixture removed from its original location and reduced by suitable means, after removal or in place, to such particle size as may be required for use in cold-mixed, cold-laid recycled bituminous paving mixtures.

### 4. Ordering Information

4.1 Orders for cold bituminous paving mixtures under this specification shall include the following information:

4.1.1 Type of bitumen (emulsified asphalt, cutback asphalt, or tar),

4.1.2 Grade of bitumen,

4.1.3 The composition of the bituminous paving mixture (dense mixture and mix designation; open mixture and mix

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.02.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.03.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.08.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 14.04.

designation; open graded friction course mixture and mix designation),

4.1.4 The maximum percentage of bitumen aggregate for recycling permitted in the mixture, and

4.1.5 The percentage of crushed particles required in the aggregate if different from that specified in 5.2.

## 5. Aggregates

5.1 The aggregates shall be crushed stone, crushed slag, crushed gravel, or sand conforming to the quality requirement of the appropriate ASTM specifications as follows:

5.1.1 *Coarse Aggregate*—Specification D 692.

5.1.2 *Fine Aggregate*—Specification D 1073.

NOTE 1—Other mineral aggregates, such as uncrushed gravel and crushed shell, may be specified, provided that local experience or tests have demonstrated their ability to produce satisfactory bituminous paving mixtures.

5.2 The aggregates for open-graded friction course mixture described in Table number 2 of Specification D 3515 shall meet all the requirements of 5.1 with the added requirement that (1) the coarse particles, retained on the No. 4 sieve, be crushed so that at least 90 weight percent have one or more fractured faces and 75 weight percent have two or more fractured faces, and (2) the coarse aggregate, or if a blend is used, the coarsest fraction be of a type known to possess adequate resistance to the polishing action of the anticipated traffic.

5.3 Recommended grading requirements for coarse and fine aggregate may be selected from Classification D 448 and Specification D 1073, respectively. Other aggregate gradations may be used, provided that the combined coarse and fine aggregates, and filler, when used, produce a mixture that conforms to the requirements for grading of total aggregate as described in Table number 1 of Specification D 3515.

5.4 When cold-mixed, cold-laid recycled mixtures are produced, aggregates conforming to 5.1 may be blended with the bitumen aggregate for recycling as necessary to produce the results required by 5.3.

## 6. Mineral Filler

6.1 The mineral filler shall conform to Specification D 242.

## 7. Bitumen

NOTE 2—Practices D 2399, D 2728, and D 3628 provide guidance in selecting types and grades of bitumen.

7.1 When cutback asphalt is used it shall conform to Specifications D 2026, D 2027, or D 2028.

7.2 When emulsified asphalt is used it shall conform to Specifications D 977 or D 2397.

7.3 When tar is used it shall conform to Specification D 490.

7.4 When cold-mixed, cold-laid recycled mixtures are produced, bitumen conforming to 7.1 or 7.2 shall be added to the bitumen aggregate for recycling as necessary.

NOTE 3—Various bituminous modifiers or recycling agents have been used on a number of cold-mixed, cold-laid recycled bituminous paving projects. Specifications for these materials are being developed.

## 8. Composition of Bituminous Paving Mixtures

8.1 The mixture shall conform to one of the compositions by weight given in Table number 1 of Specification D 3515.

NOTE 4—The mix designation selected should be determined by the intended use, thickness of paving courses, and desired texture. The required mix should be specified.

8.1.1 Compositions shown in Table number 1 of Specification D 3515 are based on the use of fine and coarse aggregates having approximately the same bulk specific gravities; grading of the total aggregate, therefore, would be the same on either a weight or bulk volume basis. If the bulk specific gravities of coarse and fine aggregates differ greatly, it may be desirable to change the grading limitations to compensate for these differences.

8.2 A job mix formula shall be selected that comes within the specification limits and that is suitable for the traffic, climatic conditions, and specific gravities of the aggregates used. Below the No. 8 (2.36-mm) sieve size, the job-mix formula grading curve shall be reasonably parallel to the curves of the grading limits as selected from Table number 1 of Specification D 3515.

8.3 Any variation from the job-mix formula in the grading of the aggregate, as shown by the sieve analyses of materials (Note 5) or, any variation from the job-mix formula in the bitumen content, as indicated by extraction tests of the finished mixture (Note 6) greater than the tolerances shown in Table number 3 of Specification D 3515, shall be investigated, and the conditions causing such variation shall be corrected (Note 7).

NOTE 5—It is recognized that the extraction test is a generally accepted and approved method for determining the composition of a bituminous mixture. However, due to the relatively wide difference in the bitumen content and aggregate gradation sometimes found in individual samples of mixture taken from the same lot, as shown by extraction tests, it is recommended that the extraction test results on individual small samples be used as an indication of the mix composition, and not as the sole basis for acceptance or rejection of the product. It may be necessary to determine both aggregate gradation and bitumen content from extraction tests samples.

NOTE 6—Cold mixtures require special preparation in the form of curing prior to performing the extraction test. One recommended curing procedure is to place the mixture to be extracted into a suitably large metal pan with a large spoon such that the mixture, in a loose state, is from 1 to 1½ in. (25 to 38 mm) in depth. Place the mixture, pan, and spoon in an oven, conforming to Specification E 145, Type 1B, the temperature of which has been adjusted to 250 ± 5°F (121 ± 3°C), for 3 h. At the end of each hour remove the pan and stir the mixture thoroughly for 1 min. Replace in the oven, except after the third hourly stirring, allow to cool to room temperature. The extraction test is then performed on this cured mixture. (Other curing procedures may be used provided local experience demonstrates their ability to prepare mixtures properly for the extraction test.)

NOTE 7—Application of tolerances may result in a gradation outside the composition limits in Table number 1 of Specification D 3515. This will not be cause for investigation.

## 9. Mixing Equipment

9.1 The equipment for mixing shall be one of the following:

9.1.1 *Central Plant*—Batch, continuous, or drum mixer.

9.1.2 *Travel Plant*, with own bituminous spray system or with separate distributor.

9.1.3 *Grader or Drag*, with separate distributor.

## 10. Mixing Operation

10.1 *Aggregate Storage*—Aggregates furnished in different

sizes or from different sources shall be kept separate, and adequate provisions shall be made to keep them from becoming mixed or otherwise contaminated. Preblending of aggregates for travel plants and road mixing is permissible so long as grading requirements are maintained. Stockpiles shall be built and the materials removed therefrom in such a manner as to minimize size segregation.

**10.2 Old Bituminous Pavement**—Bitumen aggregate for recycling shall be reduced in size as may be required. Adequate provisions shall be made to keep bitumen aggregate for recycling from being mixed with aggregates or otherwise contaminated.

**10.3 Preparation of Bitumen**—The bitumen shall be maintained at a temperature at which it can be properly handled through the pumping system and uniformly distributed throughout the mixture. At no time will the temperature of the bitumen be allowed to exceed the following:

	Temperature	
	°F	°C
Bitumen		
Cutback asphalt	250	121
Emulsified asphalt	180	82
Road tar	225	107

**NOTE 8**—The flash point of some grades of cutback asphalt is below 250°F; therefore, caution must be used when applying heat to cutbacks.

**10.4 Preparation and Handling of Mineral Aggregates**—Each aggregate shall be separately fed by feeders, except in the case of preblended aggregates where only one feeder is required, in proper uniform proportion to produce a satisfactory mixture within the limits specified. In the case of road mixing a known uniform volume or weight of a single aggregate, several aggregates, or preblended aggregate shall be windrowed or otherwise placed on the road or mixing area.

**10.5 Preparation and Handling of Bitumen Aggregate for Recycling**—Bitumen aggregate for recycling shall be separately fed by a feeder, except in the case of preblended aggregates where only one feeder is required, in proper uniform proportions to produce a satisfactory mixture within the limits specified. In the case of road mixing, a known volume or weight shall be windrowed or otherwise placed on the road or mixing area.

**10.6 Preparation of Mixture**—The proportions of the components of the mixture, within the limits specified, shall be

regulated so as to produce a satisfactory mixture. The sequence in which the bituminous material is proportioned with the aggregate, aggregate and bitumen aggregate for recycling, or bitumen aggregate for recycling may vary under different mixing procedures.

**10.6.1** The mixing shall be accomplished in the shortest time that will produce a satisfactory mixture.

**10.6.2** Minimum mixing time may be established on the best coating obtainable or percentage of coated particles as determined by Test Method D 2489. These values will vary with aggregate gradation, particle shape, and surface texture, and with the type of bitumen, bitumen content, and use for which the mix is intended.

**NOTE 9**—All the coarse particles may not be coated, particularly in dense graded mixtures.

**10.7 Mixing Plant Inspection**—The engineer or his authorized representatives shall have access at any time to all parts of the mixing plant in order to ensure the manufacture of the mixture in strict accordance with this specification.

## 11. Methods of Sampling and Testing

**11.1** Sample all material and determine the properties enumerated in this specification in accordance with the following ASTM standards:

**11.1.1 Sampling Mineral Aggregates**—Practice D 75.

**11.1.2 Sampling Bituminous Mixtures**—Practice D 979.

**11.1.3 Sieve Analysis of Aggregates**—Test Method C 136.

**11.1.4 Sieve Analysis of Mineral Filler**—Test Method D 546.

**11.1.5 Determination of Bitumen Content**—Test Methods D 2172. Determine the tar content in accordance with explanatory note appended to Test Methods D 2172.

**11.1.6 Sampling Bituminous Materials**—Practice D 140.

**11.1.7 Specific Gravity of Coarse Aggregate**—Test Method C 127.

**11.1.8 Specific Gravity of Fine Aggregate**—Test Method C 128.

**11.1.9 Plasticity Index**—Test Method D 4318.

**11.1.10 Percentage of Coated Particles**—Test Method D 2489.

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