



SECTION 14

HOT MIXED ASPHALT EMULSION MAINTENANCE MIXES

14.1 Scope

The recommended practice covers asphalt emulsion aggregate maintenance mixtures for stockpiling or immediate patching use from an approved hot mix plant. It is written as a guide and should be used as such. Use specifications should then be adapted to conform to job, local user, and performance requirements.

14.2 Applicable Documents

14.2.1 ASTM Documents:

- C127 Test for Specific Gravity and Absorption of Coarse Aggregate
- C128 Test for Specific Gravity and Absorption of Fine Aggregate
- C131 Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine
- C136 Method for Sieve Analysis of Fine and Coarse Aggregates
- D75 Practice for Sampling of Aggregates
- D140 Practice for Sampling Bituminous Materials
- D242 Specification for Mineral Filler for Bituminous Paving Mixtures
- D244 Standard Methods of Testing Emulsified Asphalts
- D423 Test Method for Liquid Limit of Soils
- D424 Test Method for Plastic Limit and Plasticity Index of Soils
- D546 Test Method for Sieve Analysis of Mineral Filler for Road and Paving Materials
- D692 Specification for Coarse Aggregate for Bituminous Paving Mixtures
- D977 Specification for Emulsified Asphalt
- D979 Practice for Sampling Bituminous Paving Mixtures
- D1073 Specification for Fine Aggregate for Bituminous Paving Mixtures
- D2172 Test for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
- D2419 Test Method for Sand Equivalent Values of Soils and Fine Aggregate
- D2489 Test Method for Degree of Particle Coating of Bituminous-Aggregate Mixtures
- D3203 Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
- D3515 Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
- D3628 Practice for Selection and Use of Asphalt Emulsion

14.2.2 AEMA Documents

- [A Basic Asphalt Emulsion Manual](#)



14.3 Asphalt Emulsion

- ASTM D977 Asphalt Emulsion
- ASTM D2397 Cationic Asphalt Emulsion

14.3.1 Sampling and Testing

- The asphalt emulsion shall be sampled in accordance with procedures outlined in ASTM D140 and tested in accordance with ASTM D244.
- All samples shall be shipped and stored in clean airtight sealed plastic containers.
- Material shall be homogeneous, miscible with water and shall show no signs of separation after thorough mixing within 30 days after delivery.

14.3.2 Selection of Asphalt Emulsion

In warmer climates or when material is to be used immediately, MS-2, HFMS-2 and CMS-2 are recommended. When prolonged stockpiling or low temperatures, -9°C (15°F) are anticipated, HFMS-2s is recommended.

When specifically approved by the purchaser other types of asphalt emulsion may be used if experience has proven that satisfactory performance will result.

14.4 Aggregate

The aggregates shall be crushed stone, crushed slag, crushed gravel, or sand conforming to the quality requirements of the appropriate ASTM specifications.

- Coarse Aggregate Specification D692
- Fine Aggregate Specification D1073.

Other mineral aggregates, such as uncrushed gravel and crushed shell, and other gradings, may be specified, provided that local experience or tests have demonstrated their ability to produce satisfactory asphalt emulsion aggregate maintenance mixtures.

14.5 Testing of Asphalt Paving Mixture

- Samples shall be obtained in accordance with ASTM D979. Stockpile samples shall be taken at least 100 mm (4 in.) below surface excluding any slight outer crust which may have formed.
- Adequate coating of the job aggregate by the asphalt emulsion shall be determined in accordance with ASTM D224.
- Residual asphalt content shall be determined by extraction in accordance with ASTM D2172.
- Stripping of residual asphalt from aggregate shall be determined in accordance with ASTM D1054. Another popular method follows:

When 50 g of the mixture, whether freshly prepared or taken from the stockpile, is heated at 121°C (260°F) in a laboratory oven for one hour and cooled with stirring to 93°C (200°F) in laboratory air, then is placed in 400 mL of boiling distilled water in a 600 mL glass beaker and stirred with a glass rod at the rate of one revolution per second for three minutes, the aggregate shall be at least 75% coated with an asphalt film.

Visual observation of the coating shall be made by decanting the water and spreading the mix on an absorbent paper.



Workability of the stockpiled mixture shall be determined by placing the cool, loose mix in a metal pan at least 10 in. by 10 in. size and sufficiently deep to form an uncompacted layer 50 mm (2 in.) in depth. Place the pan containing the mixture in a cold room or freezer for a period of time such that the total mixture will be cooled below -9°C (15°F). Then remove the pan and mixture from the cold environment and record the temperature at which the mixture is determined to be workable. In a workable mixture, a 1 in. putty knife will enter the sample with reasonable ease and the material may be mixed with very little conglomeration.

14.6 General Requirements

- If the mix is intended for base construction larger sized aggregate would be used.
- The mixture shall be capable of being handled by the use of either hand shovels or power loading equipment, shall be workable for placing and compacting with hand tools or power equipment at the temperature of mixing or at temperatures as low as -9°C (15°F). The mixture shall be usable at once from the mixer or over a period of several months from a stockpile. The mixture shall remain in place when used to patch wet or dry pavements and shall be stable under normal traffic conditions.

NOTE

These suggested limits are meant to be flexible and used as a guide. However, there have been successful mixes which performed as desired whose characteristics were outside the limits shown.

14.7 Composition Of Paving Mixtures

- Mix compositions required for hot asphalt emulsion mixtures conform to ASTM D3515, Table 1. Hot asphalt emulsion maintenance mixtures generally have a nominal maximum size of 19 mm ($3/4$ in.). In addition, laboratory testing should be performed prior to construction. This testing should include optimum asphalt determinations and mix stability studies, as well as aggregate coating and water resistance tests.

NOTE

The nominal top size aggregate (mix designation) selected should be determined by the intended use, thickness of paving courses, and desired texture. The required mix should be specified.

— Compositions shown ASTM D3515 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.

- A job mixture shall be selected that comes within the specification limits and that

is suitable for the traffic, climate conditions, and specific gravities of the aggregates used.

- Any variation from the job mix formula in the grading of the aggregate, as shown by the sieve analyses of materials in the plant or, any variation from the job mix formula in the asphalt content, as indicated by extraction tests of the finished mixture, greater than the percentage shown in ASTM D3515 Table 3, shall be investigated, and the conditions causing such variation shall be corrected.



14.8 Mixing Plant

- The mixing plant may be any approved type of equipment of the batch or continuous type which provides for a drum type dryer and pugmill mixer.
- A combination dryer and mixer (drum mixer) in which the asphalt emulsion and aggregate are heated together by the direct application of heated gases from a burner may also be used. On batch plants, the pugmill mixer chamber shall be vented to allow the escape of steam.
- The discharge end of the asphalt emulsion circulating pipe should be kept below the surface of the asphalt emulsion in the storage tank to prevent foaming and air entrainment.
- Provisions should be made in the asphalt transfer system that will enable the operator to turn off or reduce the heat media from all lines, pumps, and jacketed asphalt material buckets as soon as the system is open and circulating properly.
- Care should be taken to avoid overheating the emulsion in the lines, pumps, and tank.
- Approved storage silos for the hot asphalt emulsion mixture may be employed.

14.9 Mixing Plant Operation

14.9.1 Aggregate Storage

Aggregates furnished in different sizes or from different sources shall be kept separate, and adequate provision shall be made to keep them from becoming mixed or otherwise contaminated. Stockpiles shall be built and the materials removed therefrom in such a manner as to minimize size segregation.

14.9.2 Storage & Handling of Asphalt Emulsion

The emulsion shall be maintained at a temperature at which it can be properly handled through the pumping system and uniformly distributed through the mixture. At no time during the processing, from storage to mixing, will the temperature of the asphalt emulsion be allowed to exceed 85° C (185° F).

14.9.3 Preparation and Handling of Mineral Aggregates

Each size aggregate shall be separately fed by feeders to the cold elevator or elevators in proper proportion and at a rate to permit correct and uniform temperature control of the heating and drying operation.



14.10 Mix and Temperature

- The aggregate shall be dried and delivered to the mixer at a temperature such that the asphalt emulsion mixture will be produced at a temperature within the range of 104 to 127° C (220 to 260° F).
- Minimum mixing time may be established on the percentage of coating particles as determined by ASTM D2489 Test for Degree of Particle Coating of Bituminous-Aggregate Mixtures. The minimum values for percentage of coated particles used to establish the minimum mixing time should be set by the engineer. These values will vary with aggregate gradation, particle shape and surface texture, and with the asphalt content and use for which the mixture is intended.

14.11 Stockpile Procedure

- To prevent excess moisture on the aggregate before mixing, the aggregate may have to be aerated.
- Place stockpile on a level grade in a conical shape to promote proper drainage of precipitation. The stockpile shall be no more than one truckload high for the first 48 hours.
- Stockpiles shall be constructed in such a manner that no compaction other than the weight of the material itself will result. No equipment of any kind shall be run over the surface of the stockpile.

14.12 Construction Practice

- Equipment varies from only hand shovel to modern loaders and spreaders, from hand tampers to rollers.
- Prior to patching, the pavement should be properly prepared. The distressed section is removed extending into good pavement and as deep as necessary. Cut vertical edges with one pair of edges at right angles to the direction of traffic. If water is the cause of failure, install drainage. Clear out loose material and apply a tack coat to the vertical edges. Back fill with patch mix and compact.

14.13 Methods of Sampling and Testing

Sample all material and determine the properties enumerated in this guide in accordance with ASTM methods.

