INTERNATIONAL SLURRY SURFACING ASSOCIATION

TECHNICAL BULLETIN

800 Roosevelt Road, Building C-312, Glen Ellyn, IL 60137

No. 148

Issued 1989
1st Revision 2005

Test Method for Preparation of Microsurface and Slurry Seal Specimens for Evaluation by Hot Mixed Asphalt Design Methods (Modified Marshall Test)

1.0 Scope

1.1 This method covers the preparation of slurry seal and microsurface specimens for the purpose of evaluation under various design tests employed for Hot Mixed Asphalt Concrete.

2.0 Referenced Documents

2.1 ASTM Standard

- D 244 Emulsified Asphalt
- D 1559 Resistance to Plastic Flow of Bituminous Mixtures using Marshall Apparatus
- D 2170 Kinetic Viscosity of Asphalts
- D 2726 Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
- D 4123 Indirect Tension Test for Resilient Modulus of Bituminous Mixtures

2.2 Asphalt Institute

MS-2 Mix Design Methods for Asphalt Concrete.

3.0 Significance and Use

3.1 This method is employed in the laboratory mix design of microsurface and slurry seal mixtures. It is used to provide characterization of these materials which exceeds that gained from conventional design methods, and to offer alternate values in the selection of optimum mix formulation.

4.0 Apparatus

4.1 **Specimen Mold Assembly**-Mold cylinders 4 in. in diameter by 3 in. in height, base plates and extension collars as specified in ASTM D 1559. Three mold cylinders are required, although a greater number is advantageous.

4.2 **Ovens**-Ovens shall be provided for heating and curing the specimens. It is recommended that the heating units be thermostatically controlled so as to maintain the required temperature within 5°F.

4.3 **Mechanical Mixing Device**-A Planetary style mixer fitted with a wire whish may be used.

4.4 **Miscellaneous Equipment**:

- 4.4.1 Containers– For batching aggregate. Stainless steel bowls of adequate size may be used.
- 4.4.2 Mixing Tool– A steel serving spoon may be used.
- 4.4.3 Dispensing Devices– For adding water, asphalt emulsion or liquid additives to the aggregate. Wash bottles, dropping bottles or pipettes may be used.
- 4.4.4 Dispensing Devices- For adding mineral admix tures to the aggregate. Spatulas or chemical spoons may be used.
- 4.4.5 Scoop– For batching aggregate, flat bottom.
- 4.4.4 Wax Paper– For lining the base and sides of pans.
- 4.4.7 Paper Disks– For separating the specimen surface from specimen mold base and hammer face.
- 4.4.8 Thermometers– For ovens and water bath, with adequate range and sensitivity.
- 4.4.9. Balance– 2kg capacity, sensitive to 0.01g,for batch ing mixtures and aggregates.
- 4.4.10 Gloves– For handing hot equipment.
- 4.4.11 Marking Crayons– For identifying specimens.
- 4.4.12 Spatula– For spading sample, stiff metal blade,1 in. wide by 8 in. in length.
- 4.4.13 Pans– Large capacity metal pans for containment of curing mixtures.

5.0 Test Specimen Preparation

5.1 **Number of Specimens**– Prepare at least three specimens for each mix formulation to be evaluated.

5.2 **Aggregate Preparation**– Dry sieve aggregates into individual sieve fractions. Wash each fraction so as to remove all sieve material less than the size of the retaining sieve. Dry aggregates to as constant weight at 221°F to 230°F.

5.3 **Prepararion of Specimen Mix:**

- 5.3.1 Weigh into mixing bowl an adequate amount of each aggregate fraction to result in three compacted specimens of 2.5 ± 0.1 inches. The aggregate shall be batched in a manner to insure that it is representative of the material.
- 5.3.2 Add any necessary mineral admixtures to the aggregate and dry mix for 60 seconds. Weigh in the desired amount of mix water, followed by liquid additives, and mix until the sample displays homogenous moisture content. Form a crater in the aggregate mixuture and add the emulsifed asphalt. Mix throughly with a mechanical miver for 90 to 120 seconds or until all particles are coated and the mix is homogeneous. Care must be exercised to prevent loss of material during mixing and subsequent handling.
- 5.3.3 This procedure is intended to be used with slurry mixes of optimum consistency. Difficulties will arise in sample quality if the mixture is too wet and exhibits segregation.
- 5.3.4 Line a large metal pan with a piece of waxed paper adequate size to extend above the sides of the container. Pour the mixture into the large

metal pan and allow the material to flow out evenly across the base if the pan. If necessary, smooth the mix with the spoon to avoid thickened areas which may cure more slowly than the edges of the mix.

5.3.5 This preparation procedure is to be used only on material that maintains a free flowing consistency throughout mixing and pouring of specimens. If a mix exhibits a "break" prior to completion, it shall be discarded and a new mi formulated.

5.3.6 During preparation of sample the mix and all components shall be maintained at 77 ± 5°F.

5.4 **Curing of Specimens:**

5.4.1 Immediately after casting, the specimen is to be placed in a 140 ± 5°F oven. It shall be allowed to set and cure undisturbed for 24 ± 0.5 hours.

5.5 **Splitting of Samples**:

5.5.1 After curing, the sample pan is to be removed from the oven. While the mix is still warm, invert the pan and place the still consolidated specimen on a clean, nonabsorptive surface.

5.5.2 Peel away the waxed paper from the surface of the cured mix.

5.5.3 Quarter the material with a trowel or spatula, and retain three of the quarters for Marshall specimen samples. Use the remaining quarter for make up materials, splitting it and adding it to the three specimens until they are of sufficient size to yield a specimen of 2.5 ± 0.1inches.

5.5.4 Place the Marshall asample specimens in an oven maintained at the compaction temperature.

5.6 **Determination of Compaction Temperature:**

5.6.1 The temperature to which the asphalt emulsion base material must be heated to produce a viscosity of 280° ± 30°cST shall be the compacting temperature.

5.6.2 The asphalt base shall be recovered by ASTM D 244 or suitable method, and tested by ASTM D 217 for viscosity.

5.7 **Compaction of Specimens:**

5.7.1 The sample shall remain in the oven for a period of 2 ± 0.5 hours to stabilize at the com paction temperature, as determined in section 5.6.

5.7.2 Monitor the change in sample temperature carefully. Under no circumstances should a sample remain in the oven longer than 30 minutes over the time required to obtain the compaction temperature.

5.7.3 Assemble the necessary number of Marshall molds and preheat to the compaction temperature. Heat the face of the Marshall ham -mer, as well as a spatula, using a hot plate or other suitable device.

5.7.4 Remove the specimens and molds from the oven, place a paper disk in the bottom of the mold and spoon the for mixture into the mold. With heated spatula, rod 15 times around the perimeter of the sample and 10 times through the center. Place a paper disk at the top of the specimen.

5.7.5 Immediately compact with 30 blows per face with conventional Marshall hammer.

5.7.6 Disassemble mold and remove paper disks from ends of specimen .Allow to cool at room temperature until the sample can be handled with unprotected hands and extrude from mold.

5.7.7 The compaction procedure references above is identical to that specified in ASTM D 1559. For clarification or additional information, consult that test procedure.

6.0 Procedure

6.1 Allow samples to cool to room temperature. A fan may be used to accelerate cooling.

6.2 Clearly mark each specimen to identify its formulation.

6.3 Test each sample by the specified procedures.

7.0 Report

7.1 The report shall contain the following information:

7.1.1 Formulation for each group of samples to include remarks and observations.

7.1.2 Height of each specimen

7.1.3 Resilient Modulus at specified temperature.

7.1.4 Bulk specific gravity and density of each formulation used, determined from the average of 3 specimens.

7.1.5 Average maximum load in Stability pounds of at least three specimens, corrected when required.

7.1.6 Average flow value, in hundredths of an inch, of three specimens.

7.1.7 Complete voids analysis on each set of specimens.

8.0 Precision and Accuracy

8.1 At this time, no general statement of accuracy between multi-operator and multi-laboratory results can be made. No precision statement exists for ASTM D 1559.

8.2 All test results should be analyzed by statistical variation methods. Any specimens which individually depart from the determined limitations should be discarded.

Note: This method is excerpted from the paper "Comparison of Mix Design Methods to Determine Optimum Bitumen Content in Microsurface Systems," authored by Timothy R. Kramer and Michael P. Doyle of Sahuaro Petroleum and Asphalt Company, Phoenix, Arizona, and was presented at the 27th Annual Convention ISSA at Kona, Hawaii, February 1989. Comments are solicited by the authors.
Readers are cautioned that atypical results may occur when co-emulsified latex emulsion residues are subjected to the unrealistically high temperature required for compaction of the Marshall pills. The Marshall Test, though highly controversial, may be useful in the

selection of optimum bitumen content and other research data. Generally, correlation with field results is very poor. (Ed.).