METHOD OF TEST FOR RESISTANCE TO PLASTIC FLOW OF BITUMINOUS MIXTURES USING MARSHALL APPARATUS LS-263 R28

ASTM D6927 - 15

LS 3. PROCEDURE

3.1 Procedure of ASTM D6927 shall be followed, except as noted below.....

ASTM 4. Apparatus

4.1 *Breaking Head*, the testing head (Fig. 2) shall consist of upper and lower cylindrical segments of cast gray or ductile iron, cast steel, or annealed steel tubing.....

The lower segment shall be mounted on a base having two perpendicular guide rods or posts (minimum 12.5 mm in diameter) extending upwards.....

Guide sleeves in the upper segment shall direct the two segments together without appreciable binding or loose motion on the guide rods.....

A circular testing head with an inside bevel having dimensions other than specified in Fig. 2 has been shown to give results different from the standard testing head.....

4.2 *Compression Loading Machine*, the compression loading machine (Fig. 3) may consist of a screw jack mounted in a testing frame and shall be designed to load at a uniform vertical movement of

50 ± 5 mm/min.....

The design in Fig. 3 shows power being supplied by an electric motor. A mechanical or hydraulic compression testing machine may also be used provided the rate of loading can be maintained at 50 ± 5 mm/min.....

4.3 *Load Measuring Device*, as a minimum, a calibrated nominal 20 kN ring dynamometer (Fig. 3) with a dial indicator to measure ring deflection for applied loads is required.....

The 20 kN ring shall have a minimum sensitivity of 50 N.....

The dial indicator should be graduated in increments of 0.0025 mm or finer.....

The ring dynamometer should be attached to the testing frame (see ring holding bar, Fig 3) and an adapter (see ring dynamometer adapter, Fig. 3) should provided to transmit load to the breaking head.....

The ring dynamometer assembly may be replaced with a load cell connected to a load deformation recorder or computer provided capacity and sensitivity meet above requirements.....

Note 1, A higher capacity ring dynamometer may be required for high-stability mixes. These include mixes with harsh, crushed aggregate and dense gradation, as well as mixes made with very stiff binders.....

4.4 *Flowmeter*, the Marshall flowmeter consists of a guide sleeve and gage (Fig. 4). The activating pin of the gage shall slide inside the guide sleeve with minimal friction and the guide sleeve shall slide freely over the guide post (see Fig. 4) of the breaking head.....

These points of frictional resistance shall be checked before tests. .....

Graduations of the flowmeter gage shall be increments of 0.25 mm or finer.....

Instead of a flowmeter, other devices such as an indicator dial or linear variable differential transducer (LVDT) connected to a load deformation recorded or computer may be used.....

These alternate devices should be capable of indicating or displaying flow (deformation) to the required sensitivity. These devices must be designed to measure and record the same relative movement between the top of the guide post and the upper breaking head.....

4.5 *Water Bath*, the water bath shall be deep enough to maintain the water level a minimum of 30 mm above the top specimens.....

The bath shall be thermostatically controlled so as to maintain the specified test temperature ± 1°C at any point in the tank.....

The tank shall have a perforated false bottom or be equipped with a shelf for supporting specimens

50 mm above the bottom of the bath and equipped with a mechanical water circulator.....

4.6 *Oven*, an oven capable of maintaining the specified test temperature ± 1°C.....

4.7 *Air Bath*, the air bath for mixtures containing cutback asphalt binder shall be thermostatically controlled and shall maintain the air temperature at 25 ± 1 °C.....

4.8 *Thermometers*, calibrated thermometers for water and air baths shall cover the temperature range specified and be readable to 0.2°C.....

ASTM 5. Procedure

5.1 A minimum of three (3) specimens of a given mixture shall be tested.....

The specimens should have the same aggregate type, quality, and grading, the same mineral filler type and quality, and the same binder source, grade and amount. In addition, the specimens should have the same preparation, that is, temperatures, cooling, and compaction.....

LS 4.1 Prepare specimens as outlined in MTO Method LS-261.....

5.2 Specimens should be cooled to room temperature after compaction.....

During cooling they should be placed on a smooth, flat service.....

Bulk specific gravity of each specimen shall be determined by D2726, D1188, or D6752.....

The bulk specific gravities of replicate specimens for each binder content shall agree within ± 0.020 of the mean as noted in practice D6926.....

5.2.1 Measure specimens thickness according to Test Method D3549.....

LS 6.3 The briquettes must be allowed to cure for at least 12 h before testing.....

5.3 Bring specimens prepared with asphalt cement to the specified temperature by immersion in the water bath 30 to 40 min.....

Or placement in oven for 120 to 130 min.....

Maintain the bath or oven temperature at 60 ± 1°C.....

5.3.1 Thoroughly clean the guide rods and inside surfaces of the test head segments prior to conducting the test. Lubricate guide rods so that the upper test head segment slides freely over them.....

The testing head shall be at a temperature of 20 to 40°C.....

If a water bath is used, wipe excess water from the inside of the testing segments.....

5.3.2 Remove a specimen from the water bath or oven (in case of a water bath remove excess water with a towel) and place in the lower segment of the testing head.....

Place the upper segment of the testing head on the specimen, and place the complete assembly in position in the loading machine.....

If used, place flowmeter in position over one of the guide rods and adjust to zero while holding the sleeve firmly against the upper segment of the testing head while the test load is being applied....

5.4 The elapsed time from removal of the test specimens from the water bath to the final load determination shall not exceed 30 s.....

Apply load to the specimen by means of the constant rate of movement of the loading jack or loading machine head of 50 ± 5 mm/min until the dial gage releases or the load begins to decrease.....

5.5 If using a flowmeter, release the flow meter sleeve or note the micrometer dial reading, where used, the instant when the load decreases.....

If using load deformation recorder or other automatic recording device, stop the test when the load cell indicates the incremental rate of loading, which is driving the constant rate of deformation, has begun to decrease.....

The Marshall flow is the total sample deformation from the point where the projected tangent of the linear part of the curve intersects the x-axis (deformation) to the point where the curve starts to become horizontal.....

As shown in Fig. 1, the termination of flow usually corresponds to the peak stability, however, as an alternative when the failure condition is not clearly defined, it can be selected as the point on the curve which is 6 flow points to the right of the tangent line.....

The flow value is usually recorded in units of 0.25mm.....

The Marshall Stability is defined as the load corresponding to the flow.....

This procedure may require 2 people to conduct the test and record the data.....

Marshall flow may be read directly from the load-deformation chart or be determined after converting the chart reading with an appropriate factor.....

METHOD OF TEST FOR RESISTANCE TO PLASTIC FLOW OF BITUMINOUS MIXTURES USING MARSHALL APPARATUS LS-263 R28
ASTM D6927 - 15

ASTM 6. Calculation

6.1 Laboratory molded specimens shall satisfy the thickness requirement of 63.5 ± 2.5 mm.....

Specimens within the thickness tolerance may be corrected based on volume or thickness.....

Stabilities determined on field cores with large variation in volume or thickness shall be also corrected. Results with larger corrections should be used with caution.....

Correction factors are given in Table 1.....

The correction ratio is used in the following manner.....

A = B x C

Where:

A = corrected stability

B = measured of stability (load)

C = correlation ratio from Table 1

LS 4.2 The flow values may be determined by the timing method. The calculations are as follows: .

Stability = D (Newtons)

Flow = [(T/30)-(0.0001D)-C]*100 (in units of 0.01 inches or 0.25 mm)

Where:

T = time in s (average of two measurements taken by two different technicians)

D = deflection of proving ring in 0.0001 inch increments (this is the Marshall stability reading)

C = 0.007 (this constant must be determined for each test machine and may vary slightly)

4.3 Results are recorded on the Bituminous Mix Form (Figure 1).....

LS 6. GENERAL NOTES

6.1 All metal parts of the testing machine, the breaking head and the surface of the briquettes, must be free from foreign matter and loose particles.....

6.2 The jack head base plate must be kept tight on the elevating screw.....

6.3 The briquettes must be allowed to cure for at least 12 h before testing.....

6.4 Centre the briquette on the breaking head before testing.....

6.5 To assure that the Marshall breaking heads meet ASTM dimensional requirements, a clear plastic template with scribed reference lines is available.....

6.6 At no time should any solution be used to coat the inside of the breaking head.....

6.7 Equipment should be calibrated a minimum of once every 12 months.....

Comments