State of Nevada
Department of Transportation
Materials Division

METHOD OF TEST FOR DUPLICATING FIELD DENSITIES IN LABORATORY COMPACTED BITUMINOUS MIXTURE SAMPLES

A. SCOPE

This method covers the procedure of laboratory compacting loose bituminous mixtures to duplicate field densities.

B. APPARATUS:

1. Mechanical compactor, designed to consolidate by a series of individual or roving "kneading action" impressions made by a ram having a face shaped as a sector of a 4 in. (102 mm) diameter circle. The compactor must be capable of exerting a force of 500 psi (3.45 Mpa) under the tamper foot.

2. Compactor accessories, 4.000 ± 0.005 in. (101.60 ± 0.13 mm) in inside diameter by 5 in. (127 mm) high steel molds, and a mold holder; 4 in. (102 mm) paper disks.

3. Testing machine, 50,000 lbf (222.4 kN) capacity.

4. Two followers, Top: 3.985 ± 0.005 in. (101.2 ± 0.11 mm) in diameter by 5 1/2 in. (140 mm) high and Bottom: 3.985 ± 0.005 in. (101.2 ± 0.11 mm) in diameter by 1 1/2 in. (38.1 mm) high.

5. Oven, forced air circulation, capable of maintaining temperatures of 140°F (60°C) and 230°F (110°C).

6. Mechanical spader (optional), designed to prevent segregation of coarse and fine material or the formation of rock pockets in the test specimen by introducing the mixture into the compaction mold from an endless belt at the same time imparting a spading action with four mechanically operated 1/2 in. (13 mm) diameter, 23 in. (584 mm) long bullet-nose steel rods.

7. Special feeder trough 4 in. (102 mm) wide by 16 in. (406 mm) minimum in length and a round nose steel rod 3/8 in. (9.5 mm) in diameter by 16 in. (406 mm) long, that may be used in lieu of mechanical spader.

8. Metal balance scoop.

9. 8 in. diameter, 1/2 in. (12.5 mm) sieve.

10. Balance, 11 kg capacity, accurate to ± 0.1 g.

11. Suitable device for measuring height of test specimens to nearest 0.01 in. (0.254 mm).

12. Small metal scoops and spatulas.

13. Pans, 11 in. (279 mm) x 7 in. (178 mm) x 1 in. (25 mm) deep.

14. Safety glasses or goggles, gloves.

C. CONTROL

1. Control of the compaction pressure shall be in accordance with the Method of Operation and Calibration of the Mechanical Compactor (California Test 101).

2. Compaction temperatures shall be carefully controlled ± 5°F (±3°C).

D. PROCEDURE

1. Cure the loose mix material (either plantmixed or laboratory prepared) to be compacted in a suitable flat pan 11 in. (279 mm) x 7 in. (178 mm) x 1 in. (25 mm), for a minimum period of 15 ± 3 hours in an oven with provision for forced air circulation and thermostatically controlled to 140°F ± 5°F (60°C ± 3°C).

2. To determine the proper weight of material for compaction to obtain the correct 2.50 in. (63.5 mm) sample height. Multiply the theoretical maximum gravity (AASHTO T209) obtained on the same material by 62.4 (to obtain density) then by a factor of 7.52 (derived from adjusted volume based calculations). This is the amount of material required (in grams) to obtain a laboratory compacted briquette with approximately 8 percent air voids, which is about the average air void level attained under actual field conditions.

3. Place a mold of the correct temperature on the mold holder base. Place a 4 in. (102 mm) diameter paper disk into the mold on top of the mold holder base, then place the entire assembly into position on the mechanical spader.

4. Weigh out the proper amount of mix determined by step 2 above, which has been brought to the proper compaction temperature.

   Compaction Temperatures:

   a. Asphalt mixture with liquid asphalts: 140°F (60°C)
   b. Asphalt mixture with paving asphalts: 230°F (110°C)

5. Separate the coarse and fine material of each weighed mixture by screening it through a 1/2 in. (12.5 mm) sieve. Place the retained plus 1/2 in. (12.5 mm) aggregate mix into a parallel row in the mechanical spader feeder trough. Carefully place the remainder minus 1/2 in. (12.5 mm) mix directly on top of the plus 1/2 in. (12.5 mm) aggregate mix so that the fine material completely and evenly covers the coarse aggregate. This procedure is followed so that unwanted rock and air void "pockets" on the outside perimeter of the compacted briquette are minimized.

6. Start the mechanical spader, and when enough mix has been introduced to completely cover the paper disk in the bottom of the compaction mold, lower the tamping rods. The spader should be set to operate for 1 minute.

   Note: In lieu of the mechanical spader described above, a specially constructed feeder trough 4 in. (102 mm) wide and 16 in. (406 mm) in minimum length, may be used for introducing the mix into the mold. Weigh out the correct amount of mixture, then carefully place the material into the trough which has been preheated to the correct compaction temperature. Place a mold of the correct temperature into position on the mold holder and place a paper disk in the mold. Use a paddle, shaped to fit the feeder trough, to push one half of the material into the mold.

   Rod the material 20 times in the center of the mass and 20 times around the edge with a round nosed steel rod 3/8 in. (9.5 mm) in diameter and 16 in. (406 mm) long. Then push the remainder of the sample into the mold and repeat the rodding procedure. Perform these operations as rapidly as possible to prevent cooling of the sample. If two feeder troughs are available, the work can be expedited by preparing another sample while one is being compacted. The extra trough containing the sample is kept in the oven until ready for compaction.

7. Place mold holder containing the mix and mold into position in the mechanical compactor.

8. Apply 25 tamping blows of 250 psi (1.72 Mpa) pressure to accomplish a semi-compacted condition. Keep the tamper foot hot enough to prevent the mix from adhering to it (approximately 230°F (110°C)).

9. Carefully remove the cylinder mold from the mold holder base, place the cylinder mold on the bottom follower, then place the top follower on the semi-compacted sample.

   Note: tilting the cylinder mold at an angle before removing it from the mold holder base will help to keep the semi-compacted material from falling out of the mold.

10. Apply a steadily increasing load to the top follower until a specimen height of 2.50" (63.5 mm) is obtained. The compacted sample should now contain approximately 8 percent air voids.

11. Cool the specimen for approximately 1/2 hour at room temperature, then press the compacted sample out of the cylinder mold.