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METHOD OF TEST FOR DETERMINING PERMEABILITY OF THIN MEMBRANES UNDER ASPHALT CONCRETE

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Section H of this method. It is the responsibility of whoever uses this method to consult and use appropriate safety and health practices and determine the applicability of regulatory limitations before any testing is performed. Users of this method do so at their own risk.

A. SCOPE

A measure of permeability that is directly related to the tearing or penetration of a commercial membrane by an overlay of asphalt concrete is provided in this test method. This test may also be used to determine the permeability of any laboratory compacted asphalt concrete specimen without disturbing the specimen.

B. APPARATUS

1. One air permeability unit as developed by the California Research Corporation (Figure 1).

2. A modified metal dome for the air permeability unit (Figure 1).

3. Mechanical compactor as shown in Figure 2 designed to consolidate the material by a series of individual or roving "kneading action" impressions made by a ram having a face shaped as a sector of a 101.6 mm diameter circle. The compactor must be capable of exerting a force of 3450 kPa under the tamper foot.

4. Steel molds, 101.6 mm in diameter by 127 mm high, threaded on one end to accept the modified metal dome of the air permeability apparatus.

5. Mold holder (Figure 3).

6. Compaction base – usually concrete, 101.6 mm in diameter, and 50 mm in height.

7. Petroleum jelly or a pliable silicone grease, for use as a sealant.

8. Oven capable of maintaining a uniform temperature of ± 5°C up to at least 150°C.

9. Mechanical spader designed to prevent segregation of coarse and fine material, or the formation of a rock pocket in the test specimen, by introducing the mixture into the compaction mold from an endless belt (Figure 4).

10. Special feeder trough, 101.6 mm wide and 405 mm long that may be used in lieu of the mechanical spader (Figure 3).

11. Flat metal scoop 255 mm by 355 mm.

12. 12.5 mm sieve.

13. Balance, 2,000-g capacity, 1-g accuracy.

C. FABRICATION

1. Preheat the compaction molds and feed trough to approximately the compaction temperature specified.

2. Place waxed paper or cellophane of sufficient thickness to remain pliable, on a 101.6-mm diameter concrete compaction base.

3. Place the membrane to be tested on the wax paper (or cellophane) and base, and insert into a 101.6 mm diameter mold.

4. Place preheated mold in mold holder and raise from bottom of the mold holder with a 6.4 mm shim. Then place in the mechanical spader. *Do not* use spader rods. If a mechanical spader is not available, material may be placed by hand using the feeder trough indicated in California Test 304. No hand rodding should be used.

5. Weigh out 1,000 ± 1 g of mix which has been brought to the proper compaction temperature:

   60°C for asphalt concrete with liquid asphalt.

   130°C for asphalt concrete with paving asphalt.

6. Separate the coarse and fine material by screening the mix through a 12.5-mm sieve onto a flat metal scoop.

7. Arrange the separated material into two parallel rows across the width of the scoop.

8. Introduce the mix onto the feeder belt of the mechanical spader, and do not disturb the size arrangement effected on the metal scoop.

9. Start the mechanical spader and operate until all of the material has been introduced into the compaction mold.

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

11. Start compactor and adjust air pressure to the point where 1725 kPa will be exerted by the tamper foot. Keep the tamper foot hot enough to prevent the mix from adhering to it by using the heating element provided in the foot assembly.

12. If material is to be compacted in one lift, apply approximately 20 tamping blows of 1725 kPa pressure to accomplish a semi-compacted condition of the mix so it will not be unduly disturbed when the full load is applied. The exact number of blows to accomplish this semi-compaction shall be determined by observation. The number of blows may vary between 10 and 50, depending on the type of material. In some cases where sandy material is to be compacted, it may not be possible to compact in the mechanical compactor because of undue movement of the mixture under the compactor foot. In these instances after 30 tamps at 1725 kPa have been applied with the mechanical compactor, compact with a 180 kN static load applied with a double plunger system. If two layers are to be compacted, the first lift should be given 30 tamps at 1725 kPa. The second lift should then be added and compacted as described for one-lift construction. Two-lift construction must also have a thickness of 25 ± 6.4 mm for the first lift. Variable thickness' up to 75 mm are then permissible for the second lift.

13. Remove 6.4-mm shim and release tightening screw sufficiently to allow approximately 3.2-mm side movement under load.

14. Raise compaction pressure to 3450 kPa and apply 150 tamping blows to complete the compaction with the mechanical compactor.

15. Remove from mold holder, remove base and wax paper (or cellophane), and let the compacted specimen remain at room temperature for 24 ± 2 hours.

D. TEST PROCEDURE

1. Place mold and specimen with membrane in up position.

2. Seal around edges of membrane with petroleum jelly or silicone grease. (Use a bead pattern of sealant with a minimum of spread on the membrane.)

3. Attach metal dome for permeability by screwing onto mold.

4. Attach Air Permeometer (apparatus by California Research Corporation) to the metal dome by means of a 6.4-mm rubber tubing.

5. Using 25.4 mm of water vacuum, determine the air permeability per minute per square millimeter.

E. PRECAUTIONS

The metal dome should be periodically checked for a worn or torn gasket that may cause sealing difficulties.

The membrane area should not be reduced any more than necessary when applying sealant.

The metal dome should be placed securely in place.

F. NOTES

If the permeability is low and no puncture is visible, apply more sealant around edges of membrane and retest for permeability. If the values are repeated, they may be considered valid and should be reported. Occasionally, membrane punctures are the size of pinholes and not easily distinguishable.

G. REPORTING OF RESULTS

Report the permeability as mL per minute per square millimeter with 25.4 mm of water vacuum.

H. SAFETY AND HEALTH

Prior to handling, testing or disposing of any waste materials, Caltrans testers are required to read: Part A (Section 5.0), Part B (Sections: 5.0, 6.0 and 10.0) and Part C (Section 1.0) of Caltrans Laboratory Safety Manual. Users of this method do so at their own risk.

REFERENCES:

California Test 304

"A Method for Measuring the Air Permeabilities of Asphalt Concrete Pavements", by W. H. Ellis and R. S. Schmidt, ASTM Special Technical Publication No. 294, p. 85, 1960

End of Text (California Test 358 contains 5 pages)

SCHEMATIC DIAGRAM OF PERMEABILITY APPARATUS

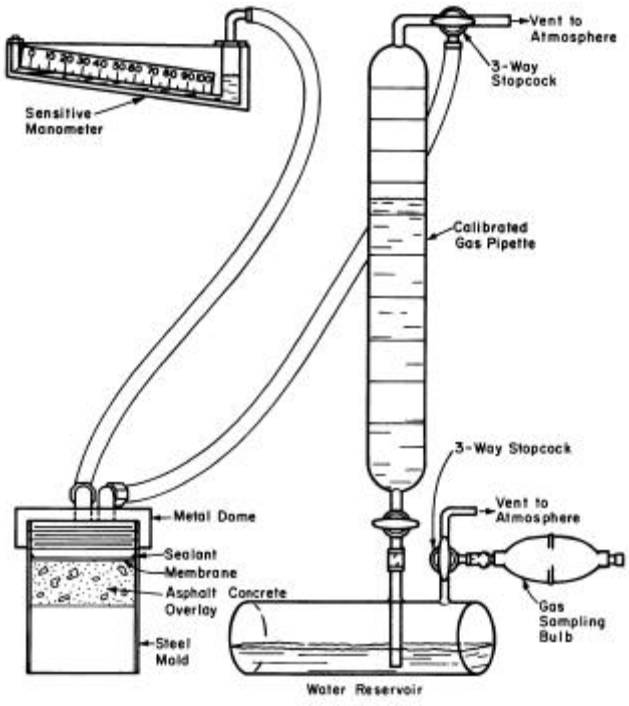

FIGURE 1

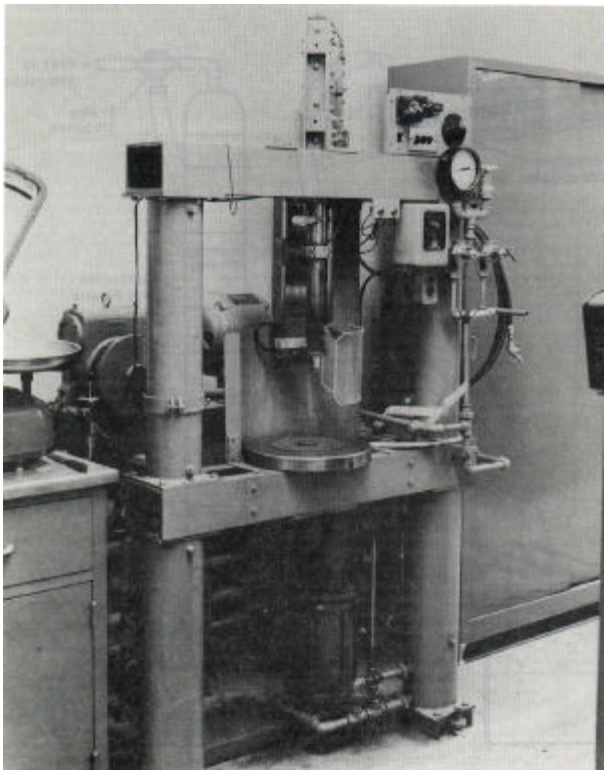

FIGURE 2

FIGURE 3

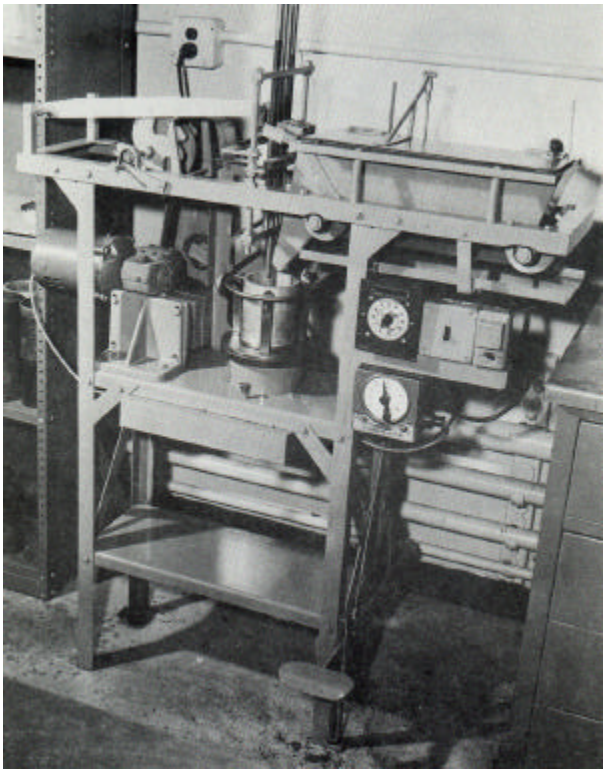

FIGURE 4