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**DIVISION OF ENGINEERING SERVICES**  
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## **DETERMINATION OF WATER RETENTION EFFICIENCY OF LIQUID MEMBRANE-FORMING CONCRETE CURING COMPOUNDS**

**CAUTION:** Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read “**SAFETY AND HEALTH**” in Section E of this method. It is the responsibility of the user of this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

### **A. SCOPE**

This test method, which is a modification of AASHTO Designation: T 155 and ASTM Designation: C 156, describes the laboratory procedure for determining the efficiency of liquid membrane-forming curing compounds in preventing moisture loss from concrete during the early hardening period.

### **B. APPARATUS**

1. Mortar molds shall be rigid, watertight pans, meeting the requirements in ASTM Designation: C 156. Pans 8 ½ inches in diameter, and over 1 ½ inches in depth have been found to be satisfactory for use. Molds shall have a flat rim, approximately ¼ inch in width.
2. The cabinet for curing the specimens shall be maintained at  $37.8 \pm 1^\circ\text{C}$  and a relative humidity of  $32 \pm 2\%$ . Airflow shall be sufficient to remove the solvent vapors quickly, but no detectable air current shall strike directly on the surface of any test specimen stored in the cabinet.
3. Analytical balance capable of weighing mortar specimens to the nearest 0.1 g.
4. Air atomizing spray gun with an attached pressure pot to apply the curing compound to the mortar specimens.
5. Graded standard sand conforming to the requirements of ASTM Designation: C 778.
6. Portland Cement, Type II. *DO NOT USE CONCRETE ADMIXTURES OR AIR-ENTRAINING CEMENT IN THIS TEST.*
7. Paraffin wax, a hotplate and a brush so that the wax can be applied to the edges of the molded specimens.

### **C. PROCEDURES**

Preparation of mortar test specimens

1. Thoroughly clean the molds before each use and apply a thin coating of a suitable mold release compound. The test shall consist of two specimens.
2. Whenever a new lot of cement or sand is to be used, prepare a trial batch of mortar having a water/cement ratio of 0.4 with sufficient sand to produce a flow of  $35 \pm 5$ , as measured in ASTM Designation: C 87. Use these proportions in preparing subsequent test batches of mortar.
3. Prepare sufficient mortar to fill the two specimen pans. Machine mix all batches of mortar at room temperature ( $25 \pm 1^\circ\text{C}$ ) following the schedule given for mixing mortars in ASTM Designation: C 156. Place the mortar in the mold in two approximately equal layers. Consolidate each layer by tamping or with a mechanical vibrator. Avoid over vibration. Strike off the excess mortar and finish the surface with a wooden screed having a flat, 2-inch wide screeding surface. Advance the screed using a circular motion. Do not work the surface more than necessary to produce a reasonably even finish.
4. After molding, place the specimens in the curing cabinet in a level position. Space the specimens uniformly on the shelf with a clear space of at least 2 inches on all sides of each specimen. Use dummy specimens to replace test specimens when a shelf is not filled with test specimens.
5. Remove test specimens from the cabinet approximately 1 hr after molding. Use a putty knife or paint scraper to form a V shaped groove approximately 1/8 inch deep and not over 1/16 inch wide between the edge of the mortar and the mold. (Mortar should be dry enough that the groove will not collapse or fill with water).
6. Fill the groove with the melted paraffin wax so that the edge sealant surface is parallel with the surface of the molded specimen. Return the specimen to the cabinet for approximately 1/2 hr.
7. Test the mortar surface condition by rubbing a small area with a fingertip. The specimen is ready for brushing when light rubbing produces only a few fine bubbles and no surface moisture is visible. Brush the entire surface of the mortar lightly with a 2-inch wide paintbrush. Brushing shall be just sufficient to remove the sheen from the surface.

#### Application of Curing Compound

8. Calculate the weight of curing compound needed to ensure an application rate of 200 ft<sup>2</sup>/gallon. This calculation is based on the density of the curing compound and the surface area of the mortar specimen.
9. Immediately after brushing, weigh the mortar specimen to the nearest 0.1 g. With the spray applicator, apply the calculated amount of curing compound in a uniform coat on the mortar specimen. Keep over spray to a minimum. Wipe off any drops of curing compound that adhere to the under surface of the rim, but do not attempt to remove compound from the upper surface of the rim.
10. Determine the actual rate of application by reweighing the mortar specimen immediately after applying the curing compound.
11. After applying the compound and reweighing the samples, place the mortar specimens in the curing cabinet and cure for 24 hrs. Remove the specimens from the curing cabinet and weigh the mortar specimens to the nearest 0.1 g.

#### D. CALCULATION

1. Calculate the *total mass lost* by each mortar specimen as the mass of the specimen immediately after initially applying the curing compound, less the mass of the specimen after the 24-hr curing period.
2. Calculate the *volatile loss* of the curing compound according to ASTM Designation: D 2369. Multiply the volatile percentage by the weight, in g, of the applied curing compound as determined in Section C, 10 above.
3. Calculate the *net water loss*, in g, from each mortar specimen as the *total mass lost* by the specimen in 24 hrs less the *volatile loss* of the curing compound.
4. The *loss of water* is calculated by dividing the *net water loss*, in kg, by the surface area of the mortar specimen, in square meters. Report the average for the two pans in kg/m<sup>2</sup>.

#### **E. SAFETY AND HEALTH**

This method involves procedures that require handling of various materials that have physical and chemical hazards and shall only be performed by personnel thoroughly trained in safety precautions associated with their use.

Personnel shall comply with the requirements for Safe Laboratory Practices contained in the Caltrans Laboratory Safety Manual. Curing compounds may vary between batches and manufacturers. It should never be assumed that the specific hazards of each type compound from different manufacturers are the same. Prior to handling any curing compound, personnel are required to consult the manufacturer's Safety Data Sheet for the material and follow all precautions that are outlined.

#### **REFERENCES**

**AASHTO Designation: T 155**  
**ASTM Designations: C 87, C 156, C 778**  
**and D 2369**  
**Caltrans Laboratory Safety Manual**

**End of Text**  
**(California Test 534 contains 3 pages)**