Standard Method of Test for

Freezing-and-Thawing Tests of Compacted Soil–Cement Mixtures

AASHTO Designation: T 136-13 (2021)

Technically Revised: 2013 **Reviewed but Not Updated: 2021**

Technical Subcommittee: 1b, Geotechnical Exploration, Instrumentation, Stabilization, and Field Testing

AASHTO

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1. SCOPE

1.1. These methods cover procedures for determining the soil–cement losses, moisture changes, and volume changes (swell and shrinkage) produced by the repeated freezing and thawing of hardened soil–cement specimens. The specimens are compacted in a mold, before cement hydration, to maximum density at optimum moisture content using the compaction procedure described in T 134.

1.2. Two methods depending on soil gradation are covered for preparation of material for molding specimens and molding specimens as follows:

1.2.1. *Method A*—Using soil material passing the 4.75-mm (No. 4) sieve. This method shall be used when 100 percent of the soil sample passes the 4.75-mm (No. 4) sieve. (See Sections 4 to 6.)

1.2.2. *Method B*—Using soil material passing the 19.0-mm ($^3/_4$-in.) sieve. This method shall be used when part of the soil sample is retained on the 4.75-mm sieve. (See Sections 7 to 9.)

1.3. The values stated in SI units are to be regarded as the standard.

1.4. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- M 85, Portland Cement
- M 145, Classification of Soils and Soil–Aggregate Mixtures for Highway Construction Purposes
- M 231, Weighing Devices Used in the Testing of Materials
- M 240M/M 240, Blended Hydraulic Cement

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- T 99, Moisture–Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
- T 134, Moisture–Density Relations of Soil–Cement Mixtures
- T 265, Laboratory Determination of Moisture Content of Soils

2.2. *ASTM Standard*:

- E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. APPARATUS

3.1. *Molds, 101.6 mm (4 in.); Rammer; Sample Extruder; and Straightedge*—As specified in T 99.

3.2. *Balances and Scales*—A balance or scale having a capacity of at least 11.5 kg (25.4 lb) and conforming to the requirements of M 231 for a G 20 class scale, and a balance of at least 1-kg (2-lb) capacity and conforming to the requirements of M 231 for a G 2 class scale.

3.3. *Drying Oven*—A thermostatically controlled drying oven capable of maintaining a temperature of 110 ± 5°C (230 ± 9°F) for drying moisture samples.

3.4. *Freezing Cabinet*—A freezing cabinet capable of maintaining temperatures of –23°C (–10°F) or lower.

3.5. *Moist Room*—A moist room or suitable covered container capable of maintaining a temperature of 21.0 ± 1.7°C (70 ± 3°F) and a relative humidity of 100 percent for seven-day storage of compacted specimens and for thawing frozen specimens.

3.6. *Wire Scratch Brush*—A wire scratch brush made of 50-by-1.6-mm (2-by-$^{1}/_{16}$-in.) flat No. 26 gauge wire bristles assembled in 50 groups of 10 bristles each and mounted to form five longitudinal rows and 10 transverse rows of bristles on a 190-by-65 mm ($7^{1}/_{2}$-by-$2^{1}/_{2}$-in.) hardwood block.

3.7. *Sieves*—75-mm (3-in.), 19.0-mm ($^{3}/_{4}$-in.), 4.75-mm (No. 4) sieves conforming to the requirements of E11.

3.8. *Mixing Tools*—Miscellaneous tools such as a mixing pan, a trowel, or a suitable mechanical device for thoroughly mixing the soil with cement and water.

3.9. *Butcher Knife*—A butcher knife approximately 254 mm (10 in.) in length for trimming the top of the specimens.

3.10. *Scarifier*—A six-pronged ice pick or similar apparatus to remove the smooth compaction plane at the top of the first and second layers of the specimen.

3.11. *Container*—A flat, round pan, for moisture absorption by soil–cement mixtures about 305 mm (12 in.) in diameter and 50 mm (2 in.) deep.

3.12. *Measuring Device*—A measuring device suitable for accurately measuring the heights and diameters of test specimens to the nearest 0.25 mm (0.01 in.).

3.13. *Pans and Carriers*—Suitable pans for handling materials and carriers or trays for handling test specimens.

3.14. *Absorptive Pads*—6.4-mm ($^{1}/_{4}$-in.) thick felt pads, blotters, or similar absorptive material for placing between specimens and specimen carriers.

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