

Idaho Standard Method of Test for

Measuring Mortar-Making Properties of Fine Aggregate



Idaho IT-13-03

ITD Standard Specification Designation: Idaho T-13

1. Scope

- 1.1 This method provides a means of determining whether a natural, unproven fine aggregate meets the minimum strength requirements for mortar making properties in concrete by comparing the compressive strength to the compressive strength of Ottawa Sand, the standard.
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2. References

- 2.1. AASHTO: T-22, T-71, T-84 & M-152
 - 2.2. ASTM: C-87, C-109, & C-778
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3. Apparatus and Tools

- 3.1. Flow Table (drop table), flow mold, caliper, and 1" x 5/8" hard rubber tamper as described in AASHTO M-152
 - 3.2. Cylinder molds, 2"x4", either plastic single use, or brass, (waxed to a glass plate).
 - 3.3. Mixing bowl and spoon. Small trowel and scoop.
 - 3.4. Tamping rod, (3/8" diameter x 8") with spherically rounded ends.
 - 3.5. Balance, capable of reading to the nearest gram.
 - 3.6. Capping compound and fixture for 2" diameter specimens.
 - 3.7. Compression testing machine with proper sized spherical test head.
 - 3.8. Moist Closet and lime saturated water bath
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4. Temperature and Humidity

- 4.1. The temperature of the mixing water, the Moist Closet, and the storage tank water shall be maintained at 73.4 ± 3 Degrees F (23.0 ± 1.7 Degrees C).
- 4.2. The relative humidity of the Moist Closet shall not fall below 95%
- 4.3. During mixing and molding of test specimens, the laboratory shall be maintained at 50% or greater relative humidity

5. Sample Preparation

- 5.1. Natural Sand Mortar - (AASHTO T-84) this mortar shall be made using a representative sample of natural sand from the unproven source (3,000 to 5,000 grams).
 - 5.1.1. The sand is moistened to a point past SSD, then covered and kept moist for a minimum of 15 hours to allow the sand to reach total saturation.
 - 5.1.2. Dry the sand to an SSD condition per AASHTO T-84, being careful not to segregate material while constantly mixing.
 - 5.1.3. Weigh 2500.0 grams, being careful to get a representative sample. Cover this sample to keep it in an SSD condition until needed.
 - 5.1.4. Cement: Weigh 700.0 grams of Portland cement, either Type I & II or Type III.
 - 5.1.5. Water: Measure 420.0 ml of conditioned water. Note: Conditioned water is distilled water at 73.4 ± 3 Degrees F (23.0 ± 1.7 Degrees C).
- 5.2. Ottawa sand mortar – This mortar is the standard of comparison.
 - 5.2.1. Blend natural Ottawa sands, combined weight 2,500.0 grams. Combine 1,225.0 grams of graded sand, and 1,275.0 grams of 20-30 sand, both conforming to ASTM C-778, and thoroughly blend.
 - 5.2.2. Cement: Weigh 700.0 grams of Portland cement, either Type I & II or Type III.
 - 5.2.3. Water: Measure 420.0 ml of conditioned water.

Note: All tests shall be run using the same cement Type, Manufacturer, and Lot. The amounts of water and cement used in this method are never varied. All of the water and cement must be used to maintain a consistent W/C ratio (0.60) between all samples. The amount of sand added to the mixture is varied to get the proper flow.

- 5.3. If brass molds are to be used, apply a light coating of release agent or light oil to molds. This will allow for removal of specimens without damage.
- 5.4. Start with a damp bowl and add 420.0 ml of conditioned water
- 5.5. Add 700.0 grams of cement and let it absorb for 1 minute
- 5.6. Stir by hand into a smooth paste.
- 5.7. Add the sand while stirring continuously until the desired consistency of the mix has been reached. Note: Normally, the mix will achieve the required consistency before all of the sand (2,500 grams) is used.
- 5.8. Stir the mixture vigorously for 30 seconds, then perform a flow test

6. Flow Test

- 6.1. Fill the cone in two layers, 20 blows per layer with the hard rubber tamping tool. The mixture should overfill the cone at this point
- 6.2. Cut the excess mortar off using the edge of a trowel creating a plane surface.
- 6.3. Carefully lift the cone off the mixture leaving the molded specimen on the table. The entire process to this point should be performed in one minute.
- 6.4. At exactly one minute, start flow table and drop 10 times. The mortar shall be proportioned to produce a consistency of 95-105 in 10 drops of the flow table.

Note: Allowance for flow trial – One free trial may be performed, but only if mix is too wet and the only ingredient that may be added is sand, to stiffen the mix. Then remix (.5.7), and perform flow again starting with (6.1).

- 6.5. After flow measurement, immediately place the mortar back in the bowl and remix vigorously for 15 seconds.
- 6.6. Fill cylinder molds (brass or plastic) in three layers, each layer receiving 25 blows using the tamping rod with spherical end. Make two sets of 3 cylinders, (6 total). One set for 3 days & one set for 7 days if Type III cement is used, or one set for 7 days and one set for 28 days if Type I & II cement is used.
- 6.7. Cut off the mortar to a plane surface, flush with the top of the mold, by drawing the straight edge of a trowel with a sawing motion across the top of the mold.
- 6.8. Place the cylinders in the Moist Closet for curing.

7. Curing Specimens

- 7.1. After 20 to 24 hours of curing in the Moist Closet, the specimens shall be removed from the molds, marked for identification, and immediately placed in a temperature controlled, lime saturated water bath for final curing.
- 7.2. 7.2. Cylinders shall remain in the water bath to cure for a period of 3 days & 7 days, or 7 days & 28 days, depending on the cement type used. They will be removed from the water bath in sufficient time to perform the capping procedure and allow for curing of capping compound prior to testing. Testing shall be performed within ± 1 hour for 3 day tests, ± 2 hours for 7 day tests, & ± 20 hours for 28 day tests, from the time of molding.

8. Capping Specimens

- 8.1. Cylinders shall be capped before testing in such a manner that the ends will be plane and at right angles to the axis of the cylinder. While cylinders are in the capping process, they shall be maintained in a moistened condition by covering with wet towels. Any conventional capping material may be used.

9. Testing Specimens

- 9.1. Cylinders shall be tested for compressive strength at 3 days and 7 days, or 7 days and 28 days after molding. Testing age of cylinders depends on cement Type used to make test specimens.
- 9.2. If more than one specimen is removed from the storage water for testing, these specimens shall be covered with a wet towel to keep specimens in a moistened condition until time of testing.
- 9.3. Before placing the test cylinders in the compression test machine, they shall be wiped to a surface dry condition and have any loose sand and/or debris removed from the bearing test surfaces.
- 9.4. Place the cylinder carefully in the test machine centering it on the upper bearing block. Check the spherical head (upper) for freedom of movement prior to the beginning of each test. A constant load shall be applied without interruption until failure, at a rate of 20 psi to 50 psi per second, (standard loading rate for cylindrical specimens, AASHTO T-22). No adjustment shall be made in the controls of the testing machine while a specimen is yielding rapidly just prior to failure.

10. Acceptance

- 10.1. Acceptance is based on a comparative strength between the two mortars. The natural sand mortar must be at least 90% of the strength that is achieved by the standard sand mortar.