

OHD L-62
METHOD OF TESTING FOR
CONTROLLED LOW STRENGTH MATERIAL

1. SCOPE

1.1 This method covers a procedure for determining the compressive strength of controlled low strength material (CLSM). Information developed by use of this method may be applicable in the evaluation of CLSM for use as a backfill, filling of abandoned structures, or for other purposes.

2. Referenced Documents

2.1 Standards AASHTO

M 201 - Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

M 205 - Molds for Forming Concrete Test Cylinders Vertically

T 22 - Compressive Strength of Cylindrical Concrete Specimens

3. Apparatus

3.1 Single-use cylinder molds - Plastic single-use 4 x 8 in. cylinder molds meeting the requirements of AASHTO M 205.

3.2 Mold removal – Mold removal can be accomplished with the use of low air pressure. The air pressure shall be low enough so the cylinders are relatively undamaged. A cylinder splitter may be used, but not recommended, if extreme care is taken to avoid damage to the cylinder.

3.3 Sampling container – The container shall be of a suitable non-absorbent material (heavy duty metal or heavy duty plastic) of sufficient capacity to allow easy sampling and remixing with a shovel or scoop. A wheelbarrow works well for a container.

3.4 Storage Container – A tightly constructed and insulated wooden box with a lid or other suitable container for the storage of the CLSM cylinders at the construction site.

Note 1 – During the hot season a five gallon bucket with a lid works well with water placed in it to just below the top of the cylinder molds to insulate the cylinders from extreme heat.

3.5 Curing Environment – A concrete cylinder curing environment meeting the requirements of AASHTO M201 shall be used for CLSM cylinders.

3.6 Small tools – Tools and items that may be required such as shovels, trowels, wire brush, soft brush and scoops.

3.7 Testing Machine – The compressive testing machine shall meet the requirements of AASHTO T 22 with the following exception, since the compressive strength of CLSM cylinders are between 100 and 800 psi, the testing machine should be verified within the 1,250 lbs. to 10,000 lbs. force range.

4. Test Specimen Preparation

4.1 Obtain a sample of the CLSM from the delivery vehicle or mixer. The sample should be a minimum of 2ft³ for each three cylinders to be prepared. Record the source, date and time of sampling. A minimum of three cylinders will be required for each lot.

Note 2 – Three cylinders are recommended to obtain reliable compressive strength data. However, since the cylinders are fragile and may be damaged during transportation and mold removal, preparation of extra cylinders may be necessary to provide the minimum number of test cylinders.

4.2 Mold cylinders on a level surface free from vibration and other disturbances. The cylinders should be prepared as near as possible to the location where they are to be stored during the first four days.

4.3 Thoroughly mix the CLSM in the sampling container (wheelbarrow, etc.) to avoid segregation and to maintain homogeneity. The sample must be routinely mixed during cylinder production to ensure that the cylinders represent the material placed in the field.

4.4 Using a scoop, scoop through the center portion of the sampling container and pour the CLSM into the mold. Repeat this step until the mold is full. Tap the outside of the cylinder mold no more than 10 times with the open face of the hand to close holes that remain and to release entrapped air voids. If necessary, use a trowel or straight edge to level off the top layer so it remains even and relatively smooth. Place a plastic lid or plastic bag loosely on the mold.

Note 3 – Some mixtures will bleed rapidly, that is, free water will appear in the sample while mixing and in the mold while pouring. A few minutes after filling the mold it may be necessary to thoroughly mix the sample in the sampling container and place a scoop full in the top of the mold to displace the water. Relevel the top and cover after refilling the cylinder.

5. Curing

- 5.1 Store the test cylinders on the construction site until the fourth day after preparation. The cylinders should be stored in an insulated container out of direct sunlight. The cylinders must always be protected from freezing. After the first day, provide a high humidity environment by surrounding the cylinders with wet burlap or another highly absorbent material or place water around the cylinders without over topping the mold.
- 5.2 On the fourth day, transport the cylinders to a curing environment at the testing laboratory. Leave the cylinders in their molds with the lids on and place the cylinders into a water storage tank or moist room until they are to be tested.

6. Compressive Strength Testing

- 6.1 On the day of testing, remove the CLSM cylinders from the curing environment and carefully remove the molds.
- 6.2 Remove any uneven surfaces with a wire brush or silicon carbide abrasive brick. Then brush away any loose particles with a soft brush or the hand.
- 6.3 Allow the cylinders to air dry for 4 to 8 hours at laboratory room temperature.
- 6.4 Measure and record the diameter and length of each cylinder to the nearest $\frac{1}{4}$ in. The diameter will be used to verify the nominal diameter used in calculations made in Section 7.1. Record the Name or Identification number of the individual performing the compressive strength test. Record the age of the cylinders at break.
- 6.5 Place the lower bearing block, with its hardened face up on the platen of the testing machine directly under the spherically seated upper bearing block. Wipe the upper and lower bearing blocks clean using a clean cloth or hand.
- 6.6 Wipe the top and bottom of the cylinder clean and place the test cylinder on to the lower test block. Carefully align the axis of the cylinder with the center of thrust of the upper bearing block. As the upper block is brought to bear on the top of the cylinder, rotate its movable portion gently by hand so that uniform seating is obtained.
- 6.6 Rate of Loading – Apply the load continuously and without shock to the cylinder. Apply the load at a constant rate such that the cylinder will fail in not less than two minutes. Make no adjustments to the controls of the testing machine while the cylinder is yielding rapidly immediately before failure.
- 6.7 Apply the load until the cylinder fails and record the maximum load carried by the cylinder during testing.

7. Calculations and Reporting

- 7.1 Calculate and record the compressive strength of each test cylinder using the following formula:

$$C = \frac{L}{\pi(D^2)/4}$$

Where:

C = compressive strength, psi.

D = nominal diameter of cylinder (normally 4 in.) and

L = maximum load, lbs.

7.1.1 Report the following:

- (1) Source of CLSM
- (2) Date and time of sampling and person sampling
- (3) Identification number of cylinder for test lot (ie. 1, 1A, 1B, 2, 2A, etc.)
- (4) Nominal diameter and length of each cylinder
- (5) Age of cylinders at break and person testing
- (6) Maximum load in lbs. for each cylinder at break
- (7) Compressive strength in psi. for each cylinder
- (8) Average maximum load in lbs. for each 3 cylinder lot
- (9) Average Compressive strength in psi. for each 3 cylinder lot