

**DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF ENGINEERING SERVICES**  
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## **METHOD FOR MAKING, HANDLING, AND STORING CONCRETE COMPRESSIVE TEST SPECIMENS IN THE FIELD**

### **A. SCOPE**

This test method describes the procedure for making, handling, and storing concrete compressive strength test specimens in the field.

This test method is applicable to concrete specified as 2 in. maximum nominal size aggregates.

### **B. REFERENCES**

California Test 521 – Compressive Strength of Molded Concrete Cylinders  
California Test 539 – Sampling Fresh Concrete  
ASTM C 31 – Making and Curing Concrete Test Specimens in the Field  
ASTM C 39 – Compressive Strength of Cylindrical Concrete Specimens  
ASTM C 172 – Sampling Freshly Mixed Concrete  
ASTM C 192 – Making and Curing Concrete Test Specimens in the Laboratory  
ASTM C 470 – Molds for Forming Concrete Test Cylinders Vertically

### **C. APPARATUS**

1. Molds: 6 in. × 12 in. test cylinder molds with lids conforming to the requirements of ASTM C 470 or reusable vertical molds conforming to the requirements of ASTM C 192.
2. Tamping rod: a round, straight steel rod with a diameter of  $\frac{5}{8}$  in.  $\pm$   $\frac{1}{16}$  in. and length of at least 4 in. greater than the depth of the measure in which rodding is to be performed (but not more than 24 in.). One or both ends of the tamping rod must be rounded to a hemispherical tip of the same diameter as the rod.
3. Scoop: any appropriate metal scoop will perform satisfactorily.

### **D. PREPARATION OF TEST SPECIMENS**

Sampling Fresh Concrete:

1. Sample concrete in accordance with California Test 539.  
  
Write the concrete sample location (deck, footing, girder, etc.) on the sample identification card.
2. Transport samples in watertight containers to the place where the test specimens are to be fabricated. Fabricate specimens as near as practicable to the place where they are to be stored during the first 24 hr.
3. If the maximum size of the coarse aggregate exceeds 2 in., screen the concrete sample through a 2 in. sieve, discard the oversized aggregate (note this on the TL-502 sample identification card), and remix the sample before molding the specimen.

Test Specimen Fabrication:

1. When more than one specimen is to be made from the same batch, make all specimens simultaneously. Place and rod the first layer in each mold before proceeding to the second layer and so on, through the third layer.
2. Place test molds on a level, firm surface to prevent distortion of the bottom surface. Place and rod the first layer in each mold before proceeding to the second layer and so on, through the third layer.
3. Using a scoop, fill the measure in 3 layers of equal depth. Move the scoop around the perimeter of the mold to ensure an even distribution of the material with minimal segregation. Fill the topmost layer to over flowing.
  - a. Rod each layer 25 times with the rounded end of the tamping rod, distributing the strokes evenly over the surface of the layer
  - b. While rodding the first layer, penetrate nearly full depth into the layer but avoid striking the bottom of the base.
  - c. While rodding the second and third layers, penetrate approximately 1 in. into the layer below with each stroke.
  - d. After each layer is rodded, pat the sides of the mold lightly with a hand or jig by rocking the mold from side to side using such force so as to close any voids left by the tamping rod and to release any large bubbles of air that may have been trapped.
4. Level the surface of the compacted concrete with the fingers or a straightedge in such a way that any slight projections of the larger pieces of coarse aggregate approximately balance the larger voids in the surface below the top of the mold. Wipe the sides of the mold free of excess concrete and press the lid on to prevent evaporation.
5. To prevent loss of moisture, seal the lid to the mold with masking tape. Do not apply water on top of the concrete before covering.
6. Clearly identify cylinders on the side of the mold with a marking pen showing the contract number, sample number, and the testing age designated.

NOTE: If specimens are representative of concrete for precast products, vibration similar to that applied to the member being manufactured may be used to consolidate the specimen in lieu of the rodding procedure described in a through c above.

**E. CARE, HANDLING, AND STORAGE OF TEST SPECIMENS**

Care of Test Specimens:

1. Place the concrete test cylinders in their field curing location as soon as possible after they are fabricated being careful not to disturb the concrete in its plastic state.
2. The curing location must be a firm level surface, free from vibration and otherwise protected from disturbance.

3. Cure all test specimens with the axis of the cylinder vertical to avoid a sloping end in the hardened concrete.
4. For Method 1 and Method 2, once the concrete has begun to set do not disturb specimens for 20 hr  $\pm$  4 hr.
5. For Method 3 (steam cured), once the concrete has begun to set do not disturb the specimens for a minimum of 4 hr. Actual steam curing methods, techniques and timelines must be detailed in the precaster's Quality Control Plan.

**Handling and storage of cylinders must conform to one of the following methods:**

1. Method 1 — Cylinders for determining the acceptability of concrete which has a specified 28 d strength:

Except for steam-cured concrete, cylinders in this category must be stored under conditions that maintain a temperature of 60°F to 80°F immediately adjacent to the specimens for a period of 1 day. This can conveniently be achieved by the use of a water tank. At the end of 20 hr  $\pm$  4 hr, remove the lids from the cylinder molds and store the specimens in a water bath at a temperature of 60°F to 80°F. At an age of 2 d and no later than 5 d, replace lids. Reseal with masking tape and ship directly to the laboratory. At the laboratory, specimens must be stored at 73°F  $\pm$  3°F.

2. Method 2 — Cylinders for evaluating the in-place strength of concrete in a structure prior to applying loads or stresses:

For determining compressive strength under this category, store specimens at or near the structure in a semi-sheltered location where the temperature of the test specimens will be approximately that of the concrete in the structure. Leave the specimens at the structure for as long a period of time as possible before shipping to the laboratory. During the storage time at the structure, keep specimens in a plywood box (without insulation) or other suitable shelter but in a shaded location. Avoid conditions of extreme exposure to wind and sun, as well as conditions of overprotection from weather variations.

3. Method 3 — Cylinders for evaluating steam cured concrete for compliance with strength specifications:

Cylinders for determining time of prestressing loading must be cured in the same manner as the concrete in the member.

Cylinders for determining compliance with 28-day strength requirements must be cured in the same manner as the member until completion of the steam curing process and then transferred to a water bath or moist room at 60°F to 80°F until tested.

NOTE: As an alternative to shipping to a Department laboratory, testing may be done using the producer's equipment, provided the laboratory and tester meet the requirements of the Department's Independent Assurance Program.

**F. IDENTIFICATION OF TEST CYLINDERS**

Form TL-0502 sample identification card must be complete. There should not be any blank spaces. Designation of type of concrete must be included (i.e., Class 3, 3,500 psi, etc.).

Source of aggregates should indicate the deposit from which the aggregates were obtained, such as "Kaiser-Radum" or "Chevreaux-Bear River" and not the batch plant. The SMARA number for the aggregate source should also be indicated.

A uniform system of marking cylinders is used. This system consists of the contract number, the sample number, and the date cast. The sample number consists of a series of digits separated by dashes to indicate: method of storage for curing, age at which cylinder(s) are to be tested, and the cylinder number of the pair, or the group of 5, which is to be tested. Use a flow pen to mark each sample can.

Example 1:    Contact No. 03-100844  
                  Sample No. 1-28-1/5  
                  Date Cast \_\_\_\_\_

Where:        In the sample number shown above, the first digit indicates Method 1 storage for curing (use only one digit for this designation). The second group of digits indicates that the cylinder is to be tested at 28 d (use 2 digits for the test age). The third symbol (1/5) indicates that it is the No. 1 cylinder of the 5-cylinder trial batch sample (the No. 2 cylinder would be marked 2/5, etc.).

Example 2:    Contract No. 03-10844  
                  Sample No. 2-14-2/2  
                  Date Cast \_\_\_\_\_

Where:        In the sample number shown above, the first digit indicates Method 2 storage for curing (use only one digit for this designation). The second group of digits indicates that the cylinder is to be tested at 14 d (use 2 digits for the test age). The third symbol (2/2) indicates that it is the No. 2 cylinder of a 2-cylinder test group.

In the space for "Water-weight per sack", indicate the total weight of water used per sack of cement in the mix based on actual weight (not design weights). On the last blank line of the concrete information box indicate specified concrete strength or class if any. Otherwise, mark the space with a line.

Under "Remarks" indicate if unit weight of the hardened concrete cylinder(s) is required. The laboratory will not furnish unit weight (pcf) data unless it is specifically requested. Make out a sample identification card for each pair of cylinders shipped in the same carton.

## **G. HEALTH AND SAFETY**

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

[http://www.dot.ca.gov/hq/esc/ctms/pdf/lab\\_safety\\_manual.pdf](http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf)

**End of Text**  
**(California Test 540 contains 4 pages)**