

Memorandum

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To: DEPUTY DISTRICT DIRECTORS, Construction
DEPUTY DIVISION CHIEF, Structure Construction
CONSTRUCTION MANAGERS
SENIOR CONSTRUCTION ENGINEERS
RESIDENT ENGINEERS

Date: August 19, 2022

File: Division of Construction
CPD 22-9



From: RAMON HOPKINS, Chief
Division of Construction

**Subject: REVISED CALIFORNIA TEST 521 TO ALLOW USE OF UNBONDED CAPS IN
CONCRETE COMPRESSIVE STRENGTH TESTING**

This directive provides information to California Department of Transportation (Caltrans) resident engineers, contractors, and testing laboratory personnel about revised California Test (CT) 521, "Method of Test for Compressive Strength Testing of Cylindrical Concrete Specimens," issued August 19, 2022. Revised CT 521 allows for unbonded caps to be used to prepare a concrete cylinder for compressive strength testing, in addition to the approved preparation methods which include sawing, grinding, or sulfur capping.

When testing is done properly, there is no statistically significant difference between the use of sulfur caps and unbonded caps in compressive strength testing of cylindrical concrete specimens. Unbonded caps have been used worldwide in concrete laboratories since the 1993 approval of ASTM C1231, "Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Cylindrical Concrete Specimens." Using unbonded caps in comparison to sulfur capped cylinders results in a substantial time savings. Sulfur capped cylinders must cure for at least two hours before testing. In addition, for concrete with design strength of 5,000 psi or greater, a sulfur capped cylinder must cure for 16 hours. Additional benefits to labs using unbonded caps include reduced safety risks to technicians by elimination of harmful vapors and use of high-temperature liquids found with sulfur caps.

An unbonded cap consists of a neoprene pad (a defined hardness of neoprene) and a steel retainer to hold the neoprene pad in place during testing. Labs electing to proceed with unbonded caps for compressive strength testing of concrete cylinders will need to purchase steel retainers and incur ongoing costs of purchasing neoprene pads, with each test requiring two neoprene pads. If not already present in the lab, a wet saw for correcting out-of-square cylinder ends will also be required. To make sure that

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neoprene pads are not used beyond their lifespan, labs will need to implement a standard practice for maintaining records of neoprene pad usage and disposal intervals. Although there is an initial investment in equipment with unbonded caps and recurring costs of neoprene pads, these expenses will be offset because sulfur, melting pots, and related equipment will not have to be purchased or maintained.

CT 521 specifies ASTM C39, "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens," as the test protocol but had previously omitted the use of unbonded caps. With the revision to CT 521, construction materials testing labs now have the option of using unbonded caps to prepare concrete cylinders for compressive strength testing, in addition to continuing to prepare test cylinders by sawing, grinding, or sulfur capping. The revision to CT 521, which allows the use of unbonded caps per ASTM C39, helps Caltrans achieve its goal of making Caltrans' test methods consistent and compatible with American Society for Testing and Materials International standards. Refer to the [Engineering Workbench](#) website to find ASTM C39 and ASTM C1231.

All projects, including ongoing projects in construction, are permitted to use revised CT 521 as of its implementation date on August 19, 2022. No change orders are necessary to use revised CT 521.

If you have questions or comments regarding this directive, contact Deborah Yost, Division of Construction, at Deborah.Yost@dot.ca.gov or (916) 764-8011.