Technology in Practice

What, Why & How?

TIP 5 - Capping Cylindrical Concrete Specimens with Sulfur Mortars and Unbonded Caps

This TIP helps understand preparing the ends of cylindrical concrete test specimens prior to strength testing

WHAT is Capping?

Capping is the preparation of the ends of cylindrical concrete specimens to ensure that a test cylinder or core has smooth, parallel, uniform bearing surfaces that are perpendicular to the applied axial load during compressive strength testing. Most common methods for end preparation of compressive strength test specimens are to use bonded sulfur mortar caps or a system of unbonded neoprene pads in metal retainer rings. With either method it should be ensured that the specific criteria for planeness and perpendicularity of the ends are in accordance with the applicable standard. The ends of cylinders may also be cut or ground and tested without end caps if the ends of the test specimens meet the requirements in ASTM C39.

WHY is Capping Important?

ASTM C39 requires that the ends of compressive test specimens be plane to within 0.002 inch (0.05 mm) and that the deviation of end faces from being perpendicular to the specimen axis is less than 0.5° (0.12 inch in 12 inches or 1 mm in 100 mm). Similar requirements are stated in ASTM C42 for testing cores. Irregular end surfaces or when the specimen axis is not perpendicular to the end faces will cause stress concentrations within the test specimen and reduce the measured strength. Since the end faces of most test specimens will not meet these requirements, procedures in ASTM C617 or C1231 for capping hardened concrete cylinders are used. This ensures that the compressive load is applied evenly and consistently for every strength test.

HOW is Capping Done?

Prior to testing a hardened concrete cylinder or core one must determine if the ends of the specimen meet the requirements of ASTM C39 or ASTM C42. If the planeness and/or perpendicularity requirements are not met then the cylinders may need to be cut or ground. In most cases capping the cylinders or using unbonded caps correct the imperfections.

Cylinders or cores that do not conform to the perpendicularity requirement of 0.5° should be cut or ground or may be capped in accordance with ASTM C617. Using bonded caps in accordance with ASTM C617 is effective when the specimen end surfaces have depressions or projections less than 1/8 in (3 mm), while unbonded cap systems in accordance with ASTM C1231 are effective with such end surface defects up to 1/5 in (5 mm). Labs, however, use either one of the methods.

ASTM C617 is the Standard Practice for Capping Cylindrical Concrete Specimens while ASTM C1231 describes alternate procedures for using unbonded caps. Cores should be cut or ground to meet the end condition requirements or they may be capped in accordance with ASTM C617. Unbonded caps are currently not permitted when testing cores but may be permitted in the future.

ASTM C617 permits a bonded cap to be applied to freshly molded cylinders using neat portland cement paste; whereas neat portland cement paste, high strength gypsum plaster or sulfur mortar are permitted as bonded capping materials for hardened concrete cylinders. Since sulfur mortar and unbonded caps are the most common, they will be discussed in this TIP.