



TESTING CONCRETE STRENGTH IN THE LABORATORY

The standard method for measuring concrete strength is to test molded concrete cylinders made at the job site from a sample of fresh concrete. The average strength of a set of two or three molded cylinders, broken open at 28 days, constitutes one test. Additional cylinders are sometimes made for seven-day tests, or to be field cured to measure early strength for form stripping.

Under standards of the American Concrete Institute, concrete is acceptable if no one test is lower than the specified strength by more than 500 pounds-per-square-inch (PSI), and if the average of three consecutive tests at least equals the specified strength. If a test falls more than 500 PSI below the specified strength, there may be more serious problems that require further investigation to ensure structural adequacy.

Reasons for Low Cylinder Strength

Low cylinder strength may be the result of reduced concrete strength due to a number of reasons including errors in production or the addition of too much water to the concrete at the job site because of delays in placement. But improper handling and testing of the core samples can also result in low test results. For this reason it is crucial that standard testing procedures of the American Society for Testing and Materials (ASTM) be followed closely. Violations in test procedures that can result in low test results include curing over 80 degree Fahrenheit, frozen cylinders, delays in curing at the testing laboratory, impact during transportation and insufficient care when breaking open the cylinders.

Important Tips for Standard Cylinder Tests

Only qualified laboratory personnel should be permitted to perform cylinder tests -- untrained construction workers should never must not make and handle the cylinders. Important steps to follow include:

- Sample concrete from the chute in two increments from the middle part of the load after some of the concrete has already been discharged.
- Transport sample to the location of the curing on the first day.
- Remix the concrete sample to ensure homogeneity.
- Use molds that conform to ASTM standards.
- Cure at 60 to 80 degrees Fahrenheit for one day and then moist cure in the laboratory until broken in compression.
- Use calibrated testing machine.

Testing Concrete Strength at the Job Site

If proper testing procedures have been followed and the measured strength of the concrete is still below the specified requirement, further testing of the in-place concrete may be required. Other circumstances that may require in-place testing include investigation of damage due to freezing, fire or adverse curing exposure, evaluation of older structures, and incidents where a lower strength concrete has been used by mistake. In-place testing can be performed through one of three methods: Drilling core samples that are later tested for strength; driving probes into the concrete to test its resistance; and gauging the strength the concrete using a rebound hammer. As with molded cylinders, in-place testing must only be performed by trained and qualified personnel.