

STRENGTH OF IN-PLACE CONCRETE

WHAT is the Strength of In-Place Concrete?

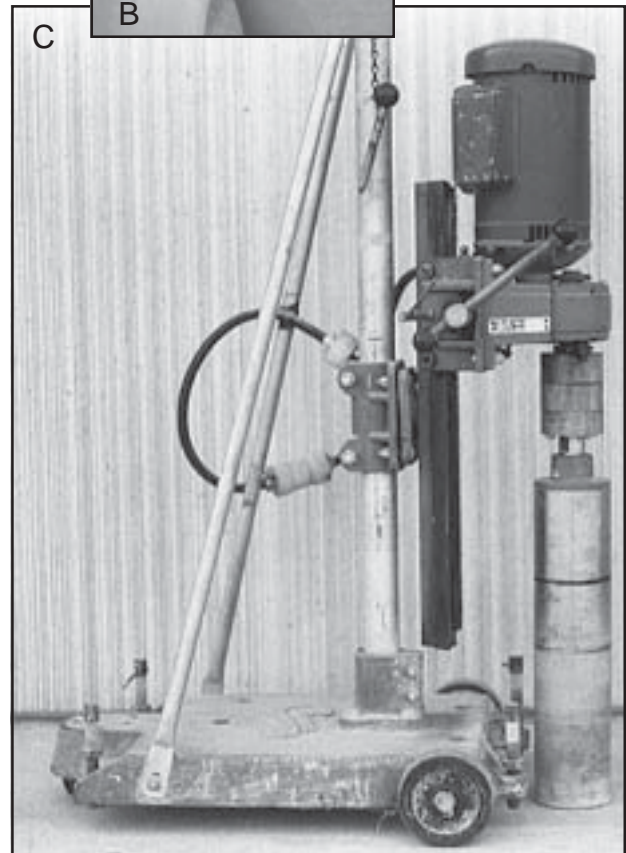
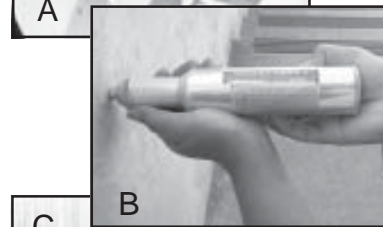
Concrete structures are designed to carry dead and live loads during construction and in service. Samples of concrete are obtained during construction and standard ASTM procedures are used to measure the potential strength of the concrete as delivered. Cylinders are molded and cured at 60 to 80°F (17 to 27°C) for one day and then moist cured in the laboratory until broken in compression, normally at an age of 7 and 28 days. The in-place strength of concrete will not be equivalent to that measured on standard cylinders. Job practices for handling, placing, consolidation, and curing concrete in structures are relied upon to provide an adequate percentage of that potential strength in the structure. Structural design principles recognize this and the ACI Building Code, ACI 318, has a process of assuring the structural safety of the concrete construction.

Means of measuring, estimating or comparing the strength of in-place concrete include: rebound hammer, penetration probe, pullouts, cast-in-place cylinders, tests of drilled cores, and load tests of the structural element.

Cores drilled from the structure are one of the means of evaluating whether the structural capacity of a concrete member is adequate and ACI 318 provides some guidance on this evaluation. Drilled cores test lower than properly made and tested standard molded 6 x 12 inch (150 x 300-mm) cylinders. This applies to all formed structural concrete. Exceptions may occur for cores from concrete cast against an absorptive subgrade or cores from lean, low strength mass concrete. The ACI Building Code recognizes that under current design practices, concrete construction can be considered structurally adequate if the average of three cores from the questionable region is equal to or exceeds 85 percent of specified strength, f'_c with no single core less than 75 percent of f'_c .

WHY Measure In-Place Strength?

Tests of in-place concrete may be needed when standard cylinder strengths are low, and not in compliance with the specification as outlined in ACI 318. However, do not investigate in-place without first checking to be sure that: the concrete strengths actually failed to meet the specification provisions, low strengths are not attributable to faulty testing practices, or the specified strength is really needed.



A - Penetration Resistance Test (ASTM C 803)

B - Rebound Test (ASTM C 805)

C - Core Test (ASTM C 42)

There are many other situations that may require the investigation of in-place strength. These include: shore and form removal, post-tensioning, or early load application; investigation of damage due to freezing, fire, or adverse curing exposure; evaluation of older structures; and when a lower design strength concrete is placed in a member by mistake. When cores or other in-place tests fail to assure structural adequacy, additional curing of the structure may provide the necessary strength. This is particularly possible with concrete containing slow strength-gaining cement, fly ash, or slag.