

## Low Concrete Cylinder Strength

### 1. WHAT Constitutes Low Cylinder Strength?

Cylinders are molded from a sample of fresh concrete. Procedures must be in accordance with CSA standards. The average strength of the set of 2 or 3 cylinders, broken at 28 days, constitutes one "test". Additional cylinders are often made for 7 day tests or to be field cured to check early strength for form stripping.

Under CSA Standards, concrete is acceptable if no one test is lower than specified by more than 3.5 MPa and the average of three consecutive tests equals at least the specified strength. If an average of three tests in a row dips below the specified strength, steps must be taken to increase the strength of the concrete. If a test falls more than 3.5MPa below the specified strength there may be more serious problems. An investigation would be made to ensure structural adequacy: and, again, steps taken to increase the strength level.

### 2. WHY Are Compressive Tests Low?

Two major reasons are: (a) improper handling and testing - found to contribute in the majority of low strength investigations, and (b) reduced concrete quality due to an error in production, or the addition of too much water to the concrete on the job due to delays in placement

or requests for wet concrete. High air content, for example, can be a cause of low strength.

Collect all test reports and analyze results before taking action. Look at the pattern of strength results. Does the sequence actually violate the specification? Do the test reports give any clue to the cause? Look at the slump, air content, concrete and ambient temperatures, number of days cylinders were left in the field, and any reported cylinder defects.

#### 27.5 MPa Specified Strength

Test No.	Individual Cyl.		"Test" Average	Average of 3 Consecutive
	No. 1	No. 2		
<b>Acceptable Example</b>				
1	28.3	29.4	28.9	--
2	26.5	28.1	27.3	--
3	30.5	30.7	30.6	28.9
4	25.3	26.3	25.8	27.9
5	31.9	31.5	31.7	29.4
<b>Low Strength Example</b>				
1	25.0	24.5	24.7	--
2	27.4	28.0	27.7	--
3	28.0	27.5	27.9	26.8*
4	33.5	32.4	33.0	29.5
5	23.4	21.4	22.4†	27.7

\*Average of 3 consecutive low.  
†One "test" more than 3.5 MPa

If the deficiency justifies investigation, first verify testing accuracy and then compare the structural requirements with the measured strength. If testing is deficient or if strength is greater than that actually needed, there is little point in investigating the in-place strength. However, if procedures conform to the standards and the specified strength is lower than for the member in question refer to CTT-10 strength of in-place concrete.

Test reports must be promptly distributed to the concrete producer, as well as the contractor and engineer. This is essential to the timely solution of problems.

### 3. HOW To Make Standard Cylinder Tests

It is essential that testing personnel be trained in the proper application of the CSA Standards for strength tests of field-made, laboratory-cured cylinders:

- a. Sample concrete falling from chute in two increments, in the middle part of the load, after some has been discharged.
- b. Transport sample to the location of curing for the first day.
- c. Remix the sample to ensure homogeneity.
- d. Use molds conforming to standards.
- e. Rod concrete in three layers and tap sides of the mold to close rod holes.
- f. Finish tops smooth and level to allow thin caps.
- g. If necessary, move cylinders immediately after molding; support the bottom
- h. Cure cylinders in the field 10°C - 25°C
- i. Protect from loss of moisture
- j. Transport cylinders within 20 ± 4hrs to the laboratory. Handle gently.