

### Assessing Concrete Strength in the Field

Concrete strength development in the field often differs from laboratory conditions. Temperature, curing environment, and construction practices all influence how strength develops in place. For critical decisions such as formwork removal, post tensioning, or opening to traffic, field-based methods provide a more reliable indication of in place performance.

### What are Field Cured Cylinders?

Field cured cylinders are cast from the same concrete as standard test cylinders but are stored and cured under the same conditions as the structure. This may include exposure to ambient temperatures, wind, insulation, curing blankets, or heated enclosures. Because they experience the same curing history as the concrete in the element, field cured cylinders provide a direct measure of in place strength.

Field cured cylinders are especially valuable for

- Early age strength verification
- Cold weather or hot weather concreting
- Mass concrete placements
- Schedule driven construction activities

Laboratory cured cylinders remain useful for quality control and specification compliance, but they often overestimate the actual strength of concrete in the structure, particularly at early ages.

### Alternative to Field Cured Cylinders

Concrete maturity sensors offer a non-destructive, real-time method for estimating in place strength. Sensors are embedded directly in the concrete at the time of placement and continuously record temperature over time. This data is transmitted or downloaded and used to calculate the concrete maturity.

### What is Concrete Maturity?

Concrete maturity is a measure that combines time and temperature to describe the progress of cement hydration. Since strength development is directly related to hydration, maturity provides a practical way to estimate strength without testing physical samples. In simple terms, concrete that cures longer and at higher temperatures gains maturity faster and therefore develops strength more quickly.

### How Maturity is Used in Practice?

A strength maturity relationship is first established in the laboratory by testing cylinders cured at different temperatures and ages. Once this relationship is defined, the maturity measured in the field can be converted into an estimated compressive strength.

Maturity methods are commonly used to:

- Determine safe formwork and shoring removal times
- Confirm strength prior to post tensioning or lifting operations
- Optimize construction schedules
- Reduce reliance on early age cylinder breaks

### Confirming In-Situ Concrete Strength in the Field

Several destructive and non-destructive testing methods are available to assess in situ concrete strength including

- Coring involves removing nominal 100 mm diameter cores from the element, which are then tested for compressive strength
- Non-destructive methods, such as Ultrasonic Pulse Velocity and Schmidt hammer testing, can provide reliable strength estimates when validated against control measurements or reference data.

### Three Rules to Consider:

1. Use field-cured cylinders or maturity sensors to assess in-place strength, especially for early-age or critical operations
2. Compare field results with lab-cured cylinders for quality control, but expect differences due to site conditions
3. Confirm in-place strength with cores or validated non-destructive testing when critical decisions depend on it.

#### References

1. CSA A23.1 A23.2 2024. *Concrete materials and methods of concrete construction Test methods and standard practices for concrete.* CSA Group
2. *Design and Control of Concrete Mixtures. 9<sup>th</sup> Edition.* Cement Association of Canada

#### Disclaimer

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