

CURING OF CONCRETE

Introduction:

Curing is the process of controlling the rate and extent of moisture loss from concrete during cement hydration. It may be either after it has been placed in position (or during the manufacture of concrete products), thereby providing time for the hydration of the cement to occur. All residential slabs to be moist cured for a minimum of 3 days and 7 days in aggressive soils are recommended.



Image 1



Image 2



Image 3

Why curing concrete:

- Preventing the loss of moisture from the concrete.
- Providing time for the hydration of the cement to occur.
- Achieving potential strength and durability (Figure 1).

Inadequate curing can result in:

- Excessive shrinkage cracking (image 1).
- Low ultimate compressive strengths.
- Increased permeability (i.e. importance of cracks in watertight structure, image 2 & Figure 2).
- Weak and powdery surfaces with low abrasion resistance (image 3).

Factors affect curing:

- **Air temperature:** When the air temperature is above 30°C, it is usually recommended that precautions be taken, particularly if there is also a hot dry wind.
- **Concrete temperature:** AS 1379 requires concrete temperatures at the point of delivery to be within the range 5 to 35°C.
- **Humidity:** A minimum of 80% RH (relative humidity) is recommended in the general environment outside the concrete for the hydration to be maintained.
- **Wind speed:** The evaporation rate of moisture from freshly placed concrete will increase to four times when wind velocity rises from zero to 15km per hour on a hot day.
- **Surface to volume ratio:** Thick section such as mass concrete are mostly 'self-curing' but require temperature gradient at outer layers to be limited.
- **Concrete mix design:** Most concrete is described by the supplier as either a 'summer-mix' or a 'winter-mix' and will include admixtures that affect setting times to suit the prevailing conditions.

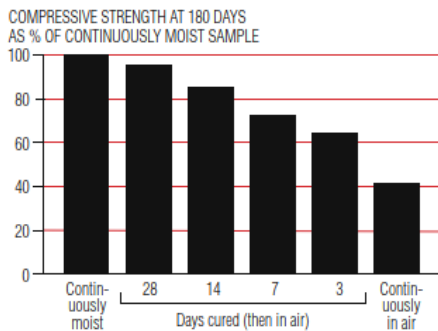


Figure 1: Effect of duration of water curing on strength of concrete.

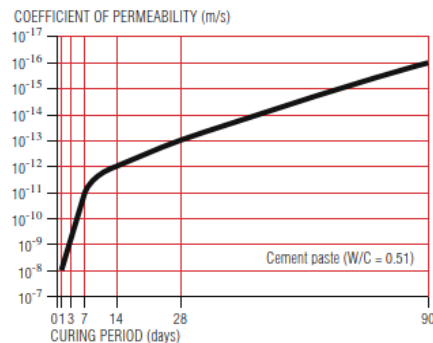


Figure 2: Effect of duration of water curing on the permeability of cement paste.



CCAA Smart Concreting App

To get the best aesthetic result of concrete, Cement Concrete & Aggregates Australia (CCAA) Smart Concreting App using local weather to calculate evaporation rates and help prevent defects and encourage best practice.

Methods of curing:

- **Water ponding:** A quick, inexpensive, and effective form of curing.
- **Spraying or sprinkling of water:** An efficient method of supplying additional moisture for curing and, during hot weather, helps to reduce the temperature of the concrete.
- **Wet sand or hessian covering:** It should be pre moistened and should not be allowed to dry out as they can act like a wick and draw moisture out of the concrete. Alternations of wetting and drying may promote the development of cracking.
- **Retaining formwork in place:** leaving formwork in place is often an efficient and cost-effective method of curing concrete, particularly during its early stages.
- **Plastic sheeting:** It can be carried out more easily and provides less impediments to construction process, it may be less effective than water curing methods.
- **Liquid membrane-forming curing compounds:** Ease of application, lower relative costs, and lack of ongoing maintenance requirements. However, it may affect the bond strength between concrete and subsequent flooring products.
- **Internal curing compounds:** These are incorporated into the concrete as an admixture, it can perform as good as, if not better than, spray on curing compounds.

“Engineering is a lifelong learning experience. Working collaboratively with concrete suppliers and concreters is also a good source of learning.”

Yuan Wu, Senior Structural Engineer

References

- Curing of concrete by CCAA
- Guide to Concrete for Housing - T53 by CCAA
- Curing of concrete - Technical Bulletin No.42 by VicRoads
- The boral book of concrete by Boral Concrete
- AS2870 - Residential slabs and footings
- AS3600- Concrete structures
- AS 1379 - Specification and supply of concrete
- Refer to Table 4.4 of AS3600 for Minimum strength and curing requirements for concrete.
- Refer to Table 5.3 of AS2870 for Minimum design characteristic strength and curing requirements for concrete.