

Appraisal of Outcome on Concrete by Various Curing Method with Its Different Compounds



Engineering

KEYWORDS : Curing Compounds, Self-Curing agents, Wrapped Curing, Durability.

Prof Tanveer Asif Zerd

Director, Professor and HOD Civil Engineering Department, K C T Engineering College Gulbarga. Karnataka.

ABSTRACT

Properties of hardened concrete, especially the durability, are deeply influenced by curing as since it has effect on hydration of cement. The progress in construction and chemical industry have paved way for development of new curing techniques and construction chemicals such as Membrane curing compounds, Self-curing agents, Wrapped curing, Water proofing compounds etc. With the development of project conventional curing methods have proven to be a costly affair and they have been replaced by Membrane curing compounds and Self-curing agents up to some extent as they can be used in inaccessible areas, Vertical structures, Water scant areas etc. It is most realistic and broadly used curing method. In this review paper effort has been made to understand the efficiency and working of curing methods which are normally adopted in the construction industry and compared with conventional water curing method.

I. INTRODUCTION

Curing is the name given to the procedures used for promoting the hydration of the cement, and consists of a control of temperature and of moisture movement from and into the concrete. Curing allows continuous hydration of cement and consequently continuous gain in the strength, once curing stops strength gain of the concrete also stops. Proper moisture conditions are critical because the hydration of the cement virtually ceases when the relative humidity within the capillaries drops below 80% [1]. With insufficient water, the hydration will not proceed and the resulting concrete may not possess the desirable strength and impermeability. The continuous pore structure formed on the near surface may allow the ingress of deleterious agents and would cause various durability problems. Moreover due to early drying of the concrete micro-cracks or shrinkage cracks would develop on surface of the concrete [2]. When concrete is exposed to the environment evaporation of water takes place and loss of moisture will reduce the initial water cement ratio which will result in the incomplete hydration of the cement and hence lowering the quality of the concrete. Various factors such as wind velocity, relative humidity, atmospheric temperature, water cement ratio of the mix and type of the cement used in the mix. Evaporation in the initial stage leads to plastic shrinkage cracking and at the final stage of setting it leads to drying shrinkage cracking. When concrete is cured at high temperature normally develops higher early strength than concrete produced and cured at lower temperature. but strength is generally lowered at 28 days and later stage [2]. A uniform temperature should be maintained through the concrete section to avoid thermal cracking. Laboratory tests show that concrete in dry environment can lose as much as 50 percent of its potential strength compared to similar concrete that is moist cured. Curing of the concrete is also governed by the moist-curing period, longer the moist-curing period higher the strength of the concrete assuming that the hydration of the cement particles will go on. American Concrete Institute (ACI) Committee 301 recommends a minimum curing period corresponding to concrete attaining specified compressive strength 70% [3]. properties of hardened concrete gets strong influence from curing, correct curing will magnify the durability, strength, volume stability, abrasion resistance, impermeability and resistance to freezing and thawing

II. LITERATURE REVIEW

DRY AIR CURING

Dry curing is a curing method wherein the concrete cubes are left in open air to be cured at room temperature. Researchers have been working on the natural air drying of concrete since long. [4] carried out experiments to study the effect of this type of curing on the properties of Micro silica Concrete, Micro silica was used 10% weight replacement of cement, with water binder ratio of 0.35. Dry-air curing produced 15.2%, 6.59% and 3.36% re-

duction in compressive strength, dynamic modulus of elasticity and ultrasonic pulse velocity respectively, this was owing to the early, International Journal of Advanced Engineering Technology drying of concrete which virtually ceased hydration of the cement because the relative humidity within capillaries dropped below 80% [1] Experimental results indicate that Dry-curing is not an efficient method to achieve good hardened properties of concrete.

WATER ADDING TECHNIQUE

Water adding techniques include immersion or Pounding, fogging or spraying and wet saturated covering.

POUNDING OR IMMERSION

It is a curing method wherein the flat concrete surfaces such as slabs and pavements are cured by pounding of water around the perimeter of the surface with the help of sand dikes. It is an effective method as it maintains a uniform temperature in the concrete and also prevents the loss of the moisture from the concrete. This method is used in laboratory experiments wherein the specimens are dipped in water after 24 hours of casting. The specimens are then tested for the strength after 7 and 28 days. Since pounding requires considerable labor, this method is generally used for small construction activities.

FOGGING OR SPRINKLING

It is a curing method wherein a fine fog mist is frequently applied on the surface of the concrete through a system of sprayers or nozzles. It is an effective method of curing when the humidity is low or the ambient temperature is well above the freezing point. This method requires ample of water and a proper supervision.

SATURATED WET COVERING

This is most often used curing method in construction industry. In this method moisture retaining fabrics such as burlap cotton mats and rugs are used as wet covering to keep the concrete in a wet condition during curing period, for if the drying is permitted, the cover will itself absorb the water from the concrete. During early period of curing alternative cycles of wetting with drying will cause cracking of the surface. The major disadvantage of this method is discoloring of concrete. Researchers are working in order to identify the effectiveness of the water curing methods over other curing methods. [5]. Carried out an experimental study on the effect of elevated temperature on differently cured concrete of M40 grade and subjected to temperature of 150°C, 300°C and 450°C for 1 hour duration in muffle furnace. His study revealed that the 28-day compressive strength of the concrete specimen cured by water curing have been more than those cured by membrane curing in both heated and high temperature exposure condition. Weight loss in both conventional

water cured concrete and membrane cured concrete are comparable. ^[4]

WATER RETAINING TECHNIQUES

Water retaining techniques include Membrane forming curing compound, plastic sheeting.

CURING COMPOUND

Various types of curing compound are available in the market, mainly includes water-based, resin solvent based, chlorinated rubber, wax based etc. Water based curing compound is most used curing compound world-wide ^[6]. These compounds are applied on the exposed surface of the concrete by the help of roller, brush or spray. Effectiveness of the curing compound is remarkable dependent on their application, time and generic type ^[7]. Curing compounds namely, acrylic and water based are effective in decreasing plastic and drying shrinkage strain for both ordinary and blended cements and the curing efficiency of such compounds with respect to compressive strength are in the range of 84 to 96 percent ^[8] also got the same results. The compressive strength ratio of field curing using curing compound to standard curing reveals that, there is no ratio fall under 85% and this results also complies with the ACI 318 requirements, the results indicates 92.11% as minimum field-standard ratio.

PLASTIC SHEET

Plastic sheets such as polyethylene film are used to cure concrete. Polyethylene films are lightweight, impervious hence prevent the moisture movement from the concrete and can be applied to simple as well as on complex shapes. Major disadvantage of this type of curing is that if concrete contains calcium chloride it causes patchy discoloration. Discoloration is more pronounced when the film develops wrinkles and it is complicated plus time consuming for big project to put the sheets without wrinkles. Polyethylene film should conform to ASTM C171. ^[4] Wrapping curing is more efficient than dry-air curing as it results in greater compressive strength, ultrasonic pulse velocity and dynamic modulus of elasticity and lower surface absorption.

SELF CURING CONCRETE

Primary requirement of fast-track construction is high early strength in concrete. Early age concrete strength without costly heat treatment is of greater significance in the construction industry ^[9], the mechanism of self curing can be explained as follows: "Continuous evaporation of moisture takes place from an exposed surface due to the difference in chemical potentials (free energy) between the vapour and liquid phases. The polymer added in the mix mainly form hydrogen bonds with water molecules and reduce the chemical potential of the molecules which in turn reduces the vapour pressure. Physical moisture retention also occurs. This reduces the rate of evaporation from the surface" Self-Curing concrete is the newly emerging trend in the construction industry. Water soluble alcohols are general used as self-curing agents. With conventional ingredients it is

possible to design reasonably good fast track concrete mixture using admixture ^[8]

III CONCLUSIONS

- Conventional water curing is the most efficient method of curing as compared to Membrane curing, Self-curing, Wrapped curing and Dry-air curing methods.
- Using Membrane curing and Self-Curing methods one can achieve 90% of efficiency as compared to Conventional Curing method. Self Curing method is most suitable for high-rise buildings especially in columns and inaccessible areas. Membrane curing compounds are most practical and widely used method it is most suitable in water scarce area.
- Wrapped curing is less efficient than Membrane curing and Self-Curing it can be applied to simple as well as complex shapes.
- Dry-Air curing should be avoided at the construction sites because designed design strength is not achieved by this method.
- The average efficiency of the curing compound increases with curing age initially by reduces at later age.
- Application of the curing compound is significantly dependent on the time of application of the compound.
- Curing of concrete is mostly governed by two parameters Temperature and Period

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