Comprehensive Review on Performance of Internal Curing Aggregates

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Abstract

The curing of concrete is essential for cement hydration, which is a series of chemical reactions that require an adequate, constant water supply and stable, proper temperatures over time. Curing is maintaining moisture and temperature conditions in a freshly placed concrete mixture in order to allow hydraulic cement hydration. External curing techniques are frequently used to cure conventional concrete. In that method, external curing water is applied at the surface, and the quality of the concrete governs the depth of penetration. As a result, external curing may not satisfy demand since external curing water is only able to act on the surface layer of concrete and cannot reach the inside of the concrete. As a result, external treatment is ineffective in preventing the ongoing reduction of interior humidity. Therefore, Internal curing is used as a method of maintaining the relative humidity within the concrete. Internal curing allows the water to be spread more evenly throughout the cross section by releasing water eventually into the concrete mixture. This literature review provides a comprehensive examination of internal curing methods, mechanisms, and their impact on the properties of concrete. Internal curing is the technique of introducing curing elements that act as a curing agent, to the concrete mixture to serve as a water reservoir. It is a viable method for providing additional water for curing cement-based materials with low water-cement ratios, and it does not adversely affect the fresh or hardened properties of concrete mix. It differs from the externally applied curing. In the internal curing process, once the concrete is hardened, the water intended for internal water curing is dispersed within the concrete mixture and facilitates the hydration process. Internal curing is used to minimize autogenous, plastic, and drying shrinkage, which increases the probability of shrinkage cracking of the concrete, to reduce the permeability of concrete and the modulus of elasticity, to improve the strength and permeability at the interface transition zone (ITZ), to obtain reduced moisture gradient along the concrete section results in less warping in concrete pavements and reduced coefficient of thermal expansion (CTE) and thermal conductivity, resulting in lower temperature gradients across the concrete section and less curling in concrete pavements etc. In past studies, internal curing methods are explored in detail, ranging from techniques like pre-soaked lightweight aggregates such as crushed clay brick waste, and ceramic tile waste to more recent innovations such as superabsorbent polymers, which act as internal reservoirs, supplying an internal source of water needed to replenish moisture lost due to chemical shrinkage and self-desiccation in various concrete types such as normal weight concrete, high- performance concrete, Roller compacted concrete etc. A wide variety of studies have been done to check the potential of different kinds of material to use as internal aggregates to replace conventional aggregates. Also in some studies, the effect of the particle size of internal curing aggregates on the performance of concrete has been checked. Practical applications of each method are critically evaluated, offering insights into their effectiveness and feasibility in different construction scenarios. The optimum amount of each internal curing aggregate and the impact of internal curing methods on various concrete parameters such as strength development, shrinkage, cracking, and durability characteristics such as chloride penetration, air permeability, and water absorption are investigated in this paper. A thorough examination of laboratory results

and real-world case studies demonstrates the practical advantages that internal curing can impose on concrete performance. In a nutshell, this literature review synthesizes the wealth of information available on internal concrete curing, offering a thorough understanding of its concepts, methods, mechanisms, and impacts. Internal curing emerges as a possible option for improving the durability and performance of concrete structures while reducing their environmental imprint as infrastructure demands continue to rise. This review's information and insights contribute to a better understanding of internal curing's potential and pave the way for its wider implementation in the building sector.

Keywords: *Internal curing, Internal curing aggregate, water-cement ratio, Durability characteristics, Shrinkage cracking*

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