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The Influence of Lightweight Aggregate on Internal Curing and Its Impact on Autogenous Shrinkage of High-Performance Concrete

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ABSTRACT

In bridge deck construction high performance concrete is often desirable, however in practice it is generally susceptible to early-age shrinkage cracking resulting in an overall reduction in service life. This research seeks to assess the potential for reducing early-age shrinkage in new bridge deck construction through the use of internal curing, a process in which internal reservoirs supply water to the hydrating cement paste during the early stages of cement hydration. In North America, internal curing is typically achieved by replacing a portion of the normal fine aggregate with an expanded fine lightweight aggregate (LWA). For this study, the free and restrained autogenous shrinkage behavior was quantified for two field mixtures: a high performance concrete (HPC) and an internally cured high performance concrete (IC-HPC). The results indicate that internal curing successfully reduces the generation of autogenous shrinkage strain. When this shrinkage is restrained, it was shown that the IC-HPC mixture was less susceptible to developing cracks in comparison to the HPC mixture. These findings suggest that internal curing can be used successfully in the field to reduce the potential for early-age shrinkage cracking, leading to production of bridge decks with longer service lives. Future research will implement these results in a service life estimation model to demonstrate the added value of internal curing bridge decks.

KEYWORDS

Autogenous shrinkage, high-performance concrete, lightweight aggregate

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