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Field Evaluation of Concrete Using Hawaiian Aggregates for Alkali Silica Reaction

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Abstract : Alkali Silica Reaction (ASR) occurs in concrete when the alkali hydroxides (Na, K and OH) from the cement react with unstable silica, SiO2, in some types of aggregate. The gel that forms during this reaction will expand when it absorbs water, potentially leading to cracking and overall expansion of the concrete. ASR has resulted in accelerated deterioration of concrete highways, dams and other structures that are exposed to moisture during their service life. Concrete aggregates available in Hawaii have not demonstrated a history of ASR, however, accelerated laboratory tests using ASTM 1260 indicated a potential for ASR with some aggregates. Certain clients are now requiring import of aggregates from the US mainland at great expense. In order to assess the accuracy of the laboratory test results, a long-term field study of the potential for ASR in concretes made with Hawaiian aggregates was initiated in 2011 with funding from the US Federal Highway Administration and Hawaii Department of Transportation. Thirty concrete specimens were constructed of various concrete mixtures using aggregates from all Hawaiian aggregate sources, and some US mainland aggregates known to exhibit ASR expansion. The specimens are located in an open field site in Manoa valley on the Hawaiian Island of Oahu, exposed to relatively high humidity and frequent rainfall. A weather station at the site records the ambient conditions on a continual basis. After two years of monitoring, only one of the Hawaiian aggregates showed any sign of expansion. Ten additional specimens were fabricated with this aggregate to confirm the earlier observations. Admixtures known to mitigate ASR, such as fly ash and lithium, were included in some specimens to evaluate their effect on the concrete expansion. This paper describes the field evaluation program and presents the results for all forty specimens after four years of monitoring.

Keywords : aggregate, alkali silica reaction, concrete durability, field exposure
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