Environmental Effects on Durability of Aggregates Stabilized with Cementitious Materials

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Abstract: The present study focuses on investigating the effect of freeze-thaw (F-T) cycles, referred to as environmental effect in this paper, on aggregates stabilized with various stabilizing agents, namely, Cement Kiln Dust (CKD), Class C Fly Ash (CFA), and Fluidized Bed Ash (FBA). Cylindrical specimens were compacted and cured for 28 days in a moist room having a constant temperature and controlled humidity. After curing, specimens were subjected to 0, 8, 16, and 30 F-T cycles, and then tested for resilient modulus (\(M_r\)). Results showed that \(M_r\) values of stabilized specimens decreased with increasing F-T cycles up to 30. The reasons for such changes are explained by the increase in moisture content during thawing and the formation of ice lenses within the pores during freezing, causing distortion to the matrix of particles. It was also found that the decrease in \(M_r\) values varies with type of stabilizing agents. The CKD-stabilized Meridian and Richard Spur aggregates exhibited a higher reduction in \(M_r\) values than the corresponding values of CFA- and FBA-stabilized specimens. The CFA-stabilized Sawyer specimens performed better than their CKD- and FBA-stabilized counterparts.

BACKGROUND

Durability of pavement materials induced by environmental factors, namely, repeated freeze-thaw action, can have a major effect on the performance of a pavement structure. Freeze-thaw action is considered as one of the most destructive actions that can induce significant damages to pavements. The extent of the damage depends on many variables such as frost penetration depth, amount of water present during freezing, void space within the domain, number of freeze-thaw cycles, duration of freezing and thawing, and type of freeze thaw cycles. The variation in pavement performance due to seasonal changes indicates possible changes in the engineering properties of pavement materials such as resilient modulus. The design and analysis of pavements, therefore, should account for such seasonal effects. NCHRP (1992) recognized the importance of evaluating the durability of stabilized aggregate bases and suggested that such effects be carefully considered in the mixture design. To this end, a bench-scale

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