ENVIRONMENTAL INFLUENCE ON THE BOND BETWEEN A POLYMER CONCRETE OVERLAY AND AN ALUMINUM SUBSTRATE

BY

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Abstract

Chloride ion induced corrosion of reinforcing steel in concrete bridge decks has become a major problem in the United States. Latex modified concrete (LMC), low slump dense concrete (LSDC) and hot-mix asphalt membranes (HMAM) overlays are currently some of the most used rehabilitation methods. Epoxy coated reinforcing steel (ECR) was developed and promoted as a long term corrosion protection method by the Federal Highway Administration (FHWA). However, recent evidence has suggested that ECR will not provide adequate long term corrosion protection. The Reynolds Metals Company has developed an aluminum bridge deck system as a proposed alternative to conventional reinforced steel bridge deck systems. The deck consists of a polymer concrete overlay and an aluminum substrate. The purpose of this investigation is to evaluate the bond durability between the overlay and the aluminum substrate after conditioning specimens in various temperature and humidity conditions. The average critical strain energy release rate, G_{cr}, for each specimen was measured using a modified mixed mode flexure (MMF) test. In this investigation the strain energy release rate is a measure of the fracture toughness of the interface between the polymer concrete overlay and the aluminum substrate.

The different environmental conditionings all had a significant effect on the bond durability. Specimens conditioned at 30 ^{O}C [86 ^{O}F], 45 ^{O}C [113 ^{O}F] and 60 ^{O}C [140 ^{O}F] at 98 % relative humidity all showed a decrease in interfacial bond strength after conditioning. A decrease in the interfacial bond strength was also observed for the specimens conditioned in freezing and thawing cycles as well as specimens conditioned in a salt water soak. Of the exposure conditions used in this investigation, the only one that showed an increase in the bond strength was drying the specimens continuously in an oven at 60 ^{O}C [140 ^{O}F].

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