

Effects of Concrete Moisture on Polymer Overlay Bond Over New Concrete

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Introduction

Epoxy polymer overlays have been used for decades on existing bridge decks to protect the deck and extend its service life. The polymer overlay's ability to seal a bridge deck is now being specified for new construction. Questions exist about the amount of drying time needed to achieve an acceptable concrete moisture content to ensure an adequate bond to the polymer overlay. The 2007 Kansas Department of Transportation (KDOT) specifications for new bridge decks call for a 14-day wet curing period followed by 21 days of drying. If not enough drying is provided, the moisture within the concrete can form water vapor pressure at the overlay interface and induce delamination. If too much drying time is provided, projects are delayed, which can increase the total project cost or even delay overlay placement until the next spring.



Cores with concrete failures just below the concrete surface.

Project Description

A testing procedure was developed to simulate a bridge deck in order to test the concrete moisture content and bonding strength of the overlay. Concrete slabs were cast to test typical concrete and curing conditions for a new bridge deck. Three concrete mixtures were tested to see what effect the water-cement ratio and the addition of fly ash might have on the overlay bond strength. Wet curing occurred at three different temperatures (40°F, 73°F, and 100°F) to see if temperature played a part in the bond strength as well. The concrete was then allowed to dry for 3, 7, 14, or 21 days. Five epoxy-polymer overlay systems that had been preapproved by KDOT were each used in conjunction with the previously mentioned concrete and curing conditions.

After this, the slabs were setup to perform pull-off tests to test the tensile rupture strength. The concrete slabs with the different epoxy overlays were heated to 122-125°F to replicate summer bridge deck temperatures. Half of the pull-off tests were performed when the slabs were heated and half were performed once the slabs had cooled back down to 73°F ± 5°F.

Project Results

Results from the pull-off tests as well as results from a moisture meter taken on the concrete prior to the overlay placement were compared and analyzed. Testing conditions were compared with each other to see which had a larger effect on the epoxy polymer overlay's bond strength. The results showed that concrete bridge deck polymer overlays could be placed sooner than 21 days after concrete placement and still have an adequate bond.

Project Information

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