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THE EFFECT OF SURFACE COATINGS AND BONDED OVERLAYS ON MOISTURE MIGRATION

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The Effect of Surface Coatings and Bonded Overlays on Moisture Migration

by

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Many of the problems associated with durability of concrete bridge decks begin with the entry of water into the concrete through cracks and pores. This report describes five series of tests made to measure the effectiveness of certain measures to prevent freeze-thaw damage. Those tests included depth of penetration of selected coatings, moisture migration through coatings, moisture migration through overlay systems, freeze-thaw durability tests on asphaltic concrete overlays, and shear bond strength of concrete overlays on surfaces coated with selected coatings.

The penetration, through the finished surface into the concrete, of the selected coatings was indicated by a phenolpthalein mixture in combination with the coating. The phenolpthalein mixture contained phenolpthalein crystals, isopropyl alcohol, and distilled water. A 4:1 ratio of coating to phenolpthalein mixture was used as the indicator of depth of penetration. The range of penetrations, in inches, indicated in the tests were .054-.062 for a linseed oil-kerosene mixture; .041-.045 for a raw tung oil-kerosene mixture; .013-.017 for Thompson's Water Seal; and .027-.031 for EpoXeal, an epoxy coating.

Moisture migration tests were made on selected surface coatings and overlays. The first test was made to determine the effectiveness of the selected coatings in resisting moisture penetration into the concrete. The coating of raw tung oil-kerosene mixture was the most resistant to moisture penetration, and the linseed oil-kerosene mixture was next in effectiveness. Both the raw tung oil-kerosene mixture and the linseed oil-kerosene mixture were more resistant to the penetration of 5% salt water than to tap water. Thompson's Water Seal, a commercial product was resistant equally to the penetration of tap water and salt water.

Thin bonded overlays 1/2 to 1 1/2 inch thick, were ponded over for 60 days in tests to determine if moisture could penetrate into the concrete beneath them. Little change in relative humidity occurred beneath the epoxy mortar or the asphaltic overlays. The relative humidity beneath the polyester mortar overlay increased for about 30 days, but then gradually receded during the last 30 days. The relative humidity beneath the portland cement concrete overlay increased during the first seven days to about 95% and remained almost constant at that level for an additional 20 days. These blocks were then dried until the relative humidity was reduced to about 70% after which they were coated with a linseed oil-kerosene coating. They were

again ponded over and relative humidity monitored. The relative humidity rose to 100% after 30 days.

Overlays bonded to 7-inch concrete cubes were tested in direct shear parallel to the interface of overlay and cube. Coatings were applied to the surface of the cubes prior to overlaying. When no surface preparation was made, the bond stress was 578 psi for uncoated cubes, 61 psi for the linseed oil-kerosene coating, 88 psi for a commercial product, Thompson's Water Seal, and 267 psi for the raw tung oil-kerosene coating. When the surface was prepared by sandblasting, the band stress was 267 psi for the linseed oil-kerosene coating and 597 psi for Thompson's Water Seal coating.

Freeze thaw tests through 59 cycles were made on the asphaltic overlays under ponded 5% salt water. After 25 cycles and 38 cycles, one of each type overlay was removed in order to examine the concrete surface. When the overlays were removed no signs of deterioration were evident and no apparent distress was in evidence when the blocks were removed from the test.

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