

RESEARCH SUMMARY
**BEST PRACTICES FOR PLACING CONCRETE
OVERLAYS ON PRESTRESSED SLAB BRIDGES**

WHAT WAS THE NEED?

To improve the service life of bridge decks, concrete overlays are commonly placed over the deck to provide a safe and durable riding surface and, to protect the deck from adverse environmental conditions. Bonding agents are often used between the underlying concrete and the overlay to create one monolithic structure. The current practice used by the Maryland Department of Transportation State Highway Administration (MDOT SHA) is to place a cement-sand slurry mix over the bridge deck prior to placement of the overlay concrete to serve as the bonding agent. However, there are challenges with using a cementitious bonding agent. They are very tedious and time consuming to construct, especially on long bridges and multi-span bridges. There is also some evidence that they may not be necessary if proper preparation and placement procedures are followed.

WHAT WAS THE GOAL?

The main objective of this research was to investigate various bonding practices including the slurry method used by MDOT SHA when constructing cast-in-place concrete overlays for prestressed concrete deck slabs. Another goal was to investigate whether the slurry is necessary to achieve a good bond or, if there are better alternatives.

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WHAT DID THE RESEARCH TEAM DO?

The research team designed and performed laboratory experiments for various test cases with different interface conditions. Seven different test cases were established; one of them was the reference test case that uses application of slurry mix to achieve a good overlay bond. Of the remaining six test cases, four cases simply involved application of different groove configurations along the interface, one case involved use of commercial bonding agent *Enecon Superbond* in addition to grooves and the last case involved use of four six-inch-long anchors of ½ in. diameter embedded equally in both layers in addition to the grooves. Two sets of tests were designed in this study – Double-L test and the Split-Prism test to evaluate the shear bond and tensile bond strengths respectively. For both test setups, it was ensured that the load applied by the testing machine was in line with the interface to avoid any additional stresses along the interface. Each specimen was subjected to load until it failed, and the recorded load value was divided by the interface area to get the failure shear and tensile stresses for the bond. In addition, compressive strength tests for each mix were conducted to ensure that the mix strengths were consistent for all test cases. Once the test results were obtained for all cases, they were checked against the values obtained for the reference test case and recommendations followed.

WHAT WAS THE OUTCOME?

The results in this study related to the use of prestressed slab panels with pre-existing grooves over which the overlay concrete can be directly poured, were very positive. The average bond shear strength values for all the four test cases with square-shaped groove configurations (¼

in., 3/8 in. and ½ in. deep grooves at spacing of ½ in. and 1 in.) along the interface were recorded to be higher than the bond shear strength in the reference test case that used the slurry mix. It was found that the interlocking effect obtained through these grooves contributes significantly to the bond shear strength.

Based on consultation with the prestressed precast slab manufacturing plants, precast slabs with standard groove configurations could, theoretically, be manufactured at plants for direct use during bridge construction. The overlay concrete could then be directly poured over these panels eliminating the current process that involves removal of overlay reinforcement cage for spreading the slurry mix, quickly placing the reinforcement cage again and then pouring the overlay concrete.

HOW WILL MDOT SHA USE THE RESULTS?

The findings in this study represent an improvement over the existing practice of using a slurry mix to enhance the bond characteristics of concrete overlays. The MDOT SHA plans to eliminate using the slurry and continue with the current finish practice for the top of the slab unit (i.e. roughened raked finish to a ¼” amplitude. MDOT SHA will continue to explore the option to have prestressed precast slabs manufactured with standard groove configurations.

LEARN MORE

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