

The Indiana Department of Transportation Experiments with New Concrete Curing Technology

by Michael Nelson, Indiana Department of Transportation




Indiana Department of Transportation bridge on State Route 105 over Salamonie Reservoir, placed on September 3, 2020. Curing consisted of only the proprietary E5 Internal Cure admixture and curing compound instead of the traditional seven-day wet cure. Photo: Michael Nelson.

In 2020, the Indiana Department of Transportation (INDOT) began experimenting with a method for curing bridge decks that might be an alternative to the traditional seven-day wet cure. The method used only curing compound and an admixture called E5 Internal Cure manufactured by Specification Products in Noblesville, Ind. The E5 admixture is unique and has been shown to provide several benefits in commercial concrete work, including improved water retention, workability, finishability, and strength. INDOT has faced challenges in achieving timely and uniform curing when constructing bridge decks, and the admixture presented a low-risk option with potentially high rewards.

In June 2020, INDOT partnered with bridge contractor R. L. McCoy on an existing bridge contract that used standard INDOT bridge concrete by incorporating the E5 admixture and the new curing method. This project was an opportunity to begin changing the culture of concrete at INDOT, so a couple of other conditions were included in the concrete placement procedure. First, absolutely no water was allowed to be applied to the surface of the concrete for finishing purposes, including by laborers or the screed itself. Second, no evaporation retardants were to be used because these products are often used incorrectly as finishing aids. The deck placement went very smoothly, and everyone involved was optimistic about their observations. The concrete finished easily, and the laborers quickly learned that using water as a crutch for finishing was not needed. They also perceived a longer window for finishing. The bridge contractor, who is also a concrete pumping contractor, reported significantly lower pumping pressure than is normally seen with INDOT's bridge concrete mixtures. The concrete exhibited very little bleed water, and the curing compound was applied relatively quickly behind the screed, providing faster protection from the environment than is typically achieved when burlap and plastic are used. Word quickly spread about the success of the trial, and to date INDOT has placed 52 decks using the new curing method.

The placements have involved 10 bridge contractors and six ready-mixed concrete companies.

The observations from the field have been consistent throughout all of the projects, and the improvements to general concrete practice were expected to provide benefits in overall concrete quality. With few exceptions, improved flexural strengths were seen. In April 2021, INDOT used a van equipped with a high-speed three-dimensional laser to inspect several of the decks. The concrete decks had minimal to no cracking, and that trend has continued with all the decks placed to date. Core samples were sent to Purdue University for analysis, and the concrete was found to be of good quality. However, the air-void system of the hardened concrete was less developed than expected when compared with the test results for the fresh concrete. Some autogenous shrinkage was also found. The conclusion was that the mixture needed more water and, perhaps the most critical finding to date, that concrete with E5 seems to thrive at a higher water-cementitious material ratio (w/cm) than is historically used for INDOT work. A w/cm between 0.44 and 0.48 seems to be ideal. There is still much to learn about this new technology, but the future is going to be exciting! 

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EDITOR'S NOTE

Michael Nelson gave a presentation on this topic during the general session of the American Association of State Highway and Transportation Officials' Committee on Bridges and Structures Annual Meeting in 2021.