

Internal Curing of Concrete Bridge Decks in Utah: Preliminary Evaluation

Internal curing of concrete bridge decks with pre-wetted lightweight fine aggregate (LWFA) has been used in a few states to extend deck service life by densifying the microstructure of concrete, reducing permeability, and reducing shrinkage cracking. In the spring of 2012, four new bridges were constructed in the West Jordan area on the Mountain View Corridor (MVC) Project, two at Dannon Way and two at 8200 South. At each location, one bridge deck was constructed using a conventional concrete mixture and one was constructed using a concrete mixture containing a portion of pre-wetted LWFA to facilitate internal curing. This is UDOT's first internal curing project.

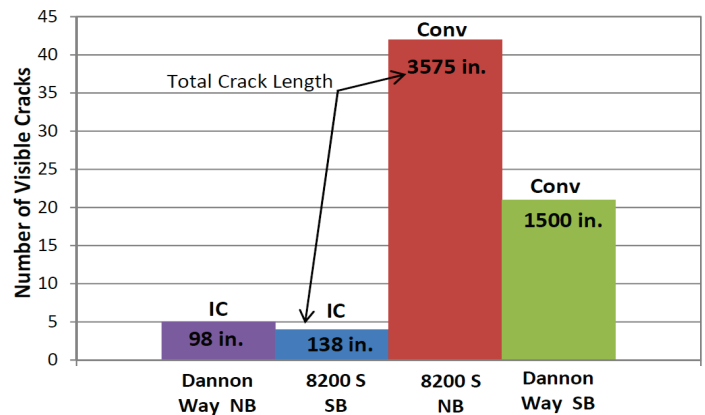
Researchers at Brigham Young University are evaluating the performance of these decks with UDOT by 1) monitoring in-situ bridge deck properties such as moisture and diffusivity with sensors embedded in the decks, 2) comparing deck performance in terms of early-age cracking with distress surveys, and 3) evaluating the field-cast concrete mixtures in the laboratory in terms of compressive strength and chloride permeability.



Concrete placement around deck sensor

Results through the end of 2012 are encouraging. Moisture content of the internally cured concrete was consistently 2 to 3 percent higher than the moisture content of the conventional concrete. Electrical conductivity values, indicating diffusivity, were approximately the same for all the decks after a couple of months.

Regarding distress surveys, on average, at 5 and 8 months, *the conventional bridge decks had about 4 and 21 times as much cracking as the internally cured decks*, respectively. Cracks found on the internally cured bridge decks were mainly located at the ends of the decks, whereas cracks in the conventional concrete bridge decks were well distributed throughout both decks.



Distress data at 8 months post-construction

Laboratory compressive strength data indicate that, through 3 months, the two concrete mixtures exhibited very similar strength gain characteristics. At 6 months, the conventional concrete was stronger by an average of 12 percent than the internally cured concrete. The rapid chloride permeability test results show that the internally cured concrete passed between 2 and 30 percent and between 2 and 25 percent less current during the test than the conventional concrete at 28 days and 6 months, respectively. Both types of concrete can be classified as having low chloride permeability.

The research team plans to continue monitoring deck sensors into the spring of 2014 along with additional laboratory testing and data analysis. Additional crack surveys are also planned. Based on the improved performance observed early on the two internally cured decks, UDOT materials engineers plan to develop a specification for internally cured concrete for future projects. For more information contact Dr. Spencer Guthrie of BYU at guthrie@byu.edu or Joe Kammerer on the MVC Project at jkammerer@utah.gov.