Early-Age Fiber-Reinforced Concrete Properties for Overlays

**the ISSUE**

Fiber-reinforced concrete (FRC) has been used for concrete pavement overlays for a few decades. It is well documented to improve performance over unreinforced plain concrete in the aspects related to crack initiation, and crack propagation. When selecting an appropriate fiber-reinforced concrete for the design of thin overlays, the flexural residual strength is the primary design criteria used. One major challenge with the FRC industry and use in pavements is that the test does not specify when (age of overlay) these tests should be performed. It was hypothesized that the FRC properties change with age and that not having a specified age for the test to be performed would result in variable performance in the field.

**the RESEARCH**

Five concrete combinations were investigated including: plain unreinforced concrete against FRC with a short steel fiber, a long steel fiber, a slender synthetic fiber, or a shorter synthetic fiber. An array of tests were performed such that specimens were tested anywhere from 3 to 90 days of age. Test methods performed included compressive strength, shrinkage, coefficient of thermal expansion, wedge-splitting fracture, and flexural strength. Two or three replicates were examined. Statistical p-values and regression fits with R2 values were calculated.
the **FINDINGS**

Compressive strength, free drying shrinkage, coefficient of thermal expansion and modulus of rupture all demonstrated statistically negligible affects regardless of fiber addition. Post-cracking residual strength was found to increase with age for the FRCs exhibiting deflection hardening. All FRC mixtures observed a potential decrease in residual strength ratio with age, and an increase in fracture energy with age.

the **IMPACT**

FRC is becoming more popular as an alternative material choice for overlay pavements. States are adding or updating their specifications every year. This research indicates to them that they should not just specify performance values measured in the lab, but also the age of the material on which testing is to be performed. For practical purposes, the authors currently recommend an age of 28 days.

For more information on this project, download the entire report at [http://www.ugpti.org/resources/reports/details.php?id=912](http://www.ugpti.org/resources/reports/details.php?id=912)