Florida Department of Transportation Research

Testing Methods for the Next Generation of Concrete

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Current Situation

Concrete is everywhere in the built environment, and it has been around for thousands of years. While it seems unchanging, concrete has reached a turning point. Concerns over the availability and cost of the materials that go into concrete and the sustainability of concrete production have caused producers and users, such as the Florida Department of Transportation (FDOT), to begin looking at concrete in a new way. Traditionally, concrete was specified by strict quality measures of its ingredients and precise recipes for the amounts of these ingredients that would produce acceptable concrete of various types. The change that is underway focuses specifications on the performance of the final concrete. The traditional method, often called "prescriptive," attempts to assure performance based on formulation, but the new method addresses performance directly. However, new testing methods and standards are needed for this change to become practical for producers and users.

The Shands Bridge (back) at Green Cove Springs is one of many concrete bridges in Florida that replaced wooden bridges (front).

Research Objectives

University of Florida researchers performed a thorough literature review to identify existing test methods that can quantify the performance of concrete with respect to heat evolution, cracking, and durability at the mix design phase.

Project Activities

FDOT has established performance measures that must be met by concrete used in transportation projects in Florida. The primary measures include heat evolution, cracking tendency, durability with respect to both chloride and sulfate content, and water permeability. FDOT also established criteria for the tests themselves. For example, the testing must be conducted on conventional portland cement concrete. The test must not require more than 30 days for completion, and no hazardous materials may be involved. Further, it was required that the tests be relatively uncomplicated and not require expensive equipment so that testing could be done by a wide variety of technical staff and affordable for many users.

The researchers examined the many test methods that are currently being used for each of the primary measures. The researchers categorized each method as to whether it currently meets FDOT testing criteria without modification, can readily be modified to meet the criteria, or does not meet one of the criteria. The researchers found that few test methods met the FDOT criteria without modifications, and those few lacked sufficient information to meet FDOT quality assurance/quality control standards.

The researchers made recommendations to produce acceptable test methods for each primary performance measure. While no single method addressed all criteria, the researchers identified methods that could be the basis for acceptable test methods with further research and development.

Project Benefits

This project lays the foundation for a new type of concrete specification that can produce more durable and sustainable concrete mixtures and reduce repair and maintenance costs for transportation structures.

For more information, please see www.fdot.gov/research/.