Recent Research – TRB Compendium of Papers 2006

Reducing Shrinkage Cracking of Structural Concrete Through the Use of Admixtures
WHRP Project 0092-04-13

The paper(s) abstracted below report recent research that may be related to the subject matter or methodologies of this WHRP project. For access to the CD-ROM and full text of the paper, contact Hussain Bahia (bahia@engr.wisc.edu) or Greg Waidley (gwaidley@engr.wisc.edu) at WHRP or John Cherney (john.cherney@dot.state.wi.us) at the WisDOT Library.

Efforts to Improve the Durability of Concretes in Virginia
Paper No. 06-0940
Author: Celik Ozyildirim
Abstract: This paper addresses some of the notable improvements in the durability of concretes for bridge structures, mainly decks, and in pavements by the Virginia Department of Transportation since 1938. These improvements are intended to extend service life with minimal maintenance. Improvements have been made in the design, material ingredients, proportioning, and construction practices for bridge structures and concrete pavements.

Measurement of Volume Change in Cementitious Materials at Early Ages: Review of Testing Protocols and Interpretation of Results
Paper No. 06-1571
Authors: Gaurav Sant, Pietro Lura, Jason Weiss
Abstract: Early-age cracking in concrete bridge decks, pavements and superstructure elements has served as the impetus for substantial research on early-age shrinkage in cementitious materials over the last two decades. Much of this research has indicated how mixture proportions, constituent materials and construction operations can be altered to reduce the risk of cracking. Unfortunately, many unrestrained shrinkage-testing protocols do not provide a comprehensive picture of the early-age shrinkage exhibited by cementitious materials, especially those used in higher strength concrete. In this paper, the authors review several early-age shrinkage testing procedures. A testing protocol is presented to show how chemical shrinkage can be measured using buoyancy measurements. A comparison of the measured autogenous shrinkage is made using four measurement methods: a sealed membrane, a corrugated tube, a non-contact measurement in a rigid mold, and the ASTM C157 standard. The results of the autogenous and chemical shrinkage tests are compared with one another to fully describe early-age length change. It is shown that through careful experimentation and interpretation, the results of these tests can be completely correlated with one another. This can provide the end-user with reliable test procedures to compare different paste compositions, different admixtures, and provides inputs for models that quantify the cracking potential.

Effects of Lithium Admixtures on Early Age Concrete Properties: A Literature Review
Paper No. 06-1080
Authors: K.E. Kurtis, M.J. Millard
Abstract: The increasing identification of alkali-silica reaction (ASR) in concrete structures in combination with the depletion of non-reactive aggregate sources, particularly in urban areas, have renewed interest in lithium-containing chemical admixtures to mitigate damage by ASR. Although the beneficial effects of lithium for prevention or reduction of ASR damage have been shown, the secondary effects of lithium compounds on early age properties remain largely uncharacterized. The purpose of this literature review is to begin to address the effects of lithium admixtures on early age properties of concrete. The effects of lithium admixture addition on the chemistry of the pore solution and hydration products and the effects, if any, on concrete setting time, air entrainment, unit weight, workability, strength, and shrinkage are addressed. In many cases, current literature describes inconclusive, and sometimes contradictory, results. The uncertainty on these effects of lithium compounds warrants further investigation with emphasis on the effects of varying lithium dosages, the influence of cement composition (i.e., admixture-cement compatibility), and the binding of lithium in fly ash concrete.