Progress Report
November 2004

FHWA POOLED-FUND PROJECT NUMBER: ***TPF-5(075)***

TITLE: Extending the Season for Concrete Construction and Repair – Phase II, Defining Engineering Parameters

PRINCIPAL INVESTIGATOR:
Charles Korhonen
US Army Cold Regions Research and Engineering Laboratory
72 Lyme Road
Hanover, NH 03755
603/646-4438 phone
603/646-4640 fax
E-mail: Charles.J.Korhonen@erdc.usace.army.mil

OBJECTIVE: To define the effect of the antifreeze admixtures developed in Phase I on the freeze-thaw durability of Portland cement concrete. We expect this study to lead to guidance for enhanced service life of concrete in northern climates.

REPORTING PERIOD: 01 August 2004 through 01 December 2004

ITEMS IN THIS ISSUE:

- Funding
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Funding: The funding for this year became available to this project in mid-August 2004. Because this is a two-year project I suspect that the second year's funds will begin to arrive at FHWA throughout this fall. Some of the second year funds appear to have arrived already. We will do our best to get caught up to schedule, as if the funds came in last fall. We really appreciate your support.

***Progress to Date*:** Between August and October 2004, approximately 180 beams (3x3x12-in.) were cast from six different concrete mixtures representing a range of w/c ratios and cement factors. These beams are all being cured at room temperature (>90% RH) for 28 days and some are already being subjected to ASTM C666, Proc B, freeze-thaw durability testing. It's too early to speculate too much, but it appears that freeze-thaw durability increases with admixture dosage, at least at the low and mid-level dosages tested on some of the mixes that have cured to this point. The dosages chosen bracket the dosages used in the Phase I study. In addition, 1x0.5x10-in. beams (approx 180) were cast and cured at room temperature (>90% RH). These will be tested for length change when subjected to a single freeze-thaw cycle ranging from 20C to –60C. All of the beams thus far have been non-air entrained to avoid problems caused by varying air contents. Over the years we have found it difficult to make concrete batches exactly the same in regards to air content. Thus, we chose to avoid this problem by studying only the effect of chemicals of freeze-thaw durability. In the coming months we will evaluate the effect of air content and begin to factor in the effects of salts in freezing environments.

ASTM: As Chair of ASTM Section C09.23.06, Cold Weather Admixture Systems, I am working with members from Sika, Euclid, Axim, Master Builders, Grace, NIST, Concurrent Technologies Corp., and other independent consultants to develop a standard specification for antifreeze admixtures (now known as cold weather admixture systems, CWAS). A second draft of the spec was submitted for sub-committee ballot in August 2004. The plan is to revise the spec, if necessary, based on ballot comments and re-submit the spec for concurrent balloting at sub-committee and committee levels around February 2005. If the ballot passes, as I expect it might, a new CWAS specification should be approved next summer (June 2005). I believe that this will pave the way for admixture companies to begin to market antifreeze admixtures (aka, CWAS) that are more usable to state DoTs because they will be fully tech-supported by the companies that market them. Of course this is all based on what happened during Phase I but I mentioned this because you have all played an integral part in this by supporting our work. Thank you for being a part of this success.

Users of Phase I Technology: There have been two non-DoT users of our technology since we completed our Phase I study.

1. The Grand Forks Air Force Base, ND, requested CRREL to demonstrate the antifreeze technology developed in our Phase I study. In February 2004, a non-reinforced section of parking apron was replaced with concrete made using one of the eight admixture combinations reports in our final project report. As will be reported in a future CRREL technical report, the antifreeze concrete behaved like normal fast-setting concrete during mixing, at time of placement, and throughout finishing. The apron was ready for traffic two days after placement in subfreezing weather.

2. The New York City Department of Design and Construction contracted CRREL to work with a ready-mix producer to develop the protocol to use antifreeze admixture concrete. In February 2004, we developed a successful trial mix with the ready-mix plant but warm weather prevented us from using it as planned. The goal is to return to NYC during this coming winter and complete the demonstration by paving one of their streets. We plan to publish our findings.

What we need from you:

1. Please verify that your state has or will contribute to year #2 of this project.