

**Final Progress Report
December 2003**

FHWA POOLED-FUND PROJECT NUMBER: TPF5-(003)

TITLE: Extending the Season for Concrete Construction and Repair

PRINCIPAL INVESTIGATOR:

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OBJECTIVE: To develop an antifreeze admixture conforming to existing industry standards. This work will adapt recently developed knowledge about off-the-shelf admixtures to the specific conditions of highway construction. The admixture will protect concrete to 23°F (-5°C) or lower and allow concrete to gain appreciable strength while at that temperature.

REPORTING PERIOD: 01 July 2003 through 15 December 2003

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Final Report: Six copies of our draft project report were sent out to five states plus the FHWA for technical review on 24 October 2003. All reviewer comments were returned to us by the end of November. By 12 December, all comments, which were many, were considered, and a final manuscript was produced and sent to our editors at CRREL, where it will be edited once more and set up for printing. We anticipate that the report will be finalized and sent out for printing by mid-January 2004, and you should see it somewhere in the March 2004 timeframe. This has been an exciting project to work on. Not only have we developed a portland cement concrete that can fully cure in sub-zero weather, we have promoted an antifreeze admixture standard at ASTM and discovered that high doses of chemical admixtures may actually enhance the freeze-thaw durability of concrete (to be investigated in Phase II). We appreciate your support in this project and the time and effort many of you spent to turn this work into a useful product.

ASTM: Since last report, ASTM created section C09.23.05, "Cold Weather Admixture Systems". On 8 December 2003, I chaired the first meeting of this section, which is under subcommittee C09.23, "Chemical Admixtures" and main committee C09, "Concrete and Concrete Aggregates". Comments on draft #2 of a cold-weather admixture were discussed, and a plan was devised for four admixture companies (Grace, Master Builders, Sika, and Euclid) to conduct preliminary laboratory tests to verify that the draft standard specification is reasonable. Though the standard should be passed within the next year or two, it appears that some admixture companies are unsure whether there would be a market for antifreeze admixtures. I suggest that whenever you talk to representatives of admixture companies, let

them know your feelings about this topic. Perhaps if enough states make their voices heard, we may see this new technology move forward.

Guidance: Originally, the plan for transferring our findings to you included a workshop. However, because many states found it very difficult to travel to CRREL (or another central location), it was decided that we would put into writing what we would have told you during a workshop. Thus, we are in the process of developing a guide for producing and using antifreeze admixtures. This guide will discuss the admixtures found to perform well in this study. We expect that this guide will be shipped to you in January 2004.

Phase II: Intriguing and interesting discoveries were made during this project. One of these discoveries was that antifreeze concrete sometimes became very freeze-thaw resistant. The implications of this are enormous. Thus, we proposed a follow-on study to evaluate this finding. As of this writing, Phase II—TPF -5(075) has been established and nine states have committed funds. We estimate that two more states need to join to meet our project budget before FHWA will release funds. Ohio and New Jersey are interested, so we are currently working with them. The other possibility is to submit a revised proposal to FHWA to account for the funds that already have been committed; that is how Phase I started. All partner states will be notified when Phase II begins. Information on Phase II is available on our website at http://www.crrel.usace.army.mil/concrete/Durability_pooled_fund_study.htm. We have received good feedback on the website for Phase I, and will continue using this model for Phase II.