

TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): FHWA

INSTRUCTIONS:

Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # <i>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i> TPF-5(150)	Transportation Pooled Fund Program - Report Period: <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input checked="" type="checkbox"/> Quarter 4 (October 4 – December 31)	
Project Title: Extending the Season for Concrete Construction and Repair, Phase III – Guidance for Optimizing Admixture Dosage Rate		
Project Manager: Fred Faridazar (202-493-3076) Fred.Faridazar@dot.gov		
Project Investigator: Lynette Barna (603-646-4503) Lynette.A.Barna@usace.army.mil		
Lead Agency Project ID:	Other Project ID (i.e., contract #): IAA DTFH61-08-X-30031	Project Start Date: IAA Effective Date Aug. 7, 2008
Original Project End Date: Period of Performance 45 months from effective date (7 May 2012)	Current Project End Date: 28 FEBRUARY 2014 ³ 01 JUNE 2013 ¹	Number of Extensions: one

Project schedule status:

On schedule
 On revised schedule
 Ahead of schedule
 Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Total Percentage of Work Completed
\$325,000 proposed project cost ² \$325,000 received to date	\$299,000	92% (based on project proposal)

Quarterly Project Statistics:

Total Project Expenses This Quarter	Total Amount of Funds Expended This Quarter	Percentage of Work Completed This Quarter
\$26,817	\$26,817	21%

¹ Effective 21 December 2011, project end date changed as per scope of work approved 7 August 2008.

² Phase III Extending the Season for Concrete Construction and Repair, Guidance for Optimizing Admixture Dosage Rates, Project Proposal, USAERDC-CRREL, submitted 2004.

³ Effective 24 May 2013, No-Cost Extension granted and IAA modified (modification 4).

Project Description:

The purpose of the Phase III study is to develop tools and guidance to specify dosage levels of chemical admixtures used in antifreeze concrete to correspond with the varying weather conditions experienced at any job location. A user guide, including a series of design tables, will be developed describing admixture dosages to be adjusted for a specific level of protection. The guide will set dosage rates for general sets of conditions to provide a conservative level of concrete protection during the curing period. The dosage rates will account for the environmental conditions and concrete geometry. The guide will allow technicians to tailor mixture proportions and protective measures based on weather predictions for the first few days following concrete placement.

This quarterly progress report provides a summary of the effort expended and fulfills the reporting requirement in support of Interagency Agreement (IAA) DTFH61-08-X-30031, Modification 1 (signed 6 January 2009) between FHWA and the U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory (ERDC-CRREL), entitled *Extending the Season for Concrete Construction and Repair, Phase III – Guidance for Optimizing Admixture Dosage Rates*.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Draft final report. The draft project report was submitted to FHWA for technical review on 08 November 2013 .

Project Update Web Meeting. FHWA hosted a project update web meeting on 21 November 2013. A copy of the draft report cover is given below. The slides from the previous web meeting were reviewed and used to lead into the discussion on the draft technical report. During the meeting the following items were discussed:

- Remaining project timeline to February 2014;
- Draft technical report layout and comment review form; The suspense date for technical review comments was extended to 06 December 2013.
- Draft technical report. Responded to questions from the FHWA team on several figures in the draft report.
- One question from FHWA asked about incorporating Supplementary Cementitious Materials (SCMs) into the antifreeze concrete formulations. We concur that SCMs need to be evaluated for use in antifreeze concrete formulations as they are an integral part and widely used in the industry. To date, antifreeze concrete formulations did not include SCMs to first build our knowledge on portland cement. Now that we have a better understanding of antifreeze concrete mixtures, the inclusion of SCMs should be proposed.
- Field trials to exercise the one-dimensional model would provide additional confidence to practitioners to adopt antifreeze concrete as an additional capability for cold weather concreting. We believe that useful data may be collected from any available project that will help further validate the 1-D thermal model and continue to build our knowledge base on antifreeze concrete.
- Transportation Research Board January 2014 – was discussed as an appropriate venue to present this FHWA-sponsored project to the transportation community. FHWA will forward potential committees and POC information for CRREL to contact.
- FHWA recommended preparing additional antifreeze concrete topics for study. FHWA will compile a current list of the POC information of the participating state DOTs in this pooled fund and forward to CRREL. CRREL suggested contacting these state DOTs to present the findings and recommendations from this study, potentially the week of 06 January 2014 (prior to TRB).
- In addition, using the updated list of POCs, FHWA was to extend to an invitation to review the draft report to the participating states in this pooled fund study.

ERDC/CRREL TR-13-DRAFT

Cold Regions Research
and Engineering Laboratory



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of Engineers®**
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Development Center

Extending the Season for Concrete Construction and Repair

Phase III—Guidance for Optimizing Admixture Dosage Rates

DRAFT Final Report

Lynette A. Barna, Charles J. Korhonen, and Paul W. Richmond

November 2013

Approved for public release; distribution is unlimited.

Quarterly Cumulative Project Expenditures

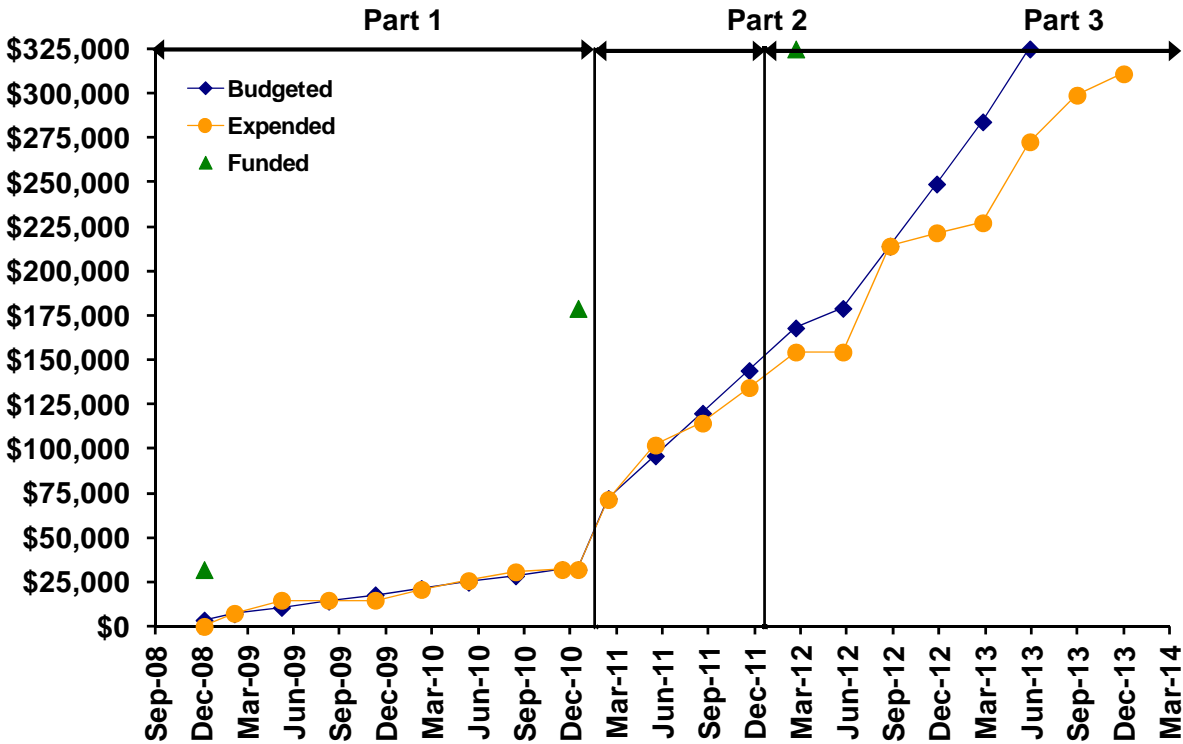


Figure 2. Cumulative project expenditures updated for 1st Quarter Fiscal Year 2014 shown by quarter beginning January 2009 when initial funding for Part 1 was confirmed.

An estimated project timeline for the project is given in the table below.

Table 1. Revised project tasking for 1st Quarter FY2014 reflecting project end date of February 2014.

Task	Estimated % Completion	FY2013		FY2014	
		3rd QTR	4th QTR	1st QTR	2nd QTR
T1. Apply energy balance approach to layered concrete system at low temperature conditions	100				
T1.1 Conduct analysis using heat transfer basics	100	Tasking Previously Completed			
T1.2 Use previous field data as input	100				
T1.3 Vary input conditions	100				
T1.4 Identify knowledge gaps	100				
T2. Develop relationships based on admixture dosage	100				
T2.1 Vary admixture dosages	100				
T2.2 Optimize admixture dosage rate	100				
T3. Draft design guidance report	10				
T3.1 Submit final report	0				★
T4. Quarterly progress reports	50	◇	◇	◇	◇

Anticipated work next quarter:

Work will continue in the following areas during the next quarter:

Draft technical report. Receive and respond to technical review comments. Prepare the final project report for publication.

Transportation Research Board January 2014. Based on feedback from FHWA, follow-up with potential TRB committees to present during TRB.

States participating in TPF-5(150). Based on feedback from FHWA, follow-up with participating states to schedule a web-based meeting to present the findings and recommendations of this study.

Project closeout. Prepare the project for closeout by the project end date.

Significant Results:

A mathematical model, based on heat transfer principles, has been developed describing the interaction of a 6-in thick concrete slab placed on grade. Currently, the model neglects the effects of solar radiation and evaporation, and does not include insulation. For the case of the slab on grade, the material layers and thicknesses are defined, including the substrate. Daily maximum and minimum air temperatures, and the time of occurrence were used as input parameters. Measured air temperatures may be used as input, or maximum and minimum predicted daily temperatures may be used. With the daily maximum and minimum temperatures, hourly temperatures are generated using a sinusoidal function.

The heat of hydration of the cement in the mixture is input to determine the amount of heat generated as the concrete cures. The estimated internal concrete temperatures as the concrete cures are output on an hourly basis in tabular form. During this quarter, heat of hydration curves were generated from our dataset and then used in the one-dimensional thermal concrete model. The heat of hydration curve for each slab were different, showing the effects of varying the admixture dosage.

The thermal modeling tool enables predicting internal concrete temperatures as it cures to compare with measured temperatures collected from field cured antifreeze concrete. The output showed good agreement with the measured concrete temperatures. The model will be a valuable tool to evaluate differing admixture dosages for antifreeze concrete formulations. This is a significant step in further building our understanding to predict the strength gain of antifreeze concrete subjected to freezing or sub-freezing temperatures.

The report for Part 1 of the project is available at:

http://www.crrel.usace.army.mil/innovations/cold_weather_concreting/antifreeze_admixtures/extending_the_season.html

Circumstance affecting project or budget (Describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope, and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

Nothing to report at this time.