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.e, SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX)* *TPF-5(150)*	**Transportation Pooled Fund Program - Report Period:** ☐ Quarter 1 (January 1 – March 31) ☐ Quarter 2 (April 1 – June 30) ☑ Quarter 3 (July 1 – September 30) ☐ Quarter 4 (October 4 – December 31)

Project Title: Extending the Season for Concrete Construction and Repair, Phase III – Guidance for Optimizing Admixture Dosage Rate

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Lead Agency Project ID:	**Other Project ID (i.e., contract #):**	**Project Start Date:**
	IAA DTFH61-08-X-30031	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.):

Meeting with contractor. Week of 23-27 September, Dr. Charles Korhonen (contractor) traveled to CRREL for a meeting. This time was used primarily to run several scenarios with the one-dimensional thermal model and to finalize the schedule for completion of the project report.

Computer code revision. Continued revising the computer code for the one-dimensional thermal model; and executed a scenario positioning a layer of insulation overlying the concrete layer using air temperature data collected from the Ft. Wainwright, Alaska study.

Draft final report. Inclusion and refinement of the design guidance section into the draft technical report. Final revisions to draft technical report.

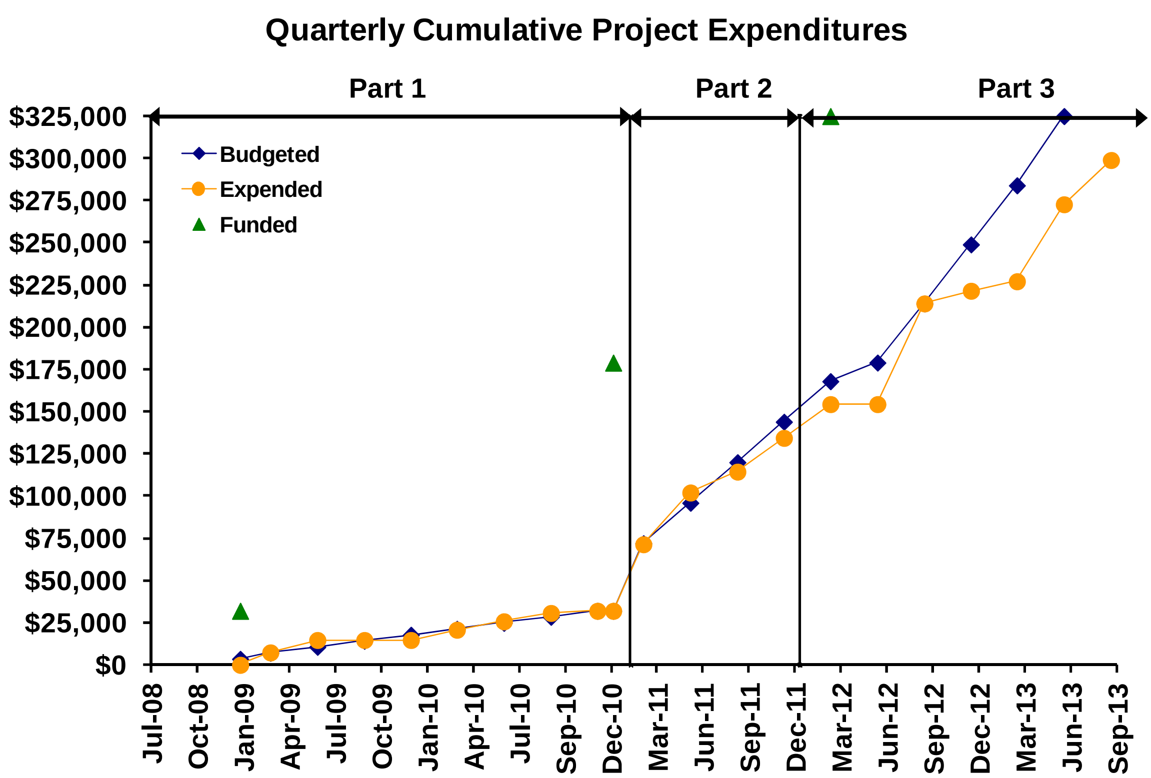

Figure 2. Cumulative project expenditures updated for 4th Quarter Fiscal Year 2013 shown by quarter beginning January 2009 when initial funding for Part 1 was confirmed.

An estimated project timeline for Part 2 of the project is given in the table below.

Table 1. Revised project tasking for 4th Quarter FY2013 reflecting project end date of February 2014.

Task	Estimated % Completion	FY2013 3rd QTR	FY2013 4th QTR	FY2014 1st QTR	FY2014 2nd QTR
T1. Apply energy balance approach to layered concrete system at low temperature conditions	100	Tasking Previously Completed			
T1.1 Conduct analysis using heat transfer basics	100				
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. The project report will be finalized for submission to FHWA for technical review.

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.