

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 checked="" 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 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: same	Number of Extensions: zero

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 ¹ \$179,000 received to date	\$67,000	37% (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
\$39,412	\$39,412	22%

¹ Phase III Extending the Season for Concrete Construction and Repair, Guidance for Optimizing Admixture Dosage Rates, Project Proposal, USAERDC-CRREL, submitted 2004.

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.):

- Confirmation of receipt of the funding, in the amount of \$147,000 to support the effort for Part 2 of the project, by ERDC-CRREL in early February 2011. IAA DTFH61-08-X-30031 Modification 2, was signed in July 2010. However, verification of receipt of the funding was not completed until months later due to miscommunication. Part 1 of the project was funded in the amount of \$32,000 in January 2009;
- Dr. Charles Korhonen, subject matter expert on the use of chemical admixtures in concrete mixtures, joined the project via a contract. He recently retired from the Cold Regions Research and Engineering Laboratory (ERDC-CRREL) after a long and distinguished career;
- Review of the literature continued of Korhonen (2006) Phase II – Defining Engineering Parameters. This report summarizes a laboratory investigation on the effects of moderate and high dosage rates of chemical admixtures used with varying cement content. Laboratory testing on specimens included initial freezing point, compressive strength, fundamental frequency (durability), and length change. With respect to compressive strength development, this report showed increasing compressive strength as admixture dosage increased. The utility of this for Part 2 of the project is the proportions of the ingredients used to batch the test specimens and the compressive strength. Admixture dosage at a concentration of 10% based on the weight of water appears to be a maximum, after which strength decreases as the admixture dosage rate increases.

Quarterly Cumulative Project Expenditures

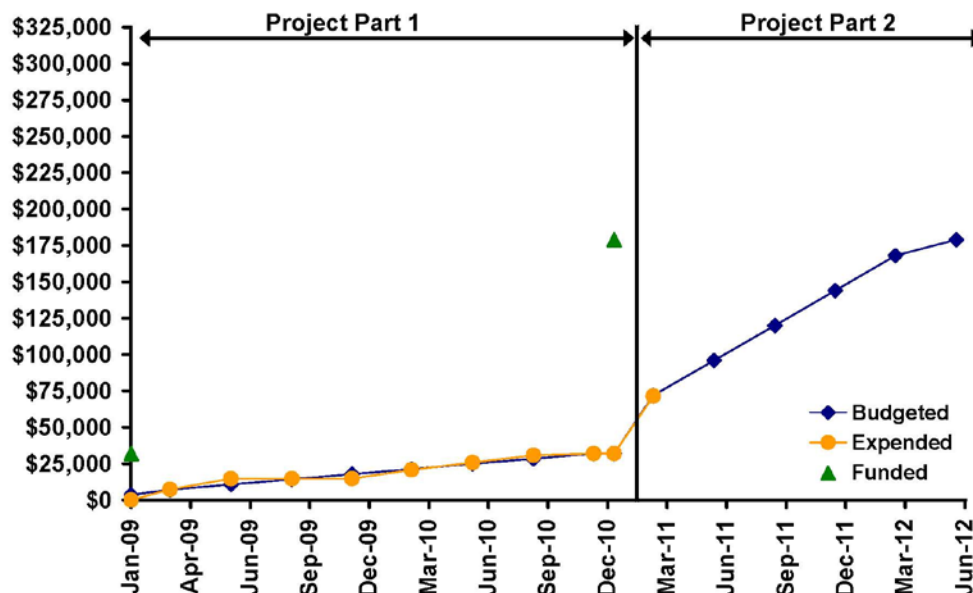


Figure 1. Cumulative project expenditures shown by quarter from January 2009 when initial funding for Part 1 was confirmed.

An estimated project timeline for Part 2 of the project is given in the table below. The vertical red dotted line indicates which task is currently under way. Application of the energy balance approach will continue during the 4th quarter of FY2011.

Table 1. Part 2 – Develop design guidance project tasks identified and estimated percent completion. (Red dotted line indicates current status).

Task	Estimated % Completion	FY2011			FY2012			
		2nd QTR	3rd QTR	4th QTR	1st QTR	2nd QTR	3rd QTR	4th QTR
T1. Apply energy balance approach to layered concrete system at low temperature conditions	25	█	█	█				
T1.1 Conduct analysis using heat transfer basics	0		█	█				
T1.2 Use previous field data as input	0		█	█				
T1.3 Vary input conditions	0		█	█				
T1.4 Identify knowledge gaps	0		█	█				
T2. Develop relationships based on admixture dosage	0			█	█			
T2.1 Vary admixture dosages	0			█	█			
T2.2 Optimize admixture dosage rate	0			█	█			
T3. Draft design guidance report	0				█	█	█	█
T3.1 Submit final report	0							★
T4. Quarterly progress reports	17		◆	◆	◆	◆	◆	◆

Anticipated work next quarter:

- Part 2 – Develop design guidance. Task 1. Application of energy balance approach. This effort will continue during the next quarter by analyzing key interactions. Information gained from previous field work will be used to develop practical guidance to aid the user community in tailoring admixture dosages.
 - a. The focus will be on assessing the response of curing concrete under freezing conditions through the application of basic modes of heat transfer. A better understanding of heat flow at low temperatures is needed;
 - b. Equations for primary modes of heat transfer (note that for now, heat flow due to radiation is assumed to be negligible) [Reference: Kreith (1973) Principles of Heat Transfer, New York]:
 - i. Conduction $q_k = -kA \frac{dT}{dx}$
 - ii. Convection $q_c = -hA(T_s - T_\infty)$
 - c. Inputs such as geometry, material layer and thickness, from field data will be used to create scenarios for evaluation;
 - d. Concrete temperature and strength are the intended outputs.

Significant Results:

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.