

State of Wisconsin/Department of Transportation
RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: Dec. 31, 2008

Program: TPF-5(092)		FHWA Pooled Fund Research Program	
Project Title: Development of Standardized Test Procedures for Evaluating Deicing Compounds		Project ID: Clear Roads 07-02/WisDOT 0092-08-32	
Administrative Contact: Colleen Bos		Sponsor: Clear Roads Pooled Fund	
WisDOT Technical Contact: Mike Sproul		Approved Starting Date: November 2007	
Project Investigator (agency & contact): Xianming Shi, PhD, PE Western Transportation Institute (WTI) Montana State University PO Box 174250 Bozeman, MT 59717-4250 phone 406.994.6486		Approved Ending Date: April 2009	

Percent complete (budget and hours): 68%

- **Hours and budget expended to date: 1572 hours, \$68,812**
- **Hours and budget expended for current quarter: 183 hours, \$7,211**
- **Hours and budget balance: 746 hours, \$31,188**

Brief project description:

Every year manufacturers introduce new deicing chemicals, additives or mixtures for use in snow and ice operations. Users do not currently have a comprehensive methodology for evaluating the performance of these new products prior to purchasing. The goal of this project is to establish laboratory tests that can be applied to all deicing chemicals, additives and mixtures to measure performance. Manufacturers would then be required to have the tests run at independent laboratories before they can be marketed or used by Clear Roads states. A standard set of performance tests for deicing chemicals, additives and mixtures that will help agencies anticipate how products may work in their specific environment is expected.

Progress this quarter (include specific tasks completed):

During this quarter the research team primarily focused their efforts on Task 3, as described below.

Task 0: Project Management (68% completed)

This task involved periodic communications within the research team as well as between the research team and the sponsor. The last quarterly progress report was submitted to Clear Roads in Sept. 2008.

Task 1: Comprehensive literature search (100% complete)

This task was complete prior to this quarter.

Task 2: Needs identification and recommendations (96% complete)

A survey response is still expected from one Clear Roads state. Once it is received the survey analysis will be updated and this task will be finalized.

Task 3: Develop testing protocols, procedures and ranges (50% complete)

As a result of finding from Tasks 1 & 2, four test methods were proposed for development, modification, and evaluation. These were approved by the TAC during the interim report meeting and are the following:

- differential scanning calorimetry (DSC) thermogram testing for liquid deicers,
- an improved SHRP Ice Melting Test for solid and liquid deicers,
- an improved SHRP Ice Penetration Test for solid and liquid deicers, and
- a modified ice undercutting test (as described by Mauritis et al., 1995) for solid deicers

During this quarter no additional DSC test development was performed. To recap, several test parameters were identified from testing conducted during the previous quarter: volume of 10 μ L (measured with a micropipette),

dilution ratio of 1.5:1 from an as-received (typically eutectic) concentration for liquid deicers or a saturated aqueous solution for solid deicers, cooling & heating rate of 3.6°F/minute, and temperature range of 77 to -76°F.

As identified in the literature search, the SHRP test methods are fairly well developed. However, according to the survey, the test methods do not appear to be widely used. The intentions behind improving two test methods are to increase the ease with which the tests can be conducted and implemented as well as to improve the test's reliability. For the Ice Melting test this has been accomplished by using readily available laboratory equipment instead of fabricating custom Plexiglas dishes; this required concurrent changes to the amount of water and deicer used. To improve the test's sensitivity to variations in temperature and humidity, two tests are conducted simultaneously, one of which uses reagent-grade NaCl as a control. This concept has been modeled after the Pacific Northwest Snowfighters corrosion dip test (NACE Standard TM0169-95 as Modified by PNS) which uses both distilled water and 3% NaCl as controls. For the Ice Penetration test an alternative apparatus has not been identified. However, the dye used to indicate penetration depth is more difficult to acquire. Tests using readily available food coloring have so far shown no adverse implications.

The modified Mauritis ice undercutting test uses standard equipment (test tube, salt water bath, battery and digital multimeter) for a single test; the circuit voltage is positive until the deicer undercuts the ice causing the test tube to detach and break the circuit. However, to reduce operator time, a data logger can be used to measure the voltage of several concurrent tests. WTI has a data logger available and will set it up next quarter to run several more tests to determine the test's repeatability.

The student researcher performing the tests had less availability during this quarter than anticipated. Thus Task 3 is not complete, but will be finished during January 2009. We do not anticipate this to delay the project completion date.

Tasks planned for next quarter:

During the next quarter the research team will finish Tasks 3 and 4. For Task 4, baseline tests will be conducted on the following deicers and blends:

- 23% Salt Brine
- 32% Calcium Chloride
- 29% Magnesium Chloride
- Geomelt 55
- Blend: 95% Salt Brine + 5% Calcium Chloride
- Blend: 90% Salt Brine + 10% Calcium Chloride
- Blend: 85% Salt Brine + 15% Calcium Chloride
- Blend: 80% Salt Brine + 20% Calcium Chloride
- Blend: 90% Salt Brine + 5% Calcium Chloride + 5% Geomelt 55
- Blend: 85% Salt Brine + 5% Calcium Chloride + 10% Geomelt 55
- Blend: 85% Salt Brine + 5% Calcium Chloride + 15% Geomelt 55

The draft final report will also be prepared in next quarter and submitted to the TAC in February 2009.

Identify any outstanding issues and barriers

There are no foreseeable outstanding issues or barriers. As mentioned in previous progress reports, the interim report will be finalized after all Clear Roads member states submit responses to the survey.

Gantt chart.

		2007	2008												2009							
Tasks	Milestones	11 12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4				
Task 0. Project Management																						
Project kickoff	11/13/2007																					
Quarterly progress reports	End of each quarter																					
Task 1. Comprehensive Literature Review																						
Interim Conference Call Meeting/Presentation	1/8/2008																					
Task 2. Needs Identification and Recommendations																						
Interim Report: Needs Identification and Recommendations Summary	5/28/2008																					
Task 3. Develop Testing Protocols, Procedures and Ranges																						
Task 4. Conduct Baseline Tests																						
Task 5. Final Report																						
Draft final report	Feb-09																					
Face-to-face TAC meeting	Mar-09																					
Final report	Apr-09																					