

QUARTERLY PROGRESS REPORT

to the

**CLEAR ROADS PANEL
STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION**

on

**State Project ID #0092-06-23
Pooled Fund Project #TPF-5(092)
Contract #406028
Purchase Order #TRG3403142**

DETERMINING EFFECTIVENESS OF DEICING MATERIALS AND PROCEDURES

for the period

October 1, 2007 to December 31, 2007

SUBMITTED BY

**EDWARD J. FLEEGE
43 13th AVE. E
ST. PAUL PARK, MN 55071-2600**

December 31, 2007

Preface

This quarterly progress report summarizes the progress of the research team during the fourth calendar quarter of 2007 to accomplish the research objectives of Wisconsin State Project ID #0092-06-23, “Determining Effectiveness of Deicing Materials and Procedures”. The project team started to work on the study on August 1, 2006 the contract starting date. This report covers the project effort from October 1 through the end of the quarter on December 31, 2007.

Edward J. Fleege
Principal Investigator, and
Overall Project Manager

Section 1

Introduction

Research Problem Statement

Snow and ice control on the U.S. highway system consumes over \$2 billion in direct costs each year. Indirect costs associated with corrosion and environmental impacts add at least \$5 billion. State and local agencies are employing solid and liquid chemicals, abrasives, and mechanical methods - individually or in combination- in their snow and ice control operations. However, the process of selecting the ideal snow and ice control treatments that meet highway agency objectives can be difficult and costly. Research by the Strategic Highway Research Program (SHRP), the Federal Highway Administration (FHWA), the American Association of State Highway Officials (AASHTO), the National Cooperative Highway Research Program (NCHRP), and other organizations in the United States and other countries has tried to address many of the issues associated with snow and ice control treatments. However, both the expenditure level and the potential environmental impact of winter chemicals have also lead highway agencies to search for and implement more effective methods of winter maintenance; such as electronic ground-speed-oriented spreader controls, thermal mapping, pre-wetting, and anti-icing. These technologies have the potential of providing more effective and timely removal of snow and ice while requiring significantly less amount of chemicals.

Most of these alternative maintenance techniques require installation of advance information technologies such as road weather information systems (RWIS), automatic vehicle location (AVL) and fleet management systems and wireless communication to obtain real-time information on weather and road conditions. As a result these new solutions incur greater capital and operating costs than conventional operations. This difference in cost structure has lead to a wide spread interest and debate on the cost-effectiveness of these new methods and technologies.

Highway agencies are under increasing budget and environmental constraints to meet the expected level of service. Salt and fuel prices are increasing and agencies have fewer workers for operations. Chemicals that are being used on the roadways are affecting ground water, lakes and rivers. Highway agencies are now asking if the developed guidelines and/or their current practices are the “best value” for chemical application during snow and ice control operations. Field-testing procedures are needed to evaluate the effectiveness of the various winter chemical application rates.

The aim of this study is to develop testing guidelines for evaluation the performance of various winter road chemicals and to produce a portable test method that can be used by any interested highway agency in a variety of locations under a variety of winter conditions. The outcome of the study will provide state and local highway winter maintenance agencies with the ability to refine their current best practices to provide the traveling public with good service at an acceptable cost while protecting the environment.

Research Objective and Scope

The overall objective of the research is to develop field testing procedures and guidelines for determining the effectiveness of various winter chemicals at various application rates.

The scope of the research is divided into three parts. Part 1 will be the development of an evaluation plan. This evaluation plan will be designed to test the effectiveness of any winter chemical in any winter weather condition. The plan will specify the minimum equipment and data needed to conduct such evaluations.

Part 2 will be the small pilot test on proposed I-94 segment near Alexandria, MN during the 2007 – 2008 winter in an effort to validate the evaluation plan that was developed in Part 1. Two Mn/DOT snowplow trucks with ground-speed controller will be available for this pilot test. Data collection forms will be developed and provided to record the necessary data from the snowplow truck operations.

Part 3 will be the final report that documents the findings and conclusions of this study. This report will include the testing guidelines and procedures that were developed along with the minimum equipment and data requirements, results of the pilot test, and recommendations for modifications to the testing procedures.

Research Approach

The research approach described below is designed to develop guidelines for testing the effectiveness of any winter chemical in any winter weather condition and to produce a portable test method that can be used by any interested highway agency in a variety of locations under a variety of winter conditions. In addition, a small pilot test will be conducted at the test section on the by-pass around Alexandria.

The research plan consists of three parts. A brief paragraph summarizing each part is presented below.

Part 1, Evaluation Plan

The evaluation plan will be developed following the gathering of related research and guidelines from around the country to understand the state of practice in testing the performance of winter chemicals and the use of sensor data in that evaluation. This information will be obtained by conducting an extensive literature search along with research on evaluating various sensors that are used for decision-making on maintenance operations. In addition to a review of the pertinent reports, domestic and international sources of information will be contacted.

Access will be obtained to the various archived databases. A thorough review will be made to acquire an understanding of the data being reported from the various systems, e.g. RWIS, MDSS, SAIL II, camera and Geonor T-200B series all weather precipitation gauge.

Using the gathered information and data, an evaluation plan will be developed that will identify the procedures to be used in evaluating the performance and optimum application rates of chemical treatments. In addition to the evaluation plan, a proposal will be developed detailing how the pilot test will be conducted.

Part 2, Pilot Test

The Pilot Test will be conducted to validate the Evaluation Plan developed in Part 1 of this project. The small pilot test will be conducted on I-94 between mile points 97 and 106 during the winter season of year 2007 –2008. During the pilot test, an attempt will be made to gather data across a representation sampling of winter events (freezing rain, snow, etc.). A minimum of 5 and a maximum of 10 events will be recorded and analyzed.

Within Part 2, there will be four activities involved in carrying out the pilot test. The first activity will be the development of forms that will be used to collect data and information. The second action will be to train the operators of the two snowplow trucks on the procedures to be used in completing the forms that are relative to their operations. The third action will be the data collection, assembling the data, and monitoring the integrity and accuracy of the data. The final activity will be analyzing the data from the pilot test.

Part 3, Reports

A Final Report will be issued in Part 3 to provide documentations of the findings and recommendations of this project. The Final Report will include an executive summary of the study plus provide the results of the literature search. This report will also include the testing guidelines and procedures that were developed including the minimum amount of equipment and data requirements needed to conduct a successful evaluation of the performance of various winter road chemicals. The documentation will include the results of the pilot test, and recommendations for modifications to the testing procedures that resulted from the findings of the pilot test. A draft of the Final Report will be submitted to Clear Roads TAC members approximately two months prior to the end of the project for their review and request for any modifications. A face-to-face meeting with the Clear Roads TAC members will take place one month prior to the end of the project to discuss the study findings and recommended revisions to the Final Report.

Section 2

Progress Schedule

The research on the project began on August 1, 2006. The project was to be conducted over a 12-month period of performance and be completed by July 31, 2007. On January 11, 2007 the completion date was extended to August 31, 2008. The revised planned schedule of activities by parts is presented in Figure 1. This schedule reflects the start date of August 1, 2006 and a revised completion date of August 31, 2008.

The revised planned progress schedule is presented in Figure 2. Figure 2A of the progress schedule illustrates the overall planned project schedule by part on a monthly basis. Figure 2B shows the planned schedule of expenditures over the project period. Figure 2C shows the planned schedule of percent completion over the project period. The progress schedule will be updated each month during the project period for internal review. The updated schedule will be presented in each quarterly report.

Determining Effectiveness of Deicing Materials and Procedures

Planned Schedule of Activities

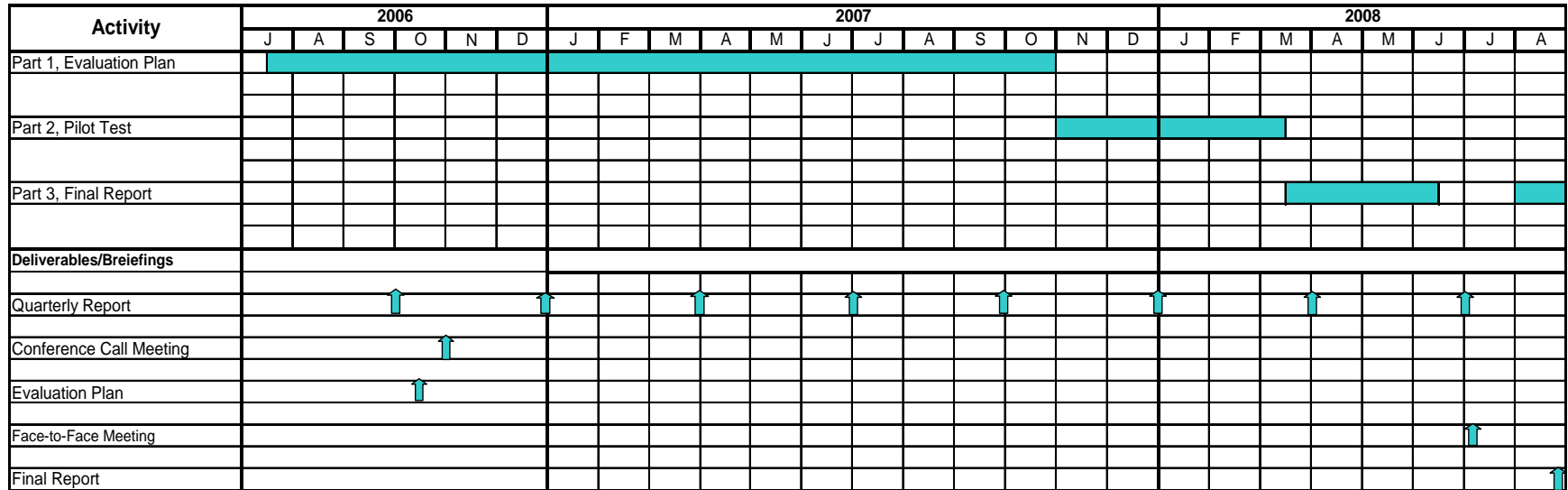


Figure 1 – Revised Planned Schedule of Activities

CLEAR ROADS RESEARCH PROGRAM
WISCONSIN DEPARTMENT OF TRANSPORTATION

PROGRESS SCHEDULE

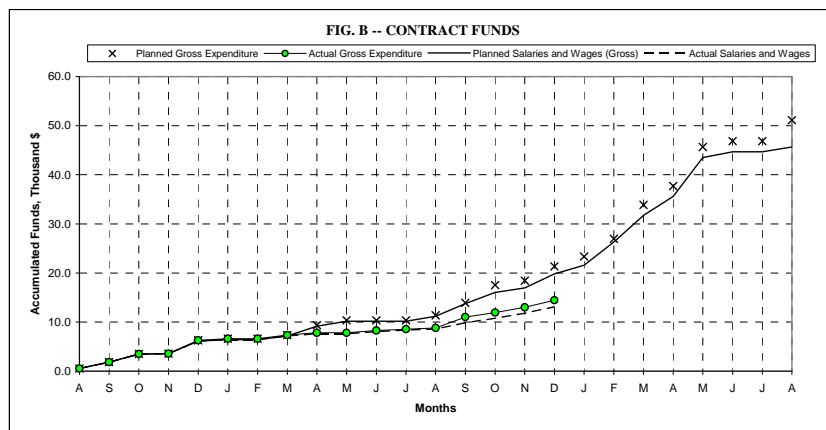
Project No. TPF - 5(092), Determining Effectiveness of Deicing Materials and Procedures
Research Agency Edward J. Fleege
Principal Investigator Edward J. Fleege

Year: 2007

Quarter: Fourth

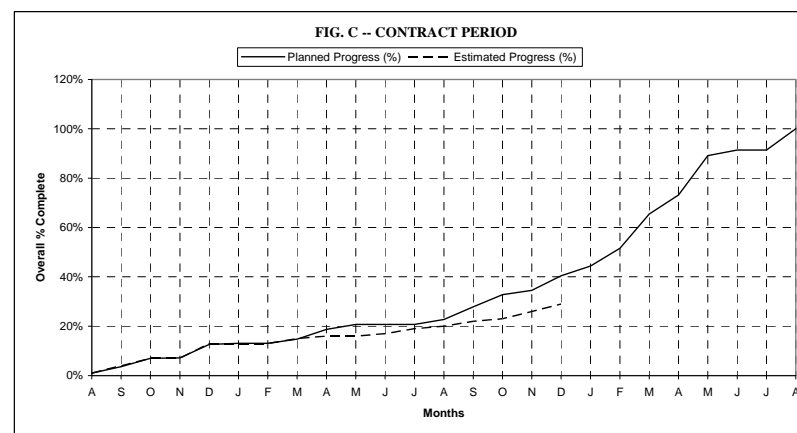
| RESEARCH ACTIVITY | 2006 | | | | | 2007 | | | | | | | | | | | | 2008 | | | | | | | ESTIMATED % COMPLETION | |
|------------------------|------|----|----|----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|----|-----|----|----|----|----|---------------------------|----|
| | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | | A |
| PART 1 | 3 | 12 | 22 | 23 | 41 | 42 | 42 | 47 | 60 | 67 | 67 | 67 | 73 | 90 | 100 | | | | | | | | | | | 85 |
| PART 2 | | | | | | | | | | | | | | | 6 | 12 | 31 | 44 | 67 | 100 | | | | | | 10 |
| PART 3 | | | | | | | | | | | | | | | | | | | | 10 | 30 | 72 | 78 | 78 | 100 | |
| OVERALL % COMPLETED | 1% | 4% | 7% | 7% | 13% | 13% | 13% | 15% | 16% | 16% | 17% | 19% | 20% | 22% | 23% | 26% | 29% | | | | | | | | | 29 |

FIG. A -- OVERALL PROJECT SCHEDULE



| | |
|-----------------------|-----------------|
| Funds Expended | <u>28%</u> |
| Contract Amount | <u>\$51,126</u> |
| Expended This Quarter | <u>\$3,408</u> |
| Total Exp. to Date | <u>\$14,438</u> |
| Balance | <u>\$36,688</u> |

Salaries and Wages Estimated This Quarter: \$6,102
Salaries and Wages Spent This Quarter: \$3,225
Accumulated Salaries and Wages To Date: \$13,088



| | |
|------------------|------------------------|
| Time Expended: | <u>68.0%</u> |
| Starting Date: | <u>August 1, 2006</u> |
| Completion Date: | <u>August 31, 2008</u> |

Figure 2 – Project Progress Schedule

Section 3

Accomplishments During the Reporting Period

Overview of Current Quarterly Activities

The project team worked on Parts 1 and 2 of the project during the fourth quarter of 2007. This report covers the project effort through the end of the quarter on December 31, 2007. A majority of the work effort was spent this reporting quarter on Part 1, Evaluation Plan and a limited amount of work was done on Part 2, Pilot Test. The results of these activities are described below.

Part 1, Evaluation Plan

The research team worked on four tasks of Part 1 during the three months of the fourth quarter of 2007. These activities were; Task 2 - Review Electronic Data; Task 4 - MDSS Recommendations; Task 5 - Development of Evaluation Plan; and Task 6 - Quarterly Report.

Members of the research team participated in one face to face meeting, one teleconference call with the project manager, and one teleconference call with the TAC panel during the reporting period.

Task 2 – Review Electronic Data

1. The two traffic detector sensors (Wavetronics) at the Alexandria ESS site have been brought on line and are reporting data.
2. All the bridge pavement sensors have been replaced and are reporting data.
3. Data from the Geonor T-200B are available but cannot be accessed remotely.
4. The Automated Vehicle Location (AVL) (IWAPI) system has been purchased. Mn/DOT is planning to install the equipment in five trucks at the Alexandria truck station. The equipment was not installed as of the end of the reporting period.

The research team was instructed to develop the recording forms for the pilot test at Alexandria as if there were no recording devices available.

Task 4 – MDSS Recommendations

Mr. Dan Peterson, Supervisor of Alexandria Truck Station, (phone 320-763-5045) reported that snow and ice control operations coverage on I-94 test site is normally 20 hours/day, but for winter events such as freezing rain, the operations coverage will increase to 24 hours/day. The MDSS system assumes bare pavement conditions will be attained within 6 hours after precipitation ends; but Mn/DOT strides to obtain bare pavement conditions within 4 to 5 hours. In preparation for this winter's snow and ice control operations, the application rates of prewetted salt have been revised to 100 to 500 lbs/lane-mile; the application rates of the 50/50 mixture of sand and salt will be 100 to 800 lbs/lane-mile. The setting and reporting on the spreader/controller for application rates will be in lbs/lane-mile. However, in practice, the amount of discharge will be for two lanes and will be windrowed along center line.

Task 5 – Development of Evaluation Plan

During the reporting period, a draft of the Evaluation Plan was submitted to the TAC panel for review and comment. The Evaluation Plan followed a detailed outline that was included in the quarterly report dated March 31, 2007. Review comments received from the TAC indicated a desire that the Plan contain the use of a test and control section in the evaluation of the effectiveness of deicing chemicals. The approach taken in the draft Plan was to look at LOS provided during the evaluation of deicing chemicals.

During a teleconference call with the TAC panel, the research team agreed to revise the Evaluation Plan to incorporate the use of test and control section into the guidelines for field testing of deicing chemicals. It is estimated that the revision of the Evaluation Plan is 95% completed at the end of the reporting period.

Task 6 – Quarterly Report

This quarterly report constitutes the sixth of eight reports to be issued for this project.

Part 2, Pilot Test

Task 1, Develop Data Collection Forms and Train Operators

Following the teleconference call on December 3, the data collection forms to be used in the Alexandria Pilot test were developed using the concept of test and control sections. Two different sets of data collection forms were developed: “Truck/Operator Activity Log” and “Weather and Pavement Condition Log.” The development of these forms assumed no sensor data would be available during the testing.

On December 12, a training session was held with the snow and ice control operational people at the Alexandria Truck Station. During the training, it was determined that the truck operator would be collecting information required by both logs. Consequently, the research team was instructed to revise the data collection forms so that all the necessary data that could not be determined from the sensors at the pilot test site could be recorded on one page (8.5 x 14). The revised data collection form and the two instruction sheets are given in a separate document entitled “Appendix. “

Section 4

Problems Encountered

The research team was required to revise a number of documents to comply with the conditions encountered in the field.

Section 5

Activities Planned for the Next Quarter

During the next quarter, the writing of the revised Evaluation Plan will be completed and the analysis of the literature search will be completed.

It is anticipated, that data collection forms for various storm events will be received from the Alexandria Pilot Test Site. Archived data from various sensors at the Alexandria ESS site will be downloaded. Analysis will be carried out shortly after receiving the information both from the field and the sensors.

Based on review of the data from the field, it will be determined if another site visit will be necessary during the coming reporting period.