

# **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**

**July 1, 2007 to September 30, 2007**

**SUBMITTED BY**

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**September 30, 2007**

## **Preface**

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This quarterly progress report summarizes the progress of the research team during the second 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 July 1 through the end of the quarter on September 30, 2007.

Edward J. Fleege  
Principal Investigator, and  
Overall Project Manager

## **Section 1**

### **Introduction**

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#### **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. A Mn/DOT snowplow truck 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 recommendation for modification to the testing procedures the 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**

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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**

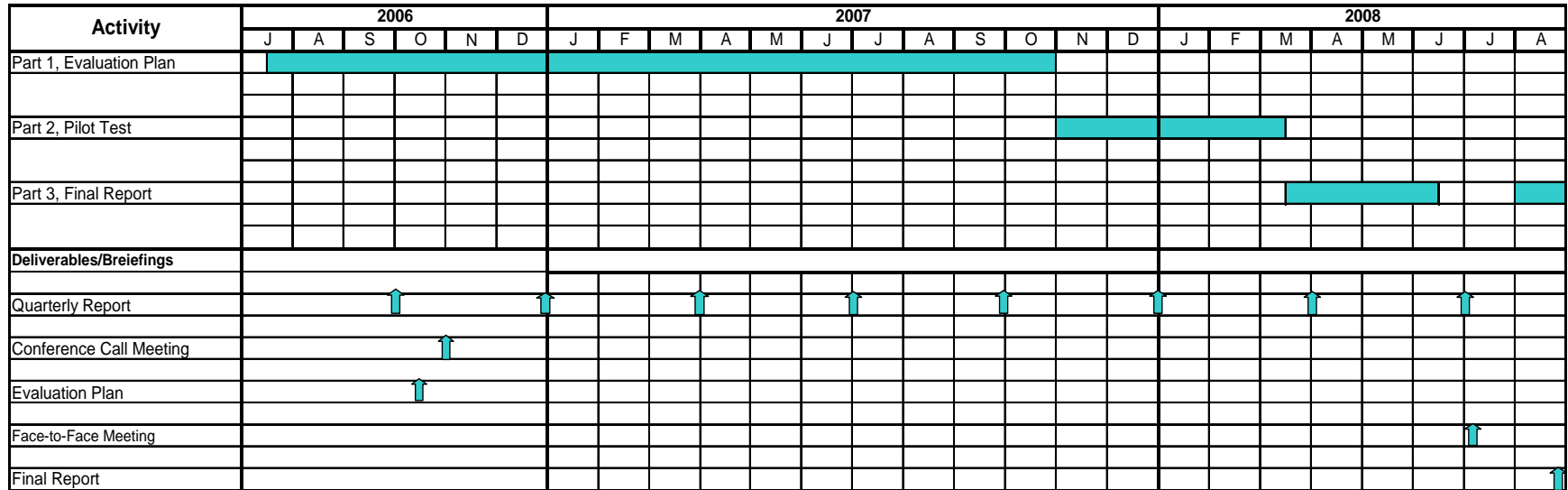


Figure 1 – Revised Planned Schedule of Activities

CLEAR ROADS RESEARCH PROGRAM  
WISCONSIN DEPARTMENT OF TRANSPORTATION

## PROGRESS SCHEDULE

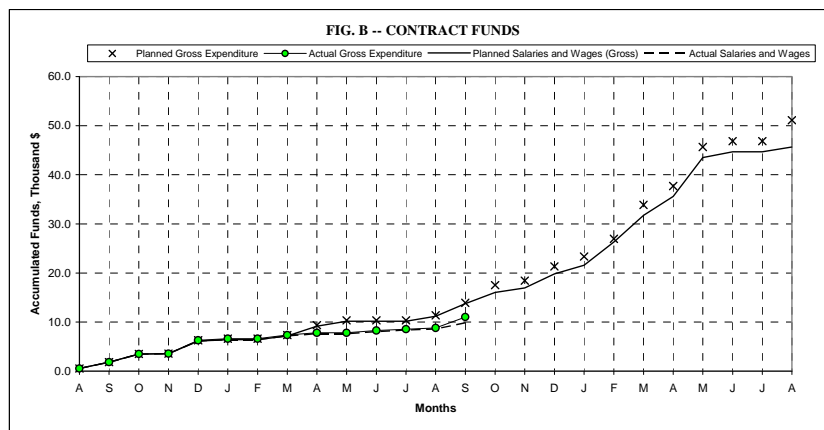
Project No. TPF - 5(092), Determining Effectiveness of Deicing Materials and Procedures  
Research Agency Edward J. Fleege  
Principal Investigator Edward J. Fleege

Year: 2007

Quarter: Third

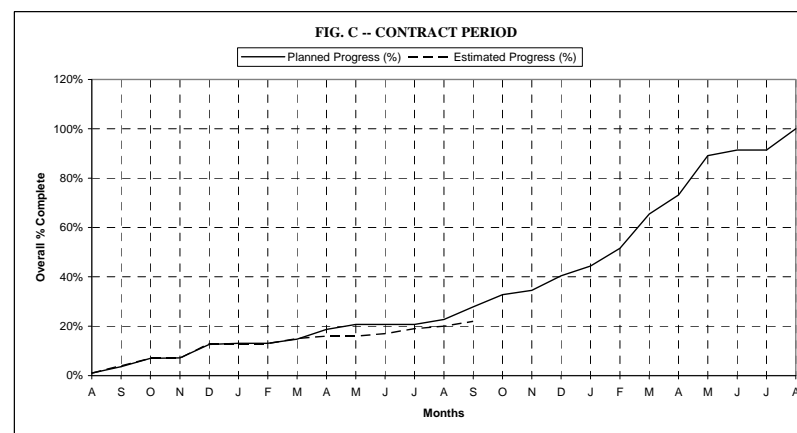
| RESEARCH<br>ACTIVITY   | 2006 |    |    |    |     | 2007 |     |     |    |    |    |    |    |    |     |    |    | 2008 |    |     |    |    |    |    | ESTIMATED %<br>COMPLETION |    |
|------------------------|------|----|----|----|-----|------|-----|-----|----|----|----|----|----|----|-----|----|----|------|----|-----|----|----|----|----|---------------------------|----|
|                        | 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 |    |    |      |    |     |    |    |    |    |                           | 55 |
| PART 2                 |      |    |    |    |     |      |     |     |    |    |    |    |    |    | 6   | 12 | 31 | 44   | 67 | 100 |    |    |    |    |                           |    |
| PART 3                 |      |    |    |    |     |      |     |     |    |    |    |    |    |    |     |    |    |      |    | 10  | 30 | 72 | 78 | 78 | 100                       |    |
| OVERALL %<br>COMPLETED | 1%   | 4% | 7% | 7% | 13% | 13%  | 13% | 15% |    |    |    |    |    |    |     |    |    |      |    |     |    |    |    |    |                           | 22 |

FIG. A -- OVERALL PROJECT SCHEDULE



|                       |                 |
|-----------------------|-----------------|
| Funds Expended        | <u>22%</u>      |
| Contract Amount       | <u>\$51,126</u> |
| Expended This Quarter | <u>\$2,776</u>  |
| Total Exp. to Date    | <u>\$11,031</u> |
| Balance               | <u>\$40,095</u> |

|  |                |
|--|----------------|
| Salaries and Wages Estimated This Quarter: | <u>\$3,560</u> |
| Salaries and Wages Spent This Quarter:     | <u>\$1,800</u> |
| Accumulated Salaries and Wages To Date:    | <u>\$9,863</u> |



|                  |                        |
|------------------|------------------------|
| Time Expended:   | <u>55.9%</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**

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#### **Overview of Current Quarterly Activities**

The project team worked on Parts 1 and 2 of the project during the third quarter of 2007. This report covers the project effort through the end of the quarter on September 30, 2007. Major of work effort was spent this reporting quarter on Part 1, Evaluation Plan and 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 three tasks of Part 1 during the three months of the third 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.

#### **Task 2 – Review Electronic Data**

Based on a meeting held on September 5 and communications with Mn/DOT, the following is the status of the various electronic data collection systems:

1. The two traffic detector sensors (Wavetronics) at the Alexandria ESS site were bought on-line on March 24. These sensors were than removed from the site for the summer to be used elsewhere. They are scheduled to be reinstalled at the site by October 15<sup>th</sup>. Mn/DOT has in-stock, a “Ground-Hog” pavement sensor that will be used as a supplement to the non-intrusive traffic detector sensors. It is planned to install the “Ground-Hog” sensor in the approach to the west bound bridge. Mn/DOT reports that the Ground-Hog sensor is not very reliable based on experience from other sites. The accuracy is in the range of  $\pm 10\%$ . The accuracy of the Wavetronics has been evaluated by other project at 3 locations. When properly calibrated, the absolute values of volume detection errors range from 0.2% to 3.5% for a given lane. The absolute values of speed detection errors range from 1.1% to 4.2%.
2. The bridges were overlaid this past summer that took out the FP2000 pavement sensors on both bridges. The west bound sensor will be replaced with another FP2000 and east bound sensor will be replaced with a Senslt Detector. Both sensors have been ordered and are planned to be installed in the middle of October. Mn/DOT does not know what parameters will be reported at this time by the Senslt Detector.
3. The Geonor T-200B is finally operational but access to the data is not available. Mn/DOT is planning to install a computer in their St. Paul office in order to have access to the data through their web portal. They are planning to have access to the data by either the middle or end of October.
4. The data from the precipitation sensor is finally reporting to the RPU and is accessible on the web site.
5. The Automated Vehicle Location (AVL) (IWAPI) system has been purchased. Mn/DOT is planning to install the equipment in five trucks for the Alexandra truck station. The equipment should arrive sometime in September. Mechanics will install

the equipment. IWAPI has been interfaced with the Dickey-john Control Point controller by Meridian. In discussion with John Mewes of Meridian, it was suggested that the research team should download the information for IWAPI from the Meridian archived database. The format of the data would be friendlier user.

#### **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 operation coverage will increase to 24 hours. The MDSS system assumes bare pavement conditions will be attained within 6 hours after precipitation ends; but Mn/DOT strives 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.

#### **Task 5 – Development of Evaluation Plan**

In the third quarterly report dated March 2007, a detailed outline for the Evaluation Plan and Associated Work Plan was provided to the panel for review, comments and concurrence by the Clear Roads Panel. The research team did not receive comments. Therefore, work began on writing the Evaluation Plan. However, as the research team began writing the Evaluation Plan, it became necessary to revise Section 5 of the "Evaluation Plan and Associated Work Plan." At the request of the Project Manager, the revised Outline will be submitted as a stand alone document for review. For documentation purpose, the revised Outline is included in this report as an appendix. It is estimated the writing of the "Evaluation Plan and Associated Work Plan" is 50% completed.

#### **Task 6 – Quarterly Report**

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

### **Part 2, Pilot Test**

#### **Task 1, Develop Data Collection Forms**

Very preliminary work began on developing data collection forms that will be used in the Pilot test.

## **Section 4**

### **Problems Encountered**

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The research team did not encounter major problems during the reporting quarter.

## **Section 5**

### **Activities Planned for the Next Quarter**

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During the next quarter, the writing of the Evaluation Plan will be completed; meetings are scheduled with Mn/DOT for the purpose of follow-ups on the various systems at the Mn/DOT's test site at Alexandria. It is expected that work will start on Part 2 of the project in next quarter.

## **Appendix**

### **Determining effectiveness of Deicing Materials and Procedures**

## **OUTLINE OF EVALUATION PLAN AND ASSOCIATED WORK PLAN**

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**1.2** Research Objective and Scope

**1.3** Overview of Part 1 – Evaluation Plan

**1.4** Organization of this Report

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**2.2** Survey of Snow Belt States

**2.3** Testing Procedures and Application Guidelines in Use

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