

# **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**

**January 1, 2007 to March 31, 2007**

**SUBMITTED BY**

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**March 31, 2007**

## **Preface**

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This quarterly progress report summarizes the progress of the research team during the first 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 January 1 through the end of the quarter on March 31, 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. 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 provide the results of the pilot test, and recommendation for modification to the testing procedures as result of the findings from 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**

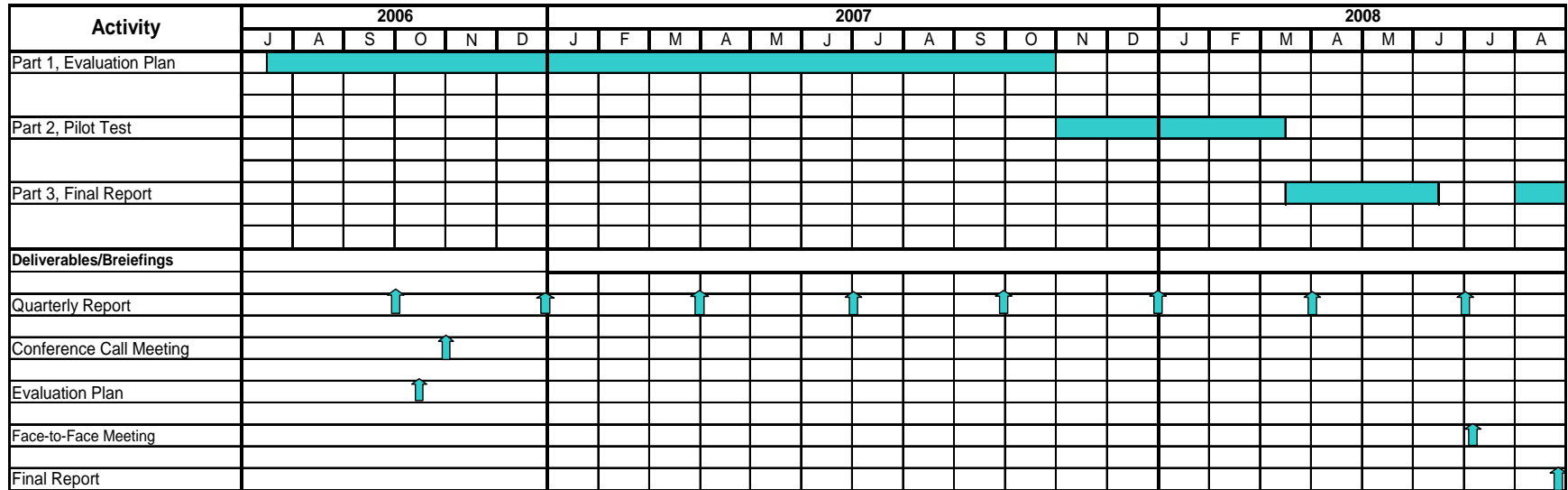


Figure 1 – Revised Planned Schedule of Activities

CLEAR ROADS RESEARCH PROGRAM  
WISCONSIN DEPARTMENT OF TRANSPORTATION

## PROGRESS SCHEDULE

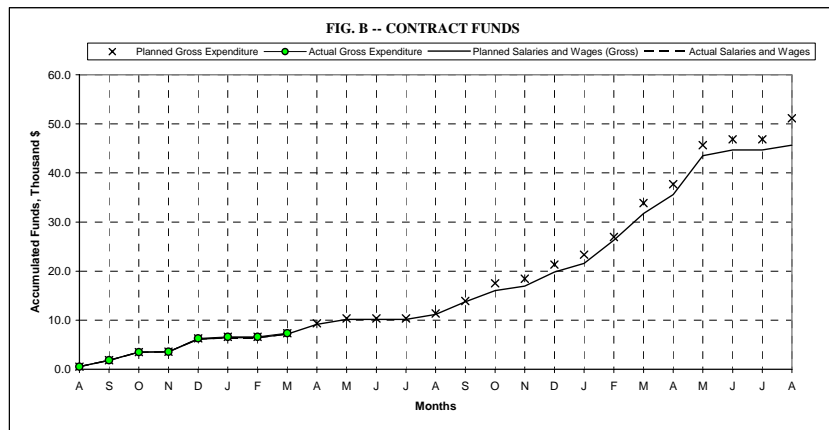
Project No. TPF - 5(092), Determining Effectiveness of Deicing Materials and Procedures  
Research Agency Edward J. Fleege  
Principal Investigator Edward J. Fleege

Year: 2007

Quarter: First

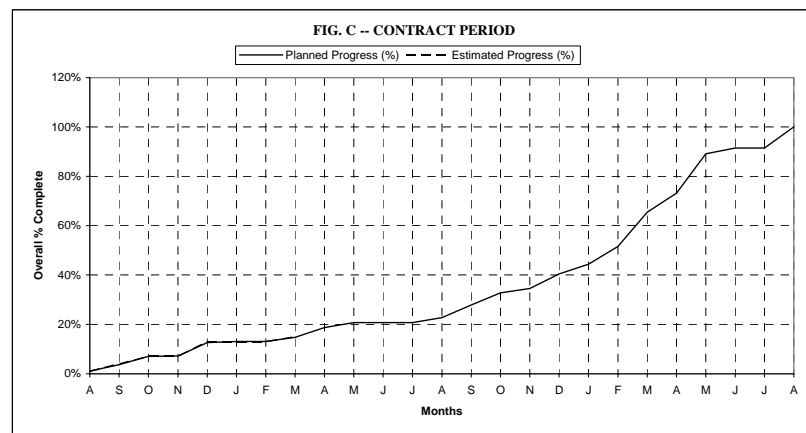
RESEARCH ACTIVITY	2006					2007										2008										ESTIMATED % COMPLETION
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	
PART 1	3	12	22	23	41	42	42	47	60	67	67	67	73	90	100											47
PART 2																										
PART 3															6	12	31	44	67	100						
OVERALL % COMPLETED	1%	4%	7%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

FIG. A -- OVERALL PROJECT SCHEDULE



Funds Expended 14%  
Contract Amount \$51,126  
Expended This Quarter \$1,054  
Total Exp. to Date \$3,525  
Balance \$47,601

Salaries and Wages Estimated This Quarter: \$1,050  
Salaries and Wages Spent This Quarter: \$1,050  
Accumulated Salaries and Wages To Date: \$7,163



Time Expended: 31.9%  
Starting Date: August 1, 2006  
Completion Date: August 31, 2008

**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 Part 1 of the project during the first quarter of 2007. This report covers the project effort through the end of the quarter on March 31, 2007. A limited amount of work was spent this reporting quarter on administrative details of the project. The balance of activities was devoted to Part 1, Evaluation Plan. The results of these activities are described below.

#### **Administrative Actions**

On January 9, the Principal Investigator participated in a conference call with the Clear Roads members to bring them up to-date on the status of the project and to answer any questions that the member may have. Also the MDSS's maintenance action recommendations, its parameter, and philosophy were discussed. Approval was obtained to extend the contract to August 31, 2008 and to add additional money to cover liability insurance for the extra year.

The project team received the Contract Release Order from the Department of Transportation Purchasing Section extending the contract and adding \$1,146.00. The Planned Schedule of Activities and Progress Schedule have been revised to reflect the time extension and additional cost.

#### **Part 1, Evaluation Plan**

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

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

Based on communications with Mn/DOT, the following is the status of the various electronic data collection systems:

1. The traffic detector sensors at the Alexandria ESS site were bought on-line on March 24. The speed data generated from the detectors output is displayed in Km/hour by the system software. Thus the speed has to be increased by a factor of 1.61 to obtain the values in MPH.. Mn/DOT will be making the necessary adjustments.
2. 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.
3. The images from the camera became available on March 24 on the Mn/DOT RWIS web site.
4. The data from the precipitation sensor is reporting to the RPU. However, Mn/DOT suspects there is a glitch in the polling software at the ESS site that disconnects the sensor reporting in a random fashion. During the week of March 19, diagnostic software was installed at the site that, hopefully, will locate and identify the glitch. A

- review of the RWIS web site during a recent rain storm shows the precipitation sensor is still not reporting on the web site.
5. The Automated Vehicle Location (AVL) system has been purchased but not installed on the trucks at Alexandria. Some snowplow trucks in other parts of the state have the equipment installed. Also, the interface of the system with the Dickey-john Control Point controller has not been completed. Meridian is developing the interface between the spreader/controller and the IWAPI controller. The research team is assisting Meridian by providing information on the Dick-john controller that was gathered from the other Clear Roads Project.
  6. The research team has been advised that a new type of research overlay project is being requested for the bridges and their approaches at Alexandria. If this project is approved and the overlay is installed, all the pavement sensors will be covered. However, Mn/DOT believes that funding can be obtained to replace the pavement sensors before next winter season, if the overlay project goes forward.

#### **Task 4 – Review MDSS**

As a result of the conference call on January 9, Meridian has modified some of the parameters that are being used in the MDSS recommendations.

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

A detailed outline for the Evaluation Plan and Associated Work Plan was developed during the reporting period. The outline is given in Appendix A. The research team welcomes any review comments and concurrence by the Clear Roads Panel on the outline.

#### **Task 6 – Quarterly Report**

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

#### **Part 2 – Pilot Test**

The planned Part 2 activities that included the development of the various collection forms, the training of the operators in the use of the forms, the attempt to collect data from one or two events in March was not possible because the IWAPI system is not operational.

## **Section 4**

### **Problems Encountered**

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The research team encountered a number of problems that have prevented the team from acquiring a thorough understanding of what data will be reported from the various systems. Without this information it is not possible to develop an evaluation plan to test the proposed guidelines during the Pilot Test. The problematic issues that have been identified are:

1. The video camera at the Alexandria ESS site has not been reporting the images from the site.
2. The precipitation sensor at the ESS site is not been reporting precipitation.
3. The Geonor T-200B Series Precipitation Sensor is collecting data but it is not able to communicate with the outside world.
4. Mn/DOT is replacing their Automated Vehicle Location (AVL) equipment with equipment from a new vendor, IWAPI. The new equipment has been purchased. However, a contract needs to be developed by Mn/DOT for the installation of the equipment into the snowplow trucks at Alexandria.
5. The interface between the spreader controller and the AVL system still has to be developed. The research team needs to know what information and, in what format, will the data be archived by IWAPI.

## **Section 5**

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

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During the next quarter, work will begin on writing the Evaluation Plan. Also, various follow-ups will be made on Mn/DOT's progress on the installation and/or repair of the various systems at the Mn/DOT test site at Alexandria.

## **Appendix A**

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

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

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### **1.0 Introduction**

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- 1.2 Research Objective and Scope**
- 1.3 Overview of Part 1 – Evaluation Plan**
- 1.4 Organization of this Report**

### **2.0 Review of Related Research And Guidelines**

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- 2.2 Survey of Snow Belt States**
- 2.3 Testing Procedures and Application Guidelines in Use**

### **3.0 Review of Electronic Data and Related Information at Alexandria, MN Test Site**

- 3.1 MDSS Data**
- 3.2 RWIS Data**
- 3.3 IWAPI Data**
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### **4.0 Alexandria Test Site Characteristics**

- 4.1 Geography**
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  - 5.1.1 LOS Characterizations**
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- 5.5 Performance – Based LOS
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- 5.6 Development of Tables and Figures Used in Evaluating the Effectiveness of the Winter Road Chemicals
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    - 6.7.2 Weather and Pavement Condition Log, Definition of Terms and Instruction for Use
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