

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 period

August 1, 2006 to September 30, 2006

SUBMITTED BY

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September 30, 2006

Preface

This quarterly progress report summarizes the progress of the research team during the third calendar quarter of 2006 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 through the end of the quarter on September 30, 2006.

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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 2006 - 2007 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 2006 –2007. 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

The research on the project began on August 1, 2006, the date of the contract starting date. The project will be conducted over a 12-month period of performance and be completed by July 31, 2007. The planned schedule of activities by parts is presented in Figure 1. This schedule reflects the start date of August 1, 2006 and a 12-month period of performance.

The 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.

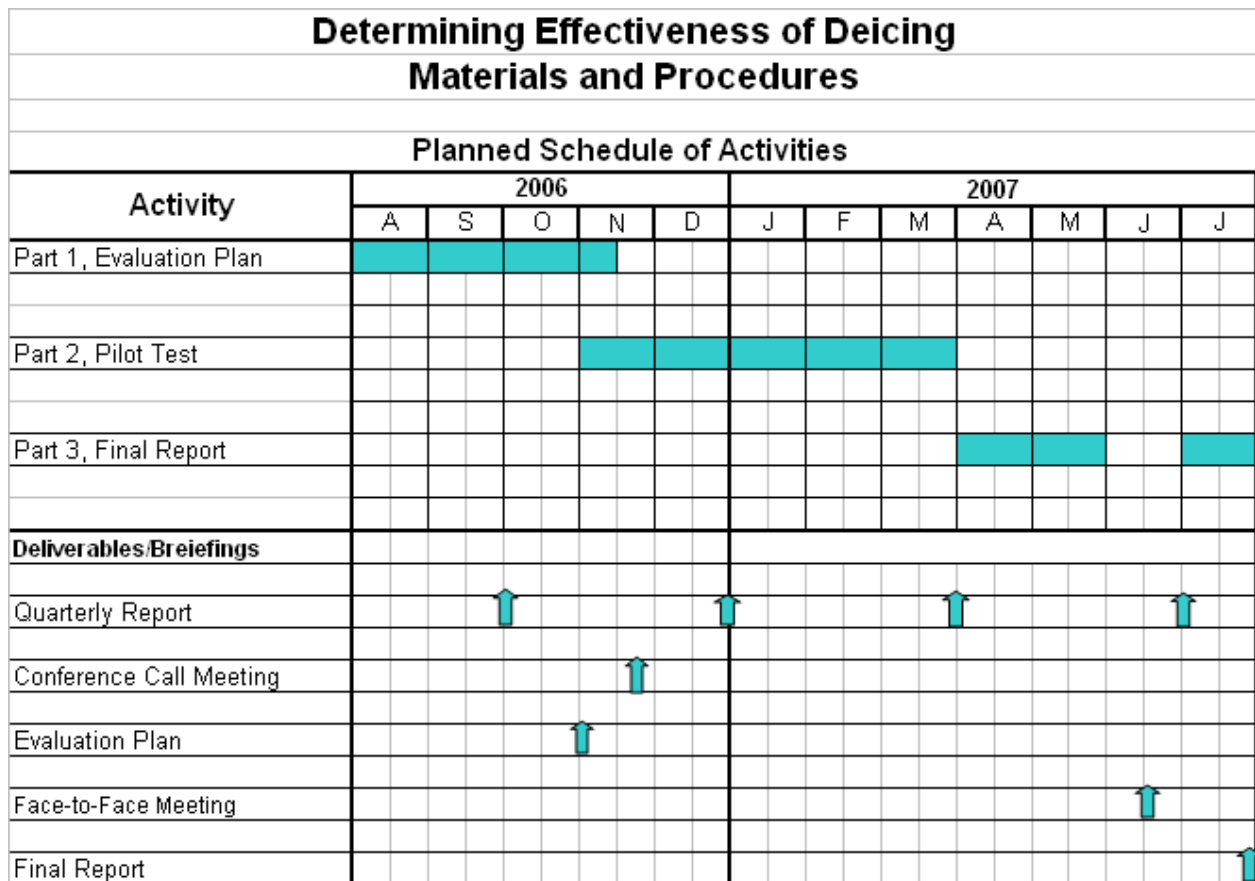


Figure 1 – Planned Schedule of Activities

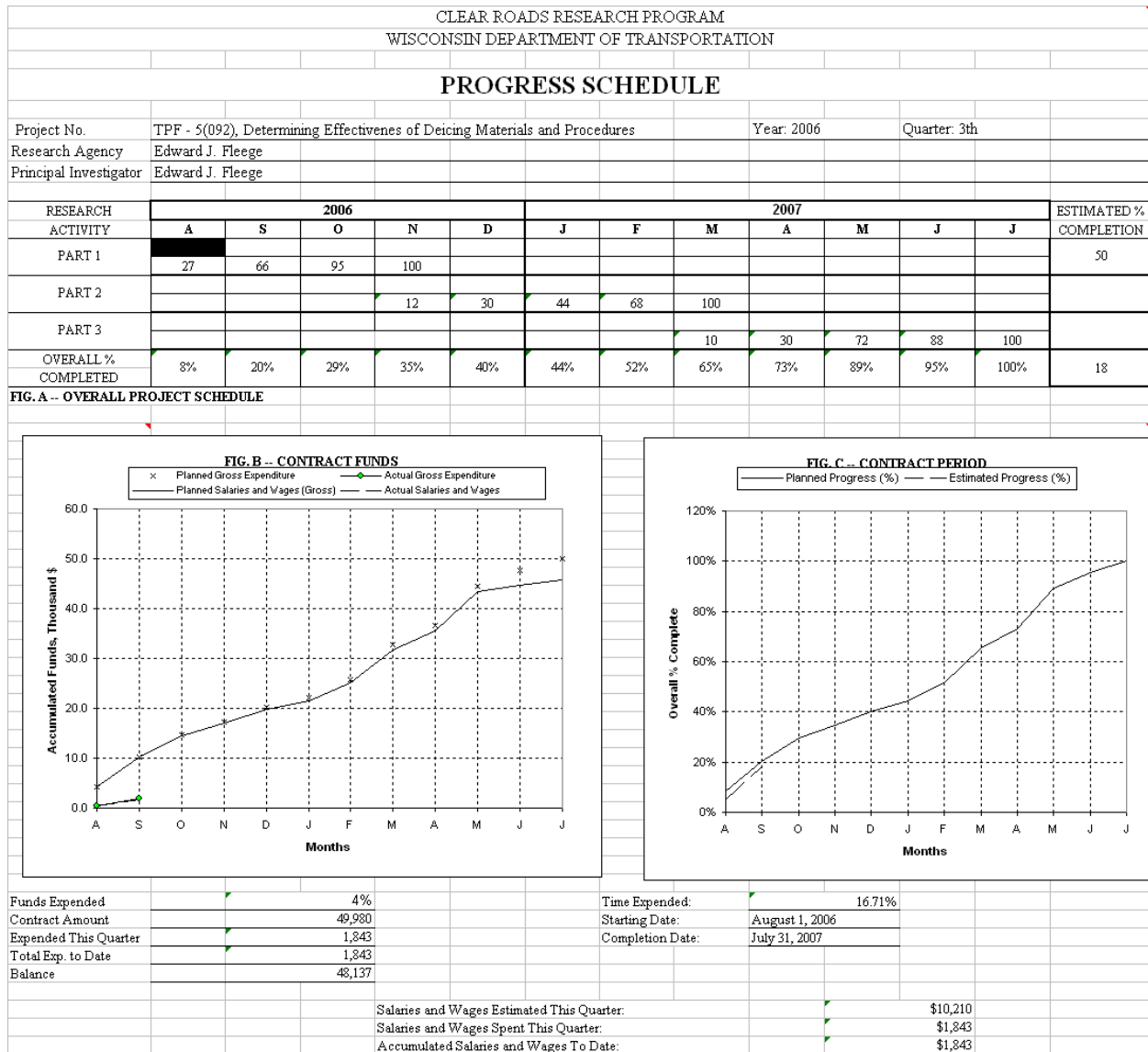


Figure 2 – Project Progress Schedule

Section 3

Accomplishments During the Reporting Period

Overview of Current Quarterly Activities

The project team worked on Part 1 of the project during the third quarter of 2006. This report covers the project effort through the end of the quarter on September 30, 2006. All of the work effort during the two months in this quarter was devoted to Part 1, Evaluation Plan. A minor effort was devoted to the administrative details of the project. The results of these activities are described below.

Winter Events

The work plan that was submitted for Part 2, Pilot Test, describes the data to be collected across a representative sampling of winter events. This work plan was amended to anticipate that a minimum of 5 and a maximum of 10 events would be recorded and analyzed, assuming an availability of winter events and field operator cooperation.

The research team reviewed the definition for a “winter event” that Minnesota Department of Transportation (Mn/DOT) uses in their record keeping. A winter weather event occurs when it is necessary for resources (labor, equipment, material) be consumed to prevent, minimize or regain the loss of bare lanes. Seven different winter weather events have been identified: freezing rain/drizzle, sleet, snow, drifting/blowing snow, frost, ice/black ice, or refreeze or any combination thereof.

Prevention is when resources are used before or during the event such as anti-icing, or applying chemicals to prevent the loss of bare lanes. Minimization is when resources/chemicals are used to reduce the effects or impact of bare lanes lost. And “regain” is the processes/resources needed to regain the loss of bare lanes.

Bare lane condition is considered to have been achieved when all driving lanes are free of snow and ice between the outer edges of the wheel paths and have less than 1 inch of accumulation on center of the roadway while center stripe and fog lines can still be covered with ice and snow. Shoulders and ramps are not required to meet this standard.

An event occurs even if bare lanes have not been lost, provided that resources have been used as defined in event definition. A new event is considered to have occurred, if an event stops and restarts after three hours.

The research team will be using this definition of “winter event” for the duration of the project.

Part 1, Evaluation Plan

The research team worked on two tasks of Part 1 during the two months of the third quarter of 2006. These activities were Task 1- Literature Search; Task 2 - Review Electronic Data; and Task 4 – Review MDSS Information.

An extensive literature search was conducted using the Transportation Research Board – Transportation Research Information Services (TRB-TRIS) to identify relevant information on performance measurements for snow and ice control operations and the performance of RWIS data. Over nine different searches were conducted using various combinations of key words. The number of hits per key word combination ranged from 1 to 1151 citations. The number of potentially useful papers/reports was reduced to 32 by a review of the citation titles. Nearly all the papers/reports have been given at either one of 4 conferences; Sixth International Symposium on Snow Removal and Ice Control Technology that was held at Spokane, Washington on June 7-9, 2004; 85th Annual Meeting of Transportation Research Board at Washington D. C. on January 22-26, 2006; 11th AASHTO-TRB Maintenance Management Conference at Charleston, South Carolina on July 16-20, 2006; and XIth International Winter Road Congress (PIARC) meeting at Sapporo, Japan on January 28-31, 2002. Copies of all these papers/reports are in the possession of the research team in electronic format. We are in the process of obtaining hard copies of the papers that are not in electronic format.

A member of the research team met with Linda Taylor, Curt Pape, and Rocky Haider from Mn/DOT for the purpose of accessing the various databases in order to obtain and record data during Part 2, Pilot Study. The following is information obtained concerning the various sensors and databases.

1. Mn/DOT's FTP site (<ftp://ftp.rwis.dot.state.mn.us>) has archived data on RWIS, Camera images, and SAIL II. The archive data for the RWIS is in comma-delimited format. The various databases are archived for only 5 days. The user name and password needed to access the FTP site has been obtained from Mn/DOT. However, Mn/DOT still has to provide the decoding format for the comma-delimited format.
2. The Geonor T-200B series all weather precipitation gauge is located at a nearby truck station. This sensor monitors the liquid equivalent of precipitation and measures snow depth. The data is collected with a Campbell Scientific data logger and all the data is archived on the logger. Access to the database is by telnetting through Mn/DOT web portal web site. Address for the web portal is: <http://webportal.dot.state.mn.us>. The user name and password needed to access the webportal site has been obtained from Mn/DOT. Technical specifications for the Geonor T-200B are still to be forwarded to the research team.
3. Goodrich Ice Detection Camera has not been installed and there is a very good possibility that the sensor will not be installed in time for this project.
4. The research team is in contact with John Mews of Meridian Environmental Technology Inc. (phone: 701-792-1892) to obtain MDSS forecast information that is provided to Mn/DOT. The information is presented in graphic format, it is up-graded constantly, and is not archived. Therefore, it will be necessary for the recommended application rates to be archived in a format that can be user friendly. The research team will be working with

Mr. Mews in the next quarter to develop a archive system that is acceptable to all parties. Mn/DOT has indicated that they would be providing the research team a copy of the software so that real time data can be viewed.

5. Mn/DOT is considering changing their Automated Vehicle Location System (AVL) (SAIL II) that is presently being used. They considering switching to IWAPI, which is a vendor, located in Boulder, Colorado. Mn/DOT expects to make the decision within the next 6 to 8 weeks. SAIL II data is archived on the above-mentioned FTP site.
The present system is able to collect a total of 18 parameters. For the application of material on the roadway, only three types of materials can be recorded; straight salt, a sand mixture of 90% sand/10% salt, and a mixture of 50% sand/50% salt.
6. Access to Mn/DOT's "Program & Project Management System (PPMS) has been provided to the research team. This database contains their "Snow and Ice Report – Sand, Salt, and Brine Report."
7. Road Condition Reporting Systems (MNCARS) is not considered to be very accurate by maintenance operations. And thus they don't use the information in their decision-making process. The inputting to the system is by the Highway Patrol. The data is used in the 511 system.
8. Mn/DOT is planning to purchase two detectors so that the traffic can be monitored in both directions. The detectors will be E15 sensors. The detectors will be mounted on the ESS tower and data will be available on the FTP site under the RWIS database.

Following the meeting, it was determined that the communication system to the Geonor T-200B series all weather precipitation gauge is not working. Also Mn/DOT has made the decision to replace their AVL system. They plan to install the new system sometime in middle of November and hope to have the system operational by December 1. Mn/DOT is planning to purchase the two traffic detector the first part of next quarter.

The research team reviewed the format of the RWIS data that is available on the FTP site (<ftp://tdrl.d.umn.edu/pub/rwis>) at Northland Advance Transportation Systems Research Laboratories on the University of Minnesota Duluth campus.

Section 4

Problems Encountered

No major problems were encountered during the reporting period.

Section 5

Activities Planned for the Next Quarter

During the next quarter work on Part 1 will be completed. The main activities will be: complete the literature search; the review of key literature reports/papers; follow-up on the progress being made on the installation of the various systems by Mn/DOT; development of Evaluation Plan. Activities for Part 2 will begin with the development of the various collection forms and training the operators to use the forms.

There may be a delay in beginning to collect data on winter events due to the installation of the AVL system and traffic detectors. However, we may use the month of November to fine tune the collection systems for the pilot study.