

Pooled Fund Study Project TPF-5(054)
SDDOT Project SD2002 – 18
Development of Maintenance Decision Support System
Phase IV
QUARTERLY PROGRESS REPORT
July-September 2007

Overview

The primary focus of the Phase IV third quarter (2007) was assessing Field Deployment Transition I (FDT-1) activities and using that assessment to assist in guiding research and operational directions. Activities during this time frame include state interviews for assessment of FDT-1, analysis of case studies collected during FDT-1, refinements to MDSS software related to case study analysis, GUI enhancements and refinements, compilation of a major report draft, planning for deployment strategies, and development of research directions for the PFS.

The analysis of case studies provides valuable information on how different modules react in various road weather situations. The analysis of case studies can lead to refinements of the existing modules and ultimately then lead to better road conditions and treatment recommendations. The complete list of FDT-1 case studies can be found in Table 1 with highlights on cases that have been used for extensive analysis to date.

MDSS Graphical User Interface (GUI) enhancements were an ongoing process through quarter III. Some of the enhancements within the system include a truck trace route feature, alternative MDSS maintenance actions, a new version of the MDSS GUI compiler, and a new version of OpenMap software. The latter two activities were aimed at both reducing the GUI download size and improving GUI performance.

While the PFS MDSS research project will continue through at least another winter, a major report was requested by the PFS states in order to get a better understanding of where the project has been and possible future directions. The third quarter was spent compiling a report outline and generating rough drafts of most of the sections within the report.

Progress by Task

Specific accomplishments on the explicit tasks of the Phase IV work plan during the third quarter of 2007 follow.

Task 1: Implement version 2.0 of the PFS MDSS in state agency offices in individual and multi-state test regions as determined by the Technical Panel and evaluate its performance during 2005-06 winter operational maintenance activities

Task completed. No additional activities during Q3 2007.

Task 2: Identify required additional research necessary to continue the enhancement of MDSS within an operational environment

Table 1 lists the different case studies collected during FDT-1. Case studies that are shaded have been analyzed in-depth and used to further develop modules within MDSS. In addition, case studies from DFT-2 (2005-2006 winter season) were also reevaluated with the most current versions of the MDSS software.

Location of the Event	Date	Type of Event	Observers
Columbus, IN	2/13/07	Freezing Rain & Snow	Tony McClellan & Gary Phillips
Yankton, SD	2/24/07	Heavy Snow	Ed Rogers, SDDOT
Red River Valley	3/01/07	Compacted Snow	John Mewes & Ben Hershey
Iowa	3/03/07	Major Ice and Snow	None
Red River Valley	3/15/07	Multi-faceted Snow event	John Mewes & Ben Hershey
Alexandria, MN	4/2/07	Snow event	Daniel Peterson
Kansas	4/13/07	Late Season; Heavy Snow	None
New Hampshire	4/15/07	Late Season; Heavy Snow	None

Table 1: Case studies performed during the first and second quarter of 2007

A large volume of data were collected from these cases; including MDSS forecast data, photographic and subjective observations, camera imagery, as well as NWS and RWIS observations.

The most important outcomes of the FDT-1 case studies to date have been modifications to the downwelling radiation calculations supplied to MDSS, changes to the intra-particle bonding of snow particles on the road (which affects traffic and wind removal of snow), and a better understanding of the sensitivity of MDSS to the texture depth of the road using the present ‘percent ice’ based road condition assessment mechanism.

Task 3: Prepare for the Field Deployment Transition (FDT) to be conducted during the winter of 2006-07

Task Completed. No additional work was performed during Q3 2007.

Task 4: Perform scientific validation of observed weather variables and comparison with input variables to the PFS MDSS

Task Completed. No additional work was performed during Q3 2007.

Task 5: Perform an assessment of the validity, acceptance, utilization and operational requirements of MDSS within State DOT winter maintenance practices

Winter wrap-up surveys were conducted across the states during the second and third quarters. Information from these surveys provided Meridian feedback on the MDSS GUI and other components of the MDSS system. The feedback included users opinions of the validity of the system, how well it was accepted into their daily maintenance routine, how often the operators and supervisors used the system, and how it was used in an operational setting within each individual garage/truck station. The feedback surveys provide the needed opinions to change or modify certain aspects of the system that were either confusing or not naturally intuitive. The surveys also provide Meridian with feedback regarding new features that were desired within the system.

Task 6: Develop a strategy to transition the MDSS PFS to a broader state DOT audience and full deployment

A major obstacle to broader MDSS deployment is the need for more information on the potential costs and benefits of MDSS deployment. After consideration of several potential approaches to this problem, the project Technical Panel settled on a simulation-based approach. In this approach the MDSS modeling software would be used to simulate maintenance activities and road conditions resulting from both current operating practices and from following MDSS' recommendations for winter maintenance operations. Simulations are to be performed over the course of the past 5 to 10 winter seasons using historical weather observations. Comparison of data from the current operating practices simulation with actual DOT records (maintenance and road condition) is to be used to both tune MDSS' settings and to gain a measure of confidence in the simulation approach. Once configurations are optimized, the simulations would then be repeated with MDSS' logic for generating recommendations. Comparisons between the maintenance resources utilized and resulting road conditions from the two different approaches to maintenance will then be used to assess potential benefits of MDSS.

Meridian is responsible for the simulation portion of this assessment. During Q3 Meridian developed a national database of weather observations for the past 10 winter seasons. This database is comprised of NWS/FAA weather observations, taken mostly at airports, as well as radiation information extracted out of the gridded North American Regional Reanalysis (NARR) dataset available from NOAA. Software was also written to convert this weather information into the format required by MDSS, and to then coordinate the operation of the recommendation modules (whether MDSS' or those associated with current operating practices) in order to generate simulations of the maintenance required to address historical weather conditions and the road conditions resulting from those maintenance activities. Initial comparisons, performed on the I-93 routes in New Hampshire, appeared to indicate that the simulation approach holds considerable promise. Completing these simulations for selected MDSS routes across the PFS states will be a major objective of Q4 of 2007.