

**Pooled Fund Study Project TPF-5(054)**  
**SDDOT Project SD2002 – 18**  
**Development of Maintenance Decision Support System**  
**Phase III**  
**FOURTH QUARTERLY PROGRESS REPORT**  
**October – December, 2005**

**Overview**

The fourth quarter of Phase III focused on the setup and implementation of Demonstration Field Test for Year 2 (DFT-2). The second interim release issued in quarter 3 was still the test version at the beginning of October, 2005. This interim version provided the foundation for analysis of the new software during two intense early storms which occurred in western North Dakota on October 6-7 and Colorado on October 10. The version was further tested during training in each of the member states during October and early November. Meridian moved closer to the formal release of Version 2.0 with the release of MDSS version 1.99 on October 20, 2005. Version 1.99 was a final check of the software prior to the release of Version 2.0. An issue developed with Version 1.99 that forced Meridian to do considerable testing to find a solution. The problem was isolated around November 20 and Version 2.0 was then released on November 22, 2005. Version 2.0 remained the operational version of the software through the end of Quarter 4.

**Develop and integrate new technologies into MDSS (Task 2)**

This winter's research on the performance of the blowing snow model at the University of North Dakota (UND) Surface Transportation Weather Research Center (STWRC) was initiated in November with the first onset of snow at the UND STWRC Road Weather Research Facility near Buxton, ND. This field research facility has been specially instrumented to measure meteorological conditions during winter events with particular emphasis on the measurement and analyses of blowing snow conditions. The algorithms associated with blowing snow and pavement precipitation estimation developed in this UND research will be integrated into the MDSS during DFT-2 for further evaluation.

**Test the graphical user interface and internal MDSS processing during DFT-2 (Task 3)**

As stated above, Meridian released the MDSS Version 2.0 software three weeks after the projected release date. This software release contained only minor changes from the software in Version 1.99 that had been sent out earlier. The delay in the formal release of Version 2.0 was due to a bug found in Version 1.99 that occurred when the software was left running continuously for more than 24 hours. Meridian performed extensive testing to isolate the source of the bug and

finally determined that the issue was in the version of the Java compiler used to compile Version 1.99. When Meridian reverted to an older version of the compiler the issue was resolved. This compiler defect had essentially no impact on the appearance or performance of the MDSS software itself; therefore, the MDSS in its Version 2.0 form was operational from October through the end of Quarter 4.

Meridian spent a considerable amount of time early in the quarter setting up the route information for a large number of new routes in order to assure the route information would appear once participants started actively using the MDSS software as part of their maintenance support function. This route setup required a significant coordination and time commitment between Meridian development personnel and the MDSS coordinators in the member states.

While the winter of 2004 - 2005 saw the integration of the first automated Mobile/Maintenance Data Collection (MDC) data into the MDSS (from Colorado), this quarter saw the expansion of the technology to several other states, as well as to new vendors. MDC activity thus took on two fronts. First, techniques for downloading, storing, and integrating the data were modified based upon knowledge from the first year of data collection, and introduction of data from new vendors. Second, in an ongoing task, new processes are being developed to implement the integration from the additional MDC states and vendors as they come online. At the end of the 4<sup>th</sup> Quarter automated MDC data was flowing operationally into MDSS from trucks in Colorado, Kansas, and Wyoming equipped with IWAPI data collection devices. In addition, data from North Dakota trucks equipped with Location Technologies devices was also nearly operational.

GUI and internal processing software modifications continued up to and through the release of v2.00 in late November. Most of the GUI modifications between v1.99 and v2.00 simply addressed problems noted during the DFT-2 training sessions. Major software revisions completed during the 4<sup>th</sup> quarter included:

- the introduction of a camera images layer to the Map View of the GUI,
- the initiation of a road condition auto-reset to act as a virtual snowplow on MDSS test routes in the absence of reports,
- incorporation of the ability to report prewetting rates & chemicals in prewet applications,
- peer-to-peer networking within the GUI to improve performance when other users on the same network are already logged in to the MDSS GUI (not yet released),
- a right-click feature on the Map View of the GUI that allows users to access items on the map that reside in very close proximity to each other (not yet released),
- user-definable alert monitoring areas separate from the Statewide and Current View options previously available in the Alert Panel of the GUI (not yet released).

Finally, following the discussions in the December 2005 Technical Panel meeting, a description of the materials & practices configuration information for each MDSS test route was sent out for review and modification. A fraction of this information was reviewed and/or modified by test area participants and configured into the operational MDSS processing by the end of the 4<sup>th</sup> quarter.

#### **Validation Program (Task 4)**

A User's Field Observation (UFO) Guide served as the roadmap for validation efforts during DFT-1. The guide contained a data collection form and detailed explanations of the techniques recommended by Meridian to collect data necessary to validate the performance of the MDSS and the recommendations issued by the decision support system. The UFO document was modified in late September and early October for release as part of the DFT-2 training sessions held in each of the states during October and the first week of November. The MDSS field coordinator at each of the test sites received multiple copies of the guideline for distribution amongst the local team participating in the validation program. During the training sessions the Meridian trainers worked with the DOT coordinators to establish the test routes and resources available for the DFT-2 validation test.

Based upon the validation efforts done in DFT-1 Meridian determined that a more structured and rigorous validation approach was needed during DFT-2. The validation program was reconfigured into two separate approaches. The first was an extension of the program that was done during DFT-1; however, Meridian designated a single coordinator for the independent validation efforts at the member-specified test sites within the eight member states. The coordinator developed a standard operating procedures document and coordinated communications with each of the participating test sites. This organized test program will be solidified in the first two weeks of 2006.

An analysis of the results of DFT-1 indicated that Meridian needed more detailed information to truly assess the performance of the MDSS. The questions that needed to be resolved included:

- Does the MDSS pavement condition model accurately portray pavement conditions if the correct weather, maintenance actions, and traffic information are entered?
- Are the maintenance recommendations reasonable?
- To what extent are the MDSS recommendations being utilized and what are the reasons maintenance personnel use or do not use these recommendations?

The Meridian research team determined that it would require a number of concentrated case studies to answer bullets 1 and 2 above. The case studies needed to be done on routes with good supplemental data such as a nearby

RWIS site, a nearby NWS ASOS or AWOS site, and/or an MDSS validation site. The selected route for the case study needed to have either an automated data collection system or the mechanism in place to effectively report maintenance actions using one of the reporting systems in use with the MDSS program. The data collection requirements included detailed documentation of maintenance actions and traffic at a single point along a route followed by a regular collection of detailed observations and/or measurements of pavement conditions, weather, and traffic at that site at specified intervals (15 – 20 minute time steps). The detailed information would include: weather observations; pictures of the weather and pavement conditions; samples of the material on the pavement to assess the chemical concentration; descriptions of the pavement constituents, the cross sectional profile, and the movement of material caused by traffic; and a description of the effect of the plowing action and/or the application process of material (bounce, scatter, etc.). Physical field observations could also be supplemented by cameras that were already part of the state traffic operations network. At the same time that these field data were being collected it was essential to monitor and log the maintenance decisions that were being used to define the maintenance actions that were being measured. This required that the observer be present at the decision point or travel with the supervisor that was making the decision.

In order to accomplish this rigorous data collection goal, Meridian determined that it would need to send two individuals to execute the case study. Logistics, budget considerations, and personnel scheduling dictated that the number of case studies would need to be limited to roughly 10 – 12 during DFT-2. Given these guidelines and the site considerations specified above, 10 routes were chosen as part of the Case Study program. Meridian designated a coordinator for the program and established two-member teams that would be prepared to deploy if a winter event seemed imminent at one of the Case Study sites. The coordinator is also tasked to work directly with DOT coordinators or test facilitators to add DOT participants who would be available to assist in the data collection process during these case study events. The case study team will work closely with the local supervisor(s) on duty during the winter event and the team is tasked to work with the vehicle operators at the site to set up arrangements for the operators to participate in the case study reporting program. The primary responsibility of the operators will be to communicate their actions with the case study team, particularly regarding maintenance actions in the vicinity of the observation site.

The plan to address the third bulleted question - the acceptance of the maintenance recommendations – is part of the duties handled by the team member who monitors the decision making process. However to get a good assessment of the level of use requires an assessment of user acceptance of maintenance recommendations over the entire winter. Meridian will assess the use of these recommendations through a survey done by supervisors and operators near the end of the DFT-2 test period.

## **Develop a Strategy to Extend MDSS Participation (Task 5)**

An exhaustive review of various business models for the PFS MDSS was made subsequent to the August PFS MDSS Technical Panel meeting per the direction of the Technical Panel members. The result of this review revealed three existing models found within the public sector including transportation agencies. These existing models included the continuation of a pooled fund activity similar to the CARS/511 pooled fund, the transfer of technology to an third-party organization for distribution, maintenance and future development such as is performed by AASHTOware, and the formation of a public-private partnership for the purpose of marketing the PFS MDSS. A document was drafted by Meridian summarizing the three models and described possible scenarios by which they could be incorporated within the PFS MDSS. This document was distributed at the December Technical Panel meeting in Sioux Falls, South Dakota. After considerable discussion at the meeting it was decided by the group that the two best business model options at this time are either (1) transfer of the PFS MDSS software to AASHTOware or (2) the formation of a Limited Liability Company as a public-private partnership between the state participants and Meridian.

A complementary document to the business plan was developed by Meridian in the form of a draft intellectual property ownership agreement. Members of the Technical Panel meeting in August had identified intellectual property ownership as a crucial item needing resolution. This document provided for joint ownership between the state participants and Meridian of PFS MDSS modules developed as a result of the pooled fund effort. The Meridian modules pre-existing the pooled fund efforts are to be retained in their entirety by Meridian. The draft intellectual property document was also distributed at the December Technical Panel meeting.

No formal actions were taken on either document as the material required further study by all meeting participants.