BEGINNING IN A POOLED FUND STUDY

A Maintenance Decision Support System (MDSS) is, in its most general terms, an automated tool for providing decision support to winter road maintenance managers. In a broader sense, MDSS is a multi-layered, information system that provides forecasts, predictions, reports on observed weather and road conditions, serves as a training tool, and becomes a management support system that can be utilized year round. In discussing MDSS, it is important to evaluate the system from the beginning, as well as glimpse to the future to see all of the possibilities the system may hold.

In the late 1990's, Indiana Department of Transportation (INDOT) decided to take an aggressive approach utilizing new technologies, such as a MDSS, to more effectively fight snow and ice. As a result, INDOT joined several pooled fund study groups. At the same time, the Federal Highway Administration (FHWA) launched a project under the FHWA's Road Weather Management Program to look at developing an MDSS prototype. The FHWA MDSS project involved developing a prototype that could be used by the private sector to develop their own MDSS based on the needs of individual clients. The idea of the MDSS project was to integrate state-of-the-art weather forecasting with road data and maintenance rules to produce a model for optimal treatment.

In late 2002, INDOT joined a new pooled fund study (PFS) group that was pursuing the development of an operational MDSS. This PFS was designed to follow the FHWA MDSS plan. The PFS project began with 5 states and has grown to include 18 states; each in different stages of deployment. By participating in the PFS since its inception, INDOT has helped guide development of the MDSS in order to meet its operational needs for fighting snow and ice, primarily.

As the field trials were conducted, some unexpected results were found. One INDOT Sub-District reported a thirty percent savings in salt usage from its neighbor. Other Subs participating in the

field study realized at least ten percent savings from their neighbors. These results were viewed with some skepticism, but INDOT's Commissioner was facing a new issue in early 2008: declining revenues.

After learning about the significant savings achieved by these groups during field testing, INDOT's Commissioner at the time, Karl Browning, decided that MDSS would be implemented statewide for the 2008-2009 winter. However, declining revenues meant that INDOT needed an innovative method to fund the necessary equipment. It was decided by Commissioner Browning that funds for this project would come from existing salt resources. This turned out to be an excellent motivator for additional salt conservation and building buy-in to this new system.

CHANGING QUICKLY – AND SUCCESSFULLY

One of the most important aspects of insuring successful implementation of MDSS was overcoming the overwhelming organizational and cultural changes this system presented to INDOT. In preparing to present this new tool, much time was devoted to: learning about the aspects of cultural backgrounds for large organizations, applying that knowledge to the cultural background of DOTs, investigating the change cycle and change management strategies, and utilizing this information to help INDOT head off issues and learn to deal with them appropriately when they occur. This is an ongoing issue as the second year of statewide MDSS use is underway.

Once the decision was made and the plan ready to be implemented, it was important to recognize that the organization and the individuals that make up the whole will experience change. Change affects an individual emotionally and, in turn, affects the individual's performance. The range of feelings and problems resulting from these emotions are compounded when an organization with many individuals attempts to implement change. A successful organizational change requires a systematic approach; one that anticipates and addresses the problems that arise when individuals within an organization are asked to do things differently than they have in the past.

Organizational change management is a systematic method that utilizes specific strategies to address change and the problems that arise when change is implemented in an organization. One important strategy includes getting acceptance from all levels of the organization early in the organizational change. It is important that the reasons for the change be communicated to all levels in such a way that most individuals see the change being important to their own security, as well as for the betterment of the organization.

Support networks must be created to quickly solve issues that arise as the change occurs. These networks must permeate the organization through all levels as well. If the individuals in the support network cannot solve an issue, they must be equipped with information to determine where to find the solution. Again, time is of the essence when trying to successfully implement change. Unsolved issues and problems during change can be used by those resisting it as an example that even those in charge do not understand the change being implemented. If these issues are not quickly resolved, the resistance will gather momentum and ultimately result in a failure to change within the organization. Even greater difficulties may be encountered during the next change if failure occurs.

Implementation of a change like MDSS is not a one year event. A successful first year does not guarantee the program will be continually accepted. Equipment issues and change resistors may have more of a negative impact in the second and third years as the program becomes standard practice and focus wanes in favor of other priorities. Training and support networks need to be fostered continually during the three year implementation process. The support networks should be improved and strengthened as the project advances in order to sustain momentum.

TURNING CHANGE AND PLANNING INTO RESULTS

For Indiana, an MDSS meant having a near real time graphical user interface (GUI), AVL/MDC, camera images from the trucks, and additional data and camera images from RWIS sites across the state.

Combining all this available information allowed managers to make more accurately timed call out and maintenance decisions, which in turn became better economical decisions.

By the end of the 2008-2009 snow and ice season, MDSS had helped INDOT realize savings of $12,108,910 (228,470 tons) in salt usage and $1,359,951 (58,274 hours) in overtime compensation from the previous winter season. Figure 1 illustrates the salt and overtime savings experienced for Indiana between fiscal year 2008 and 2009.

Figure 1

Salt Savings Comparing FY 08 to FY 09				
	FY 08 (Tons)	FY 09 (Tons)	Difference (Tons)	Savings @ $53/Ton
All Districts	558,274	329,804	228,470	$12,108,910

Overtime Savings Comparing FY 08 to FY 09				
	FY 08 (Hours)	FY 09 (Hours)	Difference (Hours)	Savings @ $23.33/hour
All Districts	226,484	168,210	58,274	$1,359,591

When normalized for winter conditions using information from the National Weather Service (NWS), INDOT still realized $9,978,536 (188,274 tons) in salt usage and $979,136 (41,967 hours) in overtime compensation. Normalizing for the winter conditions helped legitimize the actual savings that were experienced with use of the system, in spite of differing winter weather from one year to the next. Overtime and salt usage savings are illustrated in Figures 2 and 3 respectively.

Figure 2

Overtime Savings Normalized for Winter Conditions				
	FY 08 (Reduced by 7.2%)	FY 09	Difference (Hours)	Savings @ $23.33/hour
All Districts	210,177	168,210	41,967	$979,136

Salt Savings Normalized for Winter Conditions				
	FY 08 (Reduced by 7.2%)	FY 09	Difference (Tons)	Savings @ $53/Ton
All Districts	518,078	329,804	188,274	$9,978,536

Figure 3

	Salt Usage (Nov - Apr)					
	3 Year Ave.	5 Year Ave.	FY 08	FY 09	Variation 3 yr ave to 09	Variation from 08 to 09
Crawfordsville	58,313	58,324	95,318	41,402	-29.0%	-56.6%
Fort Wayne	70,389	71,946	100,762	71,674	1.8%	-28.9%
Greenfield	74,067	74,886	110,670	60,686	-18.1%	-45.2%
LaPorte	86,387	98,830	132,039	89,546	3.7%	-32.2%
Seymour	62,212	53,174	66,726	40,250	-35.3%	-39.7%
Vincennes	35,355	32,997	52,759	26,246	-25.8%	-50.3%
All Districts	**386,723**	**390,157**	**558,274**	**329,804**	**-14.7%**	**-40.9%**

While INDOT expected to see some savings and an added technical expansion with the use of an MDSS, the amount of money saved in salt and overtime, not to mention diesel fuel, was far greater than anyone at the planning and implementation level had imagined. The emerging use of MDSS as a management tool was equally as unexpected. As managers grew more accustomed to interpreting the

recommendations, they became more comfortable planning instead of reacting. With this new confidence in the MDSS, managers reported saving material and man hours by relying on the information that was provided.

RECOMMENDATIONS FOR ONGOING SUCCESS

The first year of MDSS implementation was a resounding success for Indiana. More consistent levels of service were provided across the state because a tool was provided to management that allowed them to set the desired level of service. With MDSS, managers can now assess road conditions in a near real-time environment. INDOT's environmental impacts were lessened as salt usage was reduced compared to normalized data. In addition to these benefits, INDOT realized remarkable savings of around $11 million (normalized) in salt usage and overtime. While the MDSS implementation at INDOT was successful, there are several items which will improve the overall product.

The first major improvement was started during the off season. Because of the wide area being covered by so few experts, the core implementation team began to create subject matter experts for the following areas: GUI, AVL/MDC, and QA/QC. This group is now providing local level support during the winter season.

Communication is another area within an organization that can always be improved and this certainly applies to the ongoing use of an MDSS. A communication plan has been developed for this snow and ice season that schedules periodic meetings with the District experts. Monthly status reports to the executive office are also continuing during this new year of use. Executive support will be especially crucial during the next two years to ensure the integration of the MDSS program into INDOT's culture and core business practices.

Finally, developing uses for the AVL/MDC units outside of snow and ice removal will be important to receiving full benefit of these units. Planning routine maintenance, idling time studies, and vehicle tracking, are just a few of the other areas INDOT can and should explore.

The early stages of a second season utilizing MDSS has taught INDOT that the challenges ahead may vary from year to year, but the importance of the project, the savings, and the new ideas remain a top priority. While the next two years will help incorporate MDSS into a way of business for INDOT, it is also a time to learn, grow, and change to receive maximum benefits and savings from this exciting and promising project.

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