Michigan Maintenance Vehicle Management System

Four road maintenance agencies and a regional transit authority worked together to implement a management system for maintenance vehicles in southeastern Michigan. Partners include the City of Detroit Department of Public Works, the Road Commission for Oakland County, the Road Commission of Macomb County, the Wayne County Department of Public Services, and the Suburban Mobility Authority for Regional Transportation. The four agencies, who maintain over 15,000 road miles in the region, formed the Southeast Michigan Snow and Ice Management (SEMSIM) partnership in 1998.

System Components: The maintenance vehicle management system consists of snowplow systems, a communication system, and central systems. Snowplow systems include sensors, automated controls, and in-vehicle devices. Environmental sensors are mounted on snowplows to record air temperature and pavement temperature. Vehicle status sensors monitor the position of each snowplow (i.e., location, direction and speed), plow position (i.e., up/down), and material application (i.e., salt on/off, application rate). Each maintenance vehicle, shown in the figure, has automated application controls. Computerized salt spreaders automatically adjust the application rate based upon the speed of the snowplow.

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In-vehicle devices integrate display, text messaging, and data communication capabilities. These devices include interfaces to snowplow systems and Global Positioning System receivers, which are used for automated vehicle location. The communication backbone is owned and operated by the regional transit authority. The authority's 900 MHz radio communication system transmits environmental and status data from in-vehicle devices to the transit management center. A Local Area Network, an Integrated Services Digital Network and multiple dial-up telephone lines are used to transmit data from the management center to central computers accessed by both maintenance managers and transit dispatchers.

System Operations: Central computers display a map-based interface that maintenance managers view to identify weather threats, track snowplow locations, monitor treatment activities, and plan route diversions if necessary. Each maintenance vehicle appears on the map with a color-coded trace indicating where plows have been and what treatment has been applied (e.g., spreading salt, plow down). Text messages from managers, such as route assignments, may be displayed to drivers on the in-vehicle devices. With these devices, drivers can send messages to managers, as well as view temperature measurements and salt gauge.

The maintenance vehicle management system can be used to plan treatment strategies, monitor real-time operations, and conduct post-event analysis. Post-event analysis provides maintenance managers with statistics (e.g., driver hours, truck miles, material applied) that can help reduce the costs of future winter maintenance operations. Environmental data from the plows also serves as decision support for transit dispatchers, who utilize this information to make scheduling and routing decisions during winter storms.

Transportation Outcome: SEMSIM partners have improved agency productivity by implementing the maintenance vehicle management system. With the system, managers can identify the most efficient treatment routes, reduce equipment costs, and share resources. Automated salt application controls minimize material costs. The system also improves roadway safety and mobility by allowing the partners to assess changing weather conditions and quickly respond to effectively control snow and ice.

Although each agency had different types of snowplows, with dissimilar equipment, and diverse operational procedures, this project has facilitated interagency communication that benefits both the public and partners. The SEMSIM partners can collectively procure equipment and services at lower costs than individual agencies. Additionally, the partners have agreed to allow snowplows to cross jurisdictional lines to assist one another with road treatment activities when necessary.

Implementation Issues: The SEMSIM project is funded with federal grants and matching contributions (i.e., 20 percent) by each partner. Phase one of the project was initiated in October 1998 and was scheduled for completion by December 1999. The partners developed specifications, issued a request for proposals, and contracted with a private vendor to furnish and install system components. This vendor was familiar with the region as they supplied the automated vehicle location system used to by the transit authority to monitor buses in the region.

The transit authority allowed the partners to use excess capacity in their radio communication system. Implementation problems with communication lines and devices caused delays in system acceptance and evaluation. A temporary dial-up telephone line was used for testing until technical difficulties were resolved. By the end of February 2000, the temporary system was in place and ten snowplows from each maintenance agency were equipped with system components.

A private firm was selected to evaluate each phase of the project. This firm conducted interviews and collected data to assess manager and driver needs, to document technical and institutional issues affecting operational decisions, and to determine whether or not project goals were met. An evaluation report of the first phase was released in June 2000. The partners then met to discuss plans for phases two and three. In June 2001 they contracted with the vendor to equip an additional 290 maintenance vehicles during 2002. System hardware and software will also be improved and the communication system will be web-based. The University of Michigan has enhanced central software by designing an application that will automate snowplow routing. As conditions change, the central software will calculate the most efficient routes and automatically notify drivers via in-vehicle devices.

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