CLEAR ROADS
research for winter highway maintenance

RESEARCH BRIEF

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RESOURCE GUIDE AIDS GPS/AVL IMPLEMENTATION

RESULTS SUMMARY

Researchers developed an equipment guide that describes how winter maintenance agencies are currently using GPS/AVL technology. The guide is a useful resource to other agencies that are looking to implement or expand their use of GPS/AVL.

PROJECT DETAILS

Project Title: Synthesis on Global Positioning Systems/Automatic Vehicle Location Equipment Used for Winter Maintenance

Project Number: CR14-01

Project Cost: $59,912

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Global Positioning System and automatic vehicle location (GPS/AVL) technology can turn winter maintenance vehicles into mobile data collection systems. Many winter maintenance agencies are starting to implement these systems and use the information they gather to improve service and efficiency.

Need for Research

GPS/AVL is a relatively new, fast-developing technology, but implementing an effective system can be complicated. Many vendors offer GPS/AVL hardware to install in trucks, and several communications options are available for transferring collected information to a data management system. There are also many uses for the data the system collects, so agencies need to determine precisely how they can utilize GPS/AVL to improve the cost-effectiveness of their operations.

Clear Roads wanted a guide to help winter maintenance agencies understand the options that are currently available and help them make decisions that are appropriate to their needs.

Objectives and Methodology

Researchers conducted a literature search and a survey of state and local agencies to collect information about available GPS/AVL equipment and how winter maintenance agencies are currently using it.

Based on this information, researchers developed an equipment guide that describes currently available GPS/AVL options and their capabilities, as well as the positive and negative experiences agencies have had with these technologies. Researchers also developed a synthesis of issues that agencies need to consider when implementing GPS/AVL equipment and developing policies related to GPS/AVL.

Results

The literature search found relatively little formal research on GPS/AVL equipment, but did identify some vendor information of potential solutions, along with background on how some agencies are using winter maintenance GPS/AVL. The survey results provided a snapshot of the current uses of GPS/AVL by winter

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Many agencies use GPS/AVL systems to generate reports of winter maintenance activities, including maps showing plowing and spreading activities and routes traveled.

maintenance agencies, along with benefits and problems encountered.

Survey responses came from 36 individuals representing 26 states, four cities, one county and one manufacturer. Respondents reported using GPS/AVL hardware from nine manufacturers, and researchers collected product information from these vendors. To communicate between trucks and servers, most respondents reported transferring data by cellular network, although a few use Wi-Fi or data radio systems.

Adequate communications network coverage was one of the most significant concerns identified in the literature search. However, nearly all survey respondents reported that their communications network covered all or most of their maintenance area, with only minor and acceptable gaps in coverage.

In addition to collecting data off the spreader controller, the most common types of information that survey respondents reported collecting via add-on sensors/inputs were plow position, pavement temperature and air temperature. A small number of respondents also said drivers collect dashcam images or video or data input through a user interface in the vehicle cab. The most frequently reported uses for GPS/AVL data included making plowing and material application decisions, tracking data to create shift reports or summary information for managers, sharing information with other agencies or the public, and assigning staff during winter events.

Most respondents have equipped only part of their fleet with GPS/AVL equipment, likely due to the newness and cost of the technology. States reported having equipped an average of 35 percent of their vehicles with AVL. According to the survey results, the average GPS/AVL system costs $3,843 to install and $39.30 in monthly recurring costs per vehicle.

While AVL systems generate a large amount of data, researchers found no publicly available state or local policies related to how the data may be accessed or stored. However, researchers identified topics that agencies may wish to consider in policies, such as who is allowed to access data, how long data will be stored, whether data can be used in litigation and whether GPS tracking can be used for employee discipline.

Benefits and Further Research

This guide should provide useful information for agencies that are planning to implement GPS/AVL technology or use it in new and more advanced ways. In particular, agencies can contact survey respondents who are using specific hardware or communications technologies, or using GPS/AVL for particular applications, to learn from their experiences.

Clear Roads is sponsoring a follow-up project, "Utilization of AVL/GPS Technology: Case Studies." In this project, researchers will develop approximately five detailed case studies about state department of transportation (DOT) experiences with AVL/GPS, including their decision-making processes, steps for implementing the technology, difficulties and lessons learned, and benefits and costs of implementation. This project is intended to help other agencies that are considering implementing or expanding their use of AVL/GPS technology to do so efficiently.

Part of the follow-up project will be a survey of state DOTs to evaluate the current status of AVL/GPS technology. Because the technology and state practices are evolving quickly, Clear Roads plans to update this survey annually.

"This equipment guide shows the different GPS/AVL systems that states are using. The guide can provide context and resources for people who are looking to implement systems in their own agencies."

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