RESEARCH BRIEF

![CLEAR ROADS — research for winter highway maintenance]

OPEN DATA PROTOCOL WILL ENABLE EQUIPMENT COMPATIBILITY

RESULTS SUMMARY

Researchers identified data types that will enhance a plug-and-play protocol for data transmission between winter maintenance equipment and central offices or other point locations.

An open protocol will allow interoperability between different vendors' equipment and facilitate data sharing among agencies.

PROJECT DETAILS

Project Title: Plug-and-Play Initiative, Phase 2
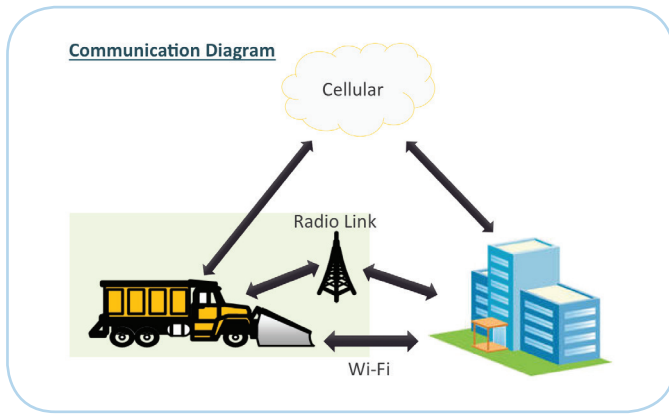
Project Number: CR14-04

Project Cost: $81,690

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Project Champion: Allen Williams
Virginia Department of Transportation
allen.williams@vdot.virginia.gov

Investigator: Scott Petersen
SRF Consulting Group, Inc.
spetersen@srfconsulting.com

As the winter road maintenance industry has become more data-driven, the lack of interoperability among different systems is limiting agencies' ability to collect and share data. For example, agencies that want to add sensors to a vehicle or systems to their fleet may be locked in to one vendor's equipment unless they install a data translator. Incompatible data also makes data sharing between agencies difficult unless both use the same system.

Need for Research

Electronic equipment and software do not automatically communicate with one another. Systems will only be compatible if the information they share is identified and formatted in a consistent way. But like most industries, when winter maintenance equipment manufacturers started computerizing their equipment, they typically created proprietary software to operate it. Functionality, not compatibility, was their priority.

Clear Roads' Plug-and-Play Initiative is working to develop data standards that enable compatibility among winter maintenance equipment regardless of manufacturer or service provider. Phase 1 established a protocol to allow automatic vehicle location equipment to communicate with spreader controllers. In the current phase, investigators are laying the groundwork for open protocols that will allow plow equipment to communicate with a central office or other point location.

Objectives and Methodology

Investigators conducted two surveys. In the first survey, winter maintenance agencies were asked about the types of data they currently use in their winter maintenance operations and what data they consider to be most important. More than 50 types of data were examined from five categories: vehicle; image, video and traffic; spreader; environmental; and operator interface or controller. Investigators performed a gap analysis by comparing the importance score of each data type with its frequency of use to identify capabilities that winter maintenance

Communication Diagram

Cellular

Radio Link

Wi-Fi

Most winter maintenance agencies use cellular networks to transmit data from vehicles to the central office. Many also use Wi-Fi or a radio link to supplement communications, particularly for maintenance conducted in areas without adequate cellular coverage.

professionals would like but that generally are not available. As part of this survey, agencies were also asked about the communication methods they use for data transmission.

The second survey targeted freight companies to collect information about industry practices with data transmission and protocols.

Using this information, investigators identified data types and communication methods that are priorities for including in a plug-and-play protocol.

Results

Sixteen states and four international or local agencies responded to the survey of winter maintenance agencies. Respondents gave 28 types of data an importance score of at least 60 out of 100, indicating that most respondents considered these data types at least somewhat important and a significant number considered them very important. If feasible, these data types should be given the highest priority for inclusion in any plug-and-play protocol. Six other types of data had importance scores between 40 and 60, suggesting they are good candidates to include in the protocol to encourage widespread adoption.

The gap analysis showed that the types of data that winter maintenance professionals are not generally using but would most like to include are surface grip; bare lane declarations; and data from precipitation sensors, sun sensors and pre-wet tank levels.

Cellular communications systems are by far the most common communications system for data transfer, used by two-thirds of respondents. In many cases, however, agencies use other methods in addition to cellular communications. Some winter maintenance takes place in areas without

cellular reception, so "store and forward"—in which the system retains data until the vehicle reaches a place with adequate cellular capability, a Wi-Fi network or another communications option—is an important capability.

Response to the freight industry survey was limited. Only four of the more than 20 companies that were contacted responded to the survey. Additional information was gathered from an interview with a prominent vendor used by many major freight operations. While this information was not directly translatable to the survey responses, it provided a broader perspective of industry practices.

Results from the four respondents suggest that the industry prefers proprietary systems, possibly because private companies can shift between vendors more easily than public agencies. Survey responses also suggest that the winter maintenance industry has much greater data needs, particularly for environmental and pavement data, than the freight industry.

Benefits and Further Research

No single protocol currently incorporates all of the plug-and-play needs for winter maintenance equipment. Rather than attempting to create a protocol specifically for the industry, researchers recommend incorporating the necessary data types into existing standards such as the maintenance decision support system (MDSS), National Transportation Communications for Intelligent Transportation System Protocol (NTCIP) or the connected vehicle protocol. As that happens, Clear Roads can maintain a list of protocols that meet winter maintenance plug-and-play needs. Agencies can then modify purchasing guidelines to include requirements that equipment use one of those open standards.

A planned next phase of this research will develop test bed software to let winter maintenance professionals easily assess whether a piece of equipment is compatible with Clear Roads' open plug-and-play protocol.

> "We want our protocols open so that data can be shared. Knowing the data types we need lets us move forward with getting them incorporated into relevant data protocols."
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> **Allen Williams**
> Virginia DOT
> allen.williams@vdot.virginia.gov