



DEPARTMENT OF
TRANSPORTATION

RESEARCH SERVICES & LIBRARY

TECHNICAL SUMMARY

Technical Liaison:

Trisha Stefanski, MnDOT
Trisha.Stefanski@state.mn.us

Project Coordinator:

Nelson Cruz, MnDOT
Nelson.Cruz@state.mn.us

Principal Investigator:

Adrian Potter, SRF Consulting Group, Inc.

RESEARCH COST:

\$17,320

EQUIPMENT COST:

\$110,000



A video screen inside the mower cab shows the operator the location of the mower (indicated by the circle) and of noxious weeds (in red).

AVL Technology Enables Smarter, More Efficient Mowing Operations

What Was the Need?

MnDOT is responsible for mowing roadsides along 14,000 centerline miles of highways for environmental and safety reasons. This is an enormous and critical task, requiring efficient use of employee time and mowing equipment, and efforts to avoid the spreading of noxious weeds, which will lead to increased use of herbicides.

A promising technology that many departments of transportation (DOTs) have installed is automated vehicle location (AVL). AVL systems provide a precise geographic location for DOT-owned vehicles so that real-time data can be obtained on field operations. This technology has been used for snowplowing and other fleet vehicle operations. However, only a few DOTs have used it for mowing operations.

To determine if AVL technology should be used in its mowing operations, MnDOT undertook a pilot project involving 30 of its mowers. The locations chosen were Metro District roadsides, as MnDOT had previously invested in creating a geographic information system map of noxious weeds on those roadsides.

What Was Our Goal?

The goals of the pilot project were to:

- Generate protocols for hardware installation and software training.
- Set up the system for communicating data from the mowers to internal MnDOT servers.
- Develop accomplishment reports based on data collected by the AVL units.
- Develop and provide initial training to operators and supervisors.
- Optimize the mower routes used.

What Did We Do?

For the 2015 and 2016 mowing seasons, researchers fitted 30 Metro District tractors with AVL technology, sensors and communication equipment.

The first stage of the project focused on developing the software interface required for the AVL system. The application had to provide a view of the mower's exact location so that the mower operator could avoid noxious weeds. Data would be collected through an in-vehicle controller unit and transferred to MnDOT for analysis via a Verizon AirCard system installed on each mower.

Mechanics installed metal racks within each of the 30 mowers to protect the Ameritrak AT-500 AVL hardware unit. A video screen was mounted on the top of the rack. A reporting system was developed for use by operators, supervisors and managers. Training sessions were scheduled at the start of each season and when new operators were hired.

A pilot project was begun to study the use of AVL technology in mowing operations. Potential benefits include improved mowing efficiency, improved reporting and ease of supervision, reduced paperwork and reduced spread of noxious weeds.

“Using the data we get from the AVL project, we can estimate how long it will take to mow the entire system. That way, we can plan far in advance of major holidays, when the most traffic comes through our system.”

—Douglas Maki,
Asset Management
Engineer, MnDOT
Metro District

“The AVL technology can be used to mark newly disruptive weed locations and anything else a mower operator might see, like potholes, damaged signs or guardrails, and excessive or dangerous debris in the field.”

—Adrian Potter,
Senior Associate, SRF
Consulting Group, Inc.

Produced by CTC & Associates for:

Minnesota Department
of Transportation
Research Services & Library
MS 330, First Floor
395 John Ireland Blvd.
St. Paul, MN 55155-1899
651-366-3780
www.mndot.gov/research



Mechanics constructed a metal rack to house the AVL unit (at right) within the cab. This location allows for convenient driver interface.

What Did We Learn?

The project achieved its initial goals of developing protocols for hardware and software, creating electronic reporting and capturing real-time data.

The research team gained the following insights during the planning and field-testing stages of the project:

- Substantial time is needed to adequately develop and test the AVL software and hardware.
- Implementing the system also requires considerable time due to resource limitations, and after implementation, it takes multiple mowing seasons to quantify weed and herbicide reductions.
- MnDOT mower operators and supervisors recognized the value of the AVL system in improving the efficient use of their time, eliminating the drafting of written reports, and giving MnDOT a more accurate record of acreage mowed.
- Since the tractors operated at such slow speeds, the initial data captured were too imprecise to analyze. But with software adjustments, this issue was resolved.
- Installation of the AVL unit could have an impact on the operation of the tractor because the additional electrical burden that the unit places on the tractor battery may require the tractor to be sent to the manufacturer for inspection.

What's Next?

The initial success of the pilot project provided the basis for continued use of AVL technology in Metro District mowing operations during the 2017 season and possibly beyond. MnDOT is currently evaluating whether this project has provided enough data to expand AVL to other districts in the state. The investigators estimate that after full implementation, MnDOT could save \$100,000 per year.

MnDOT may consider installing AVL technology in other agency equipment to optimize and monitor maintenance activities.

This Technical Summary pertains to Report 2017-11, “An Innovative Approach to Smarter Mowing, Utilizing Automated Vehicle Location to Enhance Mowing Operations,” published April 2017. The full report can be accessed at mndot.gov/research/reports/2017/201711.pdf.