CLEAR ROADS
research for winter highway maintenance

RESEARCH BRIEF

JUNE 2024

SNOWPLOW ROUTING TOOLS TO MAXIMIZE LEVEL OF SERVICE

RESULTS SUMMARY

A methodology that calculates snowplow cycle times is incorporated into a visualization tool framework that agencies can use to make real-time operational decisions and conduct better-informed post-storm analyses.

PROJECT DETAILS

Project Title: Calculating Plow Cycle Times from AVL Data

Project Number: CR21-06

Project Cost: $125,378

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Project Champion:
David Gray
New Hampshire Department of Transportation
david.a.grayjr@dot.nh.gov

Investigator:
Ming-Shiun Lee
AECOM
ming.shiun.lee@aecom.com

Need for Research

Snow-covered roads are inescapable during winter storms. Transportation agencies, however, are continuously seeking strategies and methods to clear those roads as fast as possible to maximize the level of service (LOS) to the traveling public while adhering to agency budget constraints. By better understanding the time it takes a snowplow to complete one round of snow clearing and treatment of its assigned route, agencies can better adjust routes and cost-effectively allocate resources for the specific needs of a given service area.

When agencies can observe snowplow delays in real time, they can adjust routes immediately to maintain an appropriate LOS. For example, if a snowplow is clearing a high-volume road and experiences an unexpected delay, a snowplow from a route with less traffic volume can be reallocated to the high-volume road. This research offers tools that agencies can use to make these immediate adjustments and improve pre-storm planning and post-storm analysis.

Objectives and Methodology

This project's goal was to develop a methodology for calculating plow cycle times that considered factors such as road type, road width, weather conditions and traffic volume. The methodology could then be used to create a framework for an online, map-based visualization tool that would enable agencies to make operational decisions in real time and provide valuable information for post-storm analysis.

Efforts to develop this methodology began with a review of relevant literature that focused on the use of automatic vehicle location (AVL) data to calculate plow cycle times. Then a survey of state and local transportation agencies gathered information about AVL data collection practices and uses, and the challenges that agencies had in calculating and monitoring plow cycle times. Selected agencies provided a sampling of AVL data that researchers used to identify information contained within the data sets and information that would need to be imported from other sources.

The study included an analysis of road, weather and other factors that could affect cycle time. The results of this analysis were used to develop a methodology

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Tools that calculate snowplow cycle times enhance transportation agencies' ability to improve road service, safety and reliability for travelers during winter weather events. (Photo courtesy of Oregon DOT)

for incorporating these variables into the cycle time calculations. With this methodology, the team developed a framework that details the requirements for an online visualization tool. Additionally, the team created an implementation plan for agencies to follow to get the map-based visualization tool in operation.

Results

The methodology developed in this study incorporates numerous variables that can affect plow cycle times. For example, the calculations consider what treatment the snowplow is applying to the road, the number of lanes the plow is servicing, adverse weather conditions and traffic volume. Incorporating these variables into the calculation of plow cycle times is essential for ensuring accurate information to use for planning snowplow routes.

Also developed was a framework for an online map-based visualization tool that incorporates the methodology for calculating plow cycle times. The framework provides agencies with the information needed to construct a visualization tool based upon the software and data hosting platforms used by each agency. Additionally, the report outlines the architecture of the visualization tool, which includes data requirements, database design, data conversion processes, API connections and practices for storing historical data.

Implementation and Benefits

The project provided significant guidance for agencies to implement the cycle time visualization tool. To begin the implementation process, agencies must consider the following:

- How will the visualization tool be used?
- What is the availability of AVL data and other required or optional data?
- What resources (such as personnel and budget) are available to develop and maintain the visualization tool?

The answers to these questions will guide the specific functions and requirements of the tool. For example, if AVL data is not currently available, the visualization tool cannot be built; if real-time information is not needed, the requirements for the tool will be lessened.

Among the many benefits of the visualization tool are:

- Knowing the cycle times for specific road segments under various conditions.
- Having reliable information to best allocate resources during a winter storm.
- Identifying best practices for maximizing LOS during severe winter weather.
- Having reliable data to optimize snowplow routes.

The final implemented capabilities of the visualization tool and the time to complete development will depend on the needs of and resources available to each given agency.

"This project will allow agencies to use real-time data and information to view actual snowplow performance and make changes to ensure a high level of service."

Project Champion David Gray
New Hampshire DOT
david.a.grayjr@dot.nh.gov

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