

# RESEARCH SPOTLIGHT

## Project Information

**REPORT NAME:** Winter Severity Index with Winter Maintenance Expenses and Material Usage

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**PROJECT COST:** \$190,000

**COST SHARING:** 20% MDOT, 80% FHWA through the SPR, Part II, Program

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## Updating Michigan's Winter Severity Index

The Michigan Department of Transportation (MDOT) has historically developed a Winter Severity Index (WSI) to be used for different applications. But the index doesn't accurately address the varying winter weather conditions found throughout the state and doesn't necessarily correlate with winter maintenance operations. Recent updates to the existing WSI calculation incorporate the index correlation with the cost of materials for winter road maintenance and include a division of the state by climate to more accurately reflect Michigan's regional weather differences.

### PROBLEM

Michigan's severe winter weather requires sufficient resources and planning to ensure that the state's roads remain accessible and safe for all users. Yet the unpredictable nature of winter storms poses challenges for budgeting. Climate differences between regions and variability from year to year may generate excess maintenance material in one location and a shortage in another. Currently, MDOT tracks the intensity of its winter weather using the WSI as one input for budgeting the necessary amounts of maintenance material, such as salt and sand.

Michigan's existing WSI accounted for different types of winter storms, such as snow, freezing rain and blowing snow, with data collected from live camera feeds, road



Including costs for materials like road salt in winter severity metrics helps Michigan's maintenance agencies plan more effectively for unpredictable weather conditions.

surface sensors and other sources. However, this input data did not sufficiently reflect the localized weather variability, material use, budget constraints and regional needs. A study to identify and assess other potential inputs was required to propose relevant enhancements to the WSI.

### RESEARCH

The first phase of the study included a survey of Michigan's maintenance garages

*“MDOT provides tools like the WSI for Michigan’s winter maintenance agencies. Including maintenance costs helps with budgeting decisions during unpredictable winter weather.”*

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to explore the current practices for calculating and applying WSI measurements. The survey also collected information on material use and maintenance costs at the county or garage levels, budgeting practices and perceptions about the usefulness of WSI and other weather information collection tools. Another survey of state departments of transportation (DOTs) also addressed the calculation and use of WSIs as tools for operational and budgetary decisions at the national level.

The main research component was a statistical analysis comparing weather data with maintenance material costs. Using survey responses from the Clear Roads annual survey of winter maintenance expenditures, researchers assessed how well the Accumulated Winter Season Severity Index (AWSSI) correlates to the reported costs of maintenance operations, with states grouped by climate similarity. Similar analyses at the state level developed a region-specific WSI for Michigan, correlating winter maintenance material cost and weather variables.

## RESULTS

Of the 92 Michigan garages contacted to participate in the survey, 51 responded: 20 from MDOT-managed garages and 31 from county-managed garages. Two important findings resulted from the analysis of responses:

- **Account for regional variability.** Weather conditions can vary significantly across Michigan’s climate zones, which highlights the need for a region-specific WSI to better predict maintenance material needs.
- **Integrate costs.** Including direct cost-related information into the WSI calculation improved the accuracy of estimates for winter maintenance expenses.

The survey of state DOTs garnered 41 responses. DOT representatives confirmed their use of WSIs in operational planning, with many states relying on standardized indices such as AWSSI or customized indices. The effect of localized weather events emerged as a common issue along with the need to connect WSIs with material costs and budgeting.

The statistical analysis of winter maintenance costs provided by the Clear Roads annual survey showed strong correlation with AWSSI for some climate divisions in the study, such as the South, West and Upper Midwest. However, the statistical correlation was not as strong in other regions like the Ohio Valley, Northwest and Northern Rockies. This weaker correlation might be due to variability in winter weather conditions, geographical or socioeconomic factors, or state policies.

The Material Cost-based Winter Severity Index (MC-WSI), MDOT’s modified WSI, addresses the critical needs identified in the surveys and statistical analysis. For example, the requirement for more localized climate divisions emerged as an essential element in adapting Michigan’s WSI calculation. The proposed method defines Michigan’s regions according to their climate characteristics instead of the state’s administrative regions. It also incorporates a calculation of material cost per lane mile and 13 weather variables that impact material usage.

## VALUE

The adapted WSI that more accurately reflects Michigan’s localized, variable weather conditions and includes material

cost data improves budget management and may offer better forecasting information for Michigan’s maintenance garages. The MC-WSI may address the needs of the state’s different climate regions when they face unpredictable winter weather conditions. Starting with the 2025-2026 winter season, MDOT will apply the new WSI calculation, assessing its effectiveness as a decision support tool.

## Research Administration

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### The final report is available online at

[MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1755](http://MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1755).

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