



WINTER MAINTENANCE AT A GLANCE

2014-2015

Moving Back to Moderate



Introduction

Snow and ice control is a critical element of operations on our state highway system. To meet level of service goals in this area, Wisconsin DOT contracts with the state's 72 county highway departments for winter maintenance on these highways, a unique and mutually beneficial partnership. WisDOT receives the services of a skilled, experienced work force, and supports the counties through training, research initiatives, and testing of products, equipment and methods.

This summary document highlights key aspects of the 2014-2015 winter, including weather, materials and equipment use, performance, and costs. The complete Annual Winter Maintenance Report, which provides further detail on these areas and others, will be available at: <http://wisconsindot.gov/Pages/doing-bus/local-gov/hwy-mnt/winter-maintenance/default.aspx>.

Inside

Statewide Winter Summary	2-3
Materials and Costs	4-5
Measuring and Advancing Performance.....	6-7
Looking Ahead	Back cover

Statewide Winter Summary

Winter by the Numbers

In 2014-2015, Wisconsin experienced a less costly winter than the previous year, primarily due to mild weather conditions. Compared to last year's high winter costs of \$113,473,270, this winter's costs totaled \$74,194,500; a reduction of 35%. The state experienced an average of 33 winter storms this winter, resulting in an average of 60.3 total inches of snowfall. This average represents a 41 percent decrease from last year's statewide average of 101.5 inches of snow.

This year the statewide average Winter Severity Index was 99.3 which is four percent lower than the average of the previous ten winters (103.4). [Figure 1](#) on page 3 shows county 2014-2015 winter severity indices versus 5 year averages. Salt use was 42 percent lower than 2013-2014, at 388,797 tons.

[Table 1.](#) summarizes key facts and statistics from this winter in several core areas. The 2014-2015 Annual Winter Maintenance Report provides more detail on all topics in this table.

Table 1. Statewide Summary: This Winter by the Numbers

	Measure	Previous Winter	2014-2015
Infrastructure	Lane miles	34,339 miles	34,435 miles
	Patrol sections	753.5	755.0
	Average patrol section length	45.57 lane miles	45.61 lane miles
Weather	Average statewide Winter Severity Index	133.64	99.28
	Number of storms, statewide average and range across counties	Average: 43 Range: 30 to 69	Average: 33 Range: 18 to 63
	Snowfall, statewide average and range across counties	Average: 101.5 inches Range: 56 to 233 inches	Average: 60.3 inches Range: 28 to 235 inches
Materials¹	Salt used	669,807 tons 19.5 tons per lane mile	388,797 tons 11.3 tons per lane mile
	Average cost of salt	\$60.40 per ton	\$69.01 per ton
	Prewetting liquid used	2,970,166 gal.	2,009,139 gal.
	Anti-icing agents used	877,415 gal.	1,531,787 gal.
	Sand used	58,870 cubic yd.	22,301 cubic yd.
Costs and Performance	Total winter costs ²	\$113,473,270	\$74,194,500
	Total winter costs per lane mile	\$3,304	\$2,155
	Average crew reaction time from start of storm	7.03 hours	2.66 hours
	Percentage of roads to bare/wet pavement (Within WisDOT target times)	63%	70%
	Road Weather Information System (RWIS) stations	58	65
	Counties equipped to use anti-icing agents	66 of 72 (92%)	66 of 72 (92%)
	Counties that used anti-icing agents during the winter season	63 of 72 (88%)	63 of 72 (88%)
Labor and Services	Regular county winter labor hours ³	244,602 hrs.	160,453 hrs.
	Overtime county winter labor hours	182,311 hrs.	91,691 hrs.

1. All material usage quantities are from the county storm reports except for salt. Salt quantities are from WisDOT's Salt Inventory Reporting System.

2. Costs refer to final costs billed to WisDOT for all winter activities, including activities such as installing snow fences and thawing culverts.

3. Labor hours come from county storm reports, and reflect salting, sanding, plowing and anti-icing efforts.

A Return to Normal Conditions

The 2014-15 season featured a return to more “normal” conditions following two consecutive harsh winters. Snowfall returned to more average levels, and temperatures averaged about 7 degrees warmer than in 2013-14.

The winter actually started with a bang. Several snow events hit the northern half of the state in November. Lake effect snows pummeled the counties along Lake Superior, with Iron County receiving upwards of 50 inches. December brought above-average temperatures and below-average snowfall to most of the state. Only northeastern Wisconsin experienced above-average snowfall for the month.

January was another mild month. Temperatures were once again above average, and snowfall was below average across the entire state. Extremely cold temperatures returned to Wisconsin in February. Average temperatures were some 10 to 15 degrees below 30-year averages. Fortunately, unlike the previous two winters, the cold did not bring heavy snowfall. In fact, February snowfall was below average for all but the southern quarter of the state. But no large-scale snow events occurred, as the largest storms tracked just south of the state.

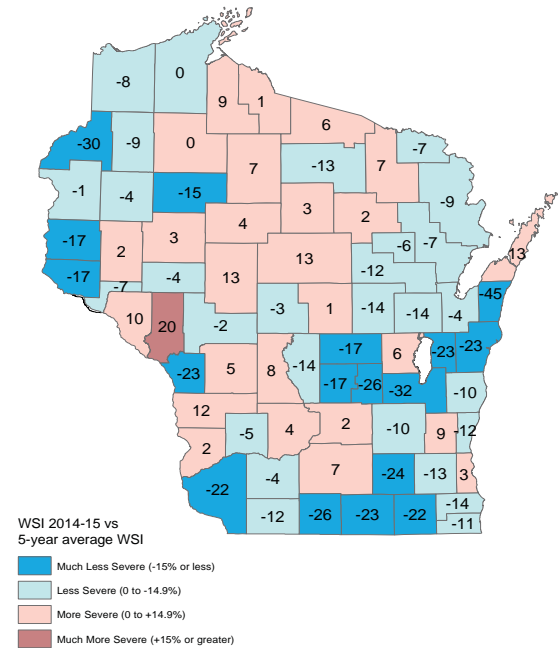
March featured a split pattern. The north saw above-average temperatures and below-average snowfall. The opposite was true in the south. One storm brought up to 10 inches of snow to areas along the Mississippi River late in the month.

During the 2014-15 winter season, county highway departments responded to:

- A statewide average of 33 winter events per county, or 10 less than the previous winter. The high was 63 in Ashland County and the low was 18 in Fond Du Lac County.
- A statewide average of 3 frost events.
- A statewide average of 11 freezing rain events.

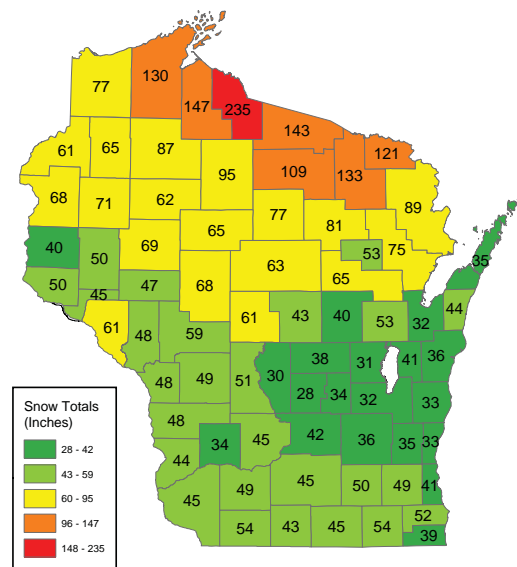
Figure 2 shows the total snowfall received in Wisconsin this winter based on storm report data. Snowfall varied significantly across the state; the highest snowfall recorded was in Iron County, at 235 inches; the lowest was in Marquette County, at 27 inches. Statewide, this winter’s total snowfall was near average at 60 inches.

Figure 1. 2014-2015 Winter Severity Index vs. 5-Year Average



Note: If you are looking at black-and-white versions of the maps in this report, you may download a color version of the report at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm.

Figure 2. Statewide Snowfall, 2014-2015



Statewide average: 60.3 inches

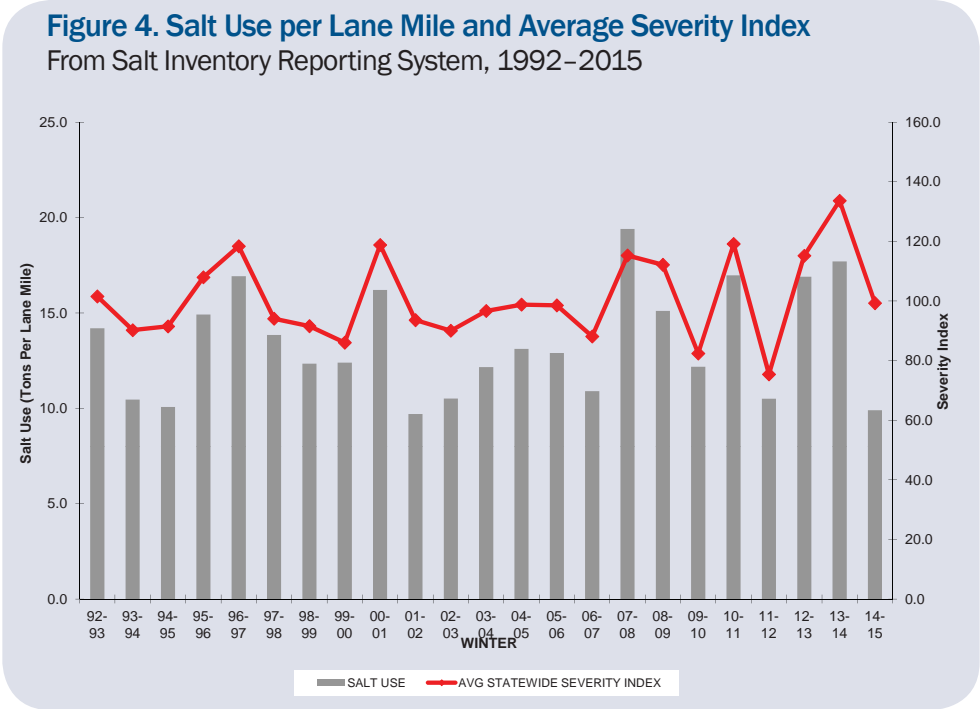
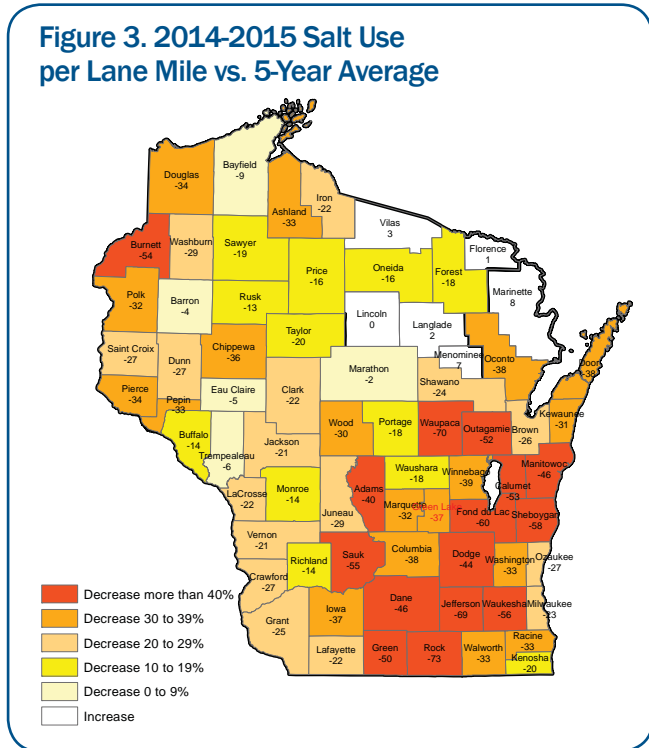
Note: Snowfall totals are based on winter storm reports data.

Salt and Anti-icing Work Together

Salt use was 49 percent lower than the previous year, at 388,797 tons. [Figure 3](#) shows county 2014-2015 salt usage per lane mile versus 5 year averages. [Figure 4](#) shows statewide historical salt usage per lane mile overlaid with average severity index. WisDOT encourages counties to use salt efficiently by making use of best practices such as anti-icing and prewetting. Use of anti-icing materials was up around 73 percent over last year, with counties using a record 1,531,787 gallons of anti-icing liquid. 63 counties made at least one anti-icing application. Prewetting salt before it is applied has advantages as well, keeping material on the pavement and minimizing waste. Both practices are used not only across the country but throughout the world.

In contrast, WisDOT actively discourages counties from using sand on the state trunk highway system. Sand is not effective at high traffic speeds, negatively impacts the environment, and ultimately decreases the level of service provided. Counties used 22,301 cubic yards of sand on state highways this year, a 62 percent decrease from the previous year. For more on the disadvantages of sand use, see a report prepared for WisDOT through the Clear Roads pooled fund project at: http://clearroads.org/wp-content/uploads/dlm_uploads/tsr-limitations-of-abrasives.pdf.

Wisconsin counties applied a statewide average of 9.93 tons of salt per lane mile on state highways, a decrease of 49 percent compared with the 2013-2014 winter. When compared with nearby states, which differ by winter severity and level of service standards, Wisconsin salt use is relatively high. In the last year with comparable data available - 2009-2010 - Wisconsin used 12.2 tons of salt per lane mile on state highways. In that same year, Minnesota (5.9 tons per lane mile), Iowa (9.8) and Indiana (11.8) used less while Illinois (12.3) and Michigan (12.6) used more.



Higher Labor and Equipment Costs

The total cost of statewide winter operations this winter was \$74.19 million, making it 35 percent less costly than 2013-2014. [Figure 5](#) also demonstrates a 14 percent decrease in winter costs from the average of the previous five years (see [Figure 5](#)).

This winter's statewide average cost per lane mile of \$2,155 was much lower than last year's cost of \$3,304 per lane mile. This year's cost is comparable to the cost from winter 2009-2010.

WisDOT spent \$26.9 million on salt, \$23.8 million on equipment-related expenses, \$19.0 million on labor, and \$2.2 million on materials other than salt, such as sand. Administrative costs added \$2.4 million to the total. Similar to previous winters, anti-icing activities only make up only about 2 percent of total expenditures.

On the whole, winter costs per lane mile tend to decrease as statewide average winter severity decreases. However, increases in labor rates and salt pricing will affect overall winter maintenance cost even in less severe winters. Since this was a mild winter compared to last year, it is no surprise that costs were lower than last year, despite increases in labor rates and salt prices. Salt expenditures decreased by 34 percent compared to the prior year, despite a slight increase in the cost per ton, and the cost for materials other than salt decreased by 22 percent. Labor and equipment costs decreased by 34 percent and 38 percent, respectively. Salt continues to be the single largest expenditure, accounting for 36 percent of all costs (see [Figure 6](#)).

Salt prices remain high nationwide, due in part to higher fuel prices and increased demand: The average of \$69.01 per ton is an increase of 114 percent compared with the average price of just \$32.21 ten years ago. [Figure 7](#) shows the upward trend in salt prices for Wisconsin and for 14+ states nationwide. Despite this increase, WisDOT pays less on average per ton for salt than most other snowy states across the country.

Figure 5. 2014-2015 Winter Costs vs. 5-Year Average

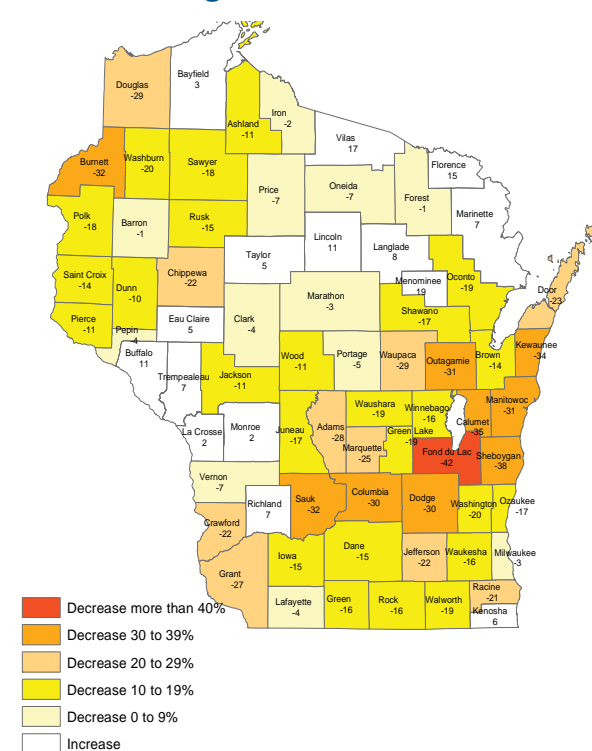


Figure 6. Expenditures by Category, 2014-2015

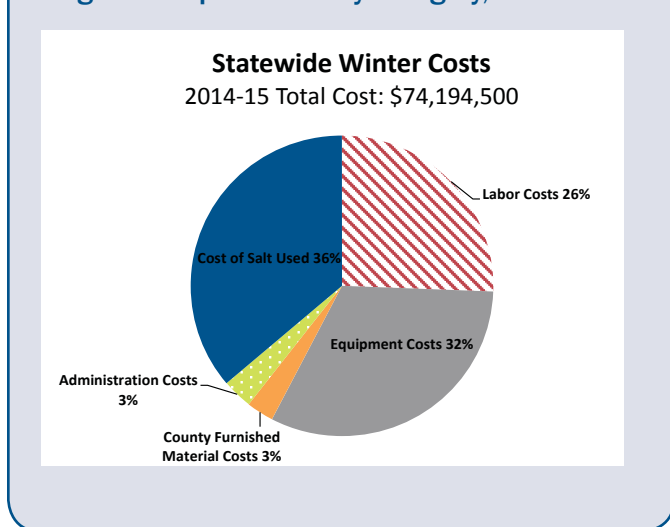
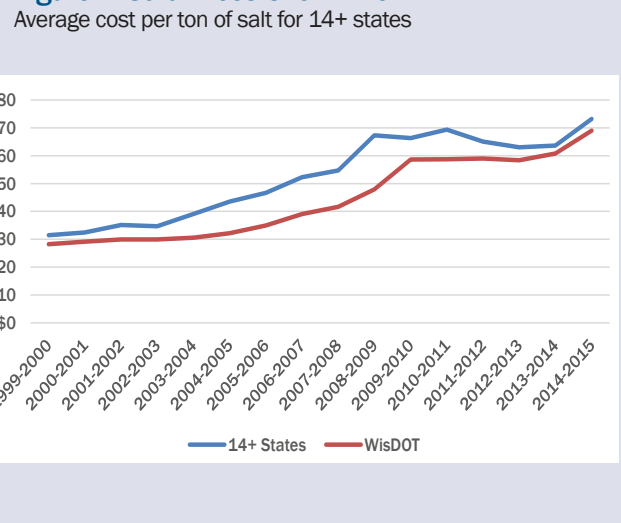


Figure 7. Salt Prices Over Time



Coordinating Counties' Response

This winter WisDOT continued its emphasis on close communication between the counties and WisDOT regional staff. Before each event, regional staff worked with the counties to coordinate available materials, staffing and equipment, and regional staff assisted the counties in managing shifts for long events.

This winter WisDOT also continued to implement its Adverse Conditions Communication/Coordination Plan to provide improved coordination during severe weather or other emergencies. The regions worked closely with the Wisconsin State Patrol in advance of storm events to ensure readiness across the affected areas. WisDOT staff helped man the state Emergency Operations Center in Madison, increasing the department's level of engagement during winter events and its ability to respond to severe incidents on the highway system. Post-storm analysis of the crews' response remains a challenge that the department plans to address in future winters.

Response Time

The counties continue to work on becoming more proactive in responding to winter storm events. Average response time this winter was 2 hours and 40 minutes. This is 4 hours and 22 minutes faster than 2013-2014, and 24 minutes faster than the average of the prior 10 years. As expected, average reaction times for more urban counties, which provide the highest level of service (24-hour coverage), were less than those counties that are directed by WisDOT to provide 18-hour coverage.

"Time to bare/wet pavement" is measured from a storm's reported end time. Heavily traveled urban highways tend to be returned to a bare/wet condition sooner than rural roads. WisDOT expects 24-hour roads to be clear within four hours of the end of the storm and 18-hour roads to be clear within six hours. This year, on average statewide, 70 percent of roads were to bare/wet pavement within the targeted time frame (see Table 2 on page 7).

Analyzing Travel and Crashes

By keeping roads as clear as possible within their expected level of service (18- or 24-hour coverage), maintenance crews have an opportunity to help prevent crashes. This year, there were 6,773 winter weather crashes (those that occurred on pavements covered with snow, slush or ice). In part, this data reflects the fact that the lower number of storm events decreased the exposure rate.

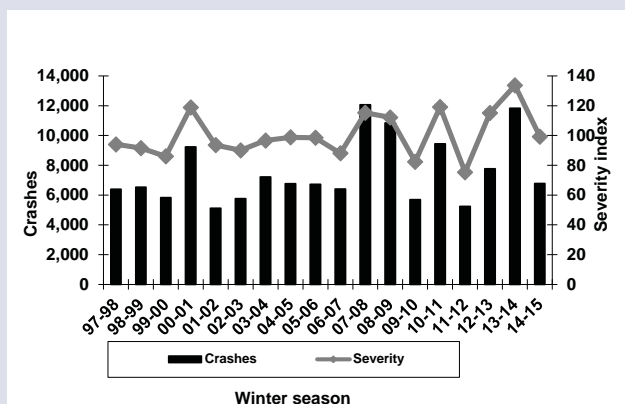
The crash rate (number of crashes per 100 million vehicle miles traveled) decreased this year to a statewide average of 25, down from last year's crash rate of 44. Last year, 11,837 winter crashes were reported.

Crash rates tend to correlate with winter severity. Compared with recent years that had similar severity indices, this winter's crash rate was similar. Figure 8 shows the trends in total crashes statewide over the last 15 years overlaid with the Winter Severity Index.

Tracking the Winter

Each week during winter, representatives from the 72 county highway departments complete winter storm reports. These reports give WisDOT the tools to manage statewide materials use and maintenance expenses as the winter progresses. Winter storm reports are also used to create the "Winter Severity Index" and other statewide performance measures.

Figure 8. Crashes and Winter Severity Index



Using Performance Measures

Developed in 2001, Compass is WisDOT’s quality assurance and asset management program for highway operations. Measures for winter operations were first established in 2003. As indicated in Table 2, this winter was less costly than the previous four winters when adjusted for winter severity. This winter, the success rate of getting bare/wet pavement within 4 or 6 hours (depends on road level of service) of the end of the storm improved from last year as did the number of winter weather crashes, when compared to the last two years.

Table 2. Statewide Compass Measures for Winter

	2010-11	2011-12	2012-13	2013-14	2014-15
Percentage of roads to bare/wet pavement (Within WisDOT target times)	79%	79%	73%	63%	70%
Cost per lane mile	\$2,696	\$1,656	\$2,778	\$3,304	\$2,155
Winter Severity Index	119.2	75.4	115.2	133.6	99.3
Cost per lane mile per Winter Severity Index point	\$22.62	\$21.99	\$24.11	\$24.73	\$21.71
Winter weather crashes	35 per 100 million VMT	20 per 100 million VMT	29 per 100 million VMT	44 per 100 million VMT	25 per 100 million VMT

MDSS and AVL-GPS Initiative

The Maintenance Decision Support System (MDSS) was initially deployed in Wisconsin in 2009, and became fully operational in 2011. The MDSS combines state-of-the-art weather forecasting with WisDOT’s rules of practice to generate treatment recommendations for plow routes statewide. Ideally the system would include real-time information from plow trucks that is gathered via the Automatic Vehicle Location/Global Positional System (AVL/GPS), but increases in licensing fees forced the Department to eliminate this live data feed. AVL/GPS data is still being gathered, but not in real-time.

This year WisDOT undertook a major effort to improve cycle time information in the MDSS configuration. Discussions with Iteris (the MDSS provider) and other states in the MDSS Pooled Fund Study (PFS) revealed that errors in cycle time are a major cause of degraded treatment recommendations. A new plan will be developed to try and eliminate these inconsistencies prior to the coming winter.

Training was reconfigured slightly in FY 2015; two introductory sessions were held for new users and a “main” MDSS training was held which focused on more advanced topics. Due to users’ requests, MDSS trainings will be held earlier next year (prior to late November/early December).



When integrated with AVL/GPS equipment, the MDSS system can show past applications and future treatments as well as actual precipitation amounts and predicted snowfall, with probabilities. The vertical line shows actual time with the past being to the left and the future to the right.

Looking Ahead

The 2014-2015 winter season was what most would consider an average winter: average snowfall, moderate cold snaps and the winter ended earlier than typical. On paper it should have been a less costly winter but that was not necessarily the case. This year freezing rain events more than doubled; these events tend to be the most costly behind extreme cold snaps.

In 2015-2016, WisDOT will continue to look toward efficiencies that reduce winter maintenance costs. The use of anti-icing on a routine basis in critical locations will be continued. Working with software for winter route optimization for participating counties will begin. Additional review of winter plow routes and current best practices will be ongoing.

Areas of focus for the 2015-2016 winter:

1. AVL/GPS (Automatic Vehicle Location/Global Positioning System) has become standard equipment and is now being utilized in 49 counties. The effort to implement the technology statewide is proceeding with a high emphasis on service providers with Interstates and Expressways and counties who are actively using the MDSS forecasting-treatment recommendation program.
2. WisDOT is going to partner with Dane County Highway Department to conduct a route optimizing study on Dane County's highways. The software called 'Fleet Route' is being jointly purchased for the study.
3. WisDOT plans on focusing MDSS user training on the transition to the web-based version as well as the mobile version. WisDOT will continue implementing the improved reporting capabilities of MDSS and will continue to study using MDSS data to develop an objective winter severity index.
4. Mixing liquid deicers is becoming more popular nationwide, as is the technique of getting more liquids on the roadway during plowing operations through the use of slurry generators. We will work with counties to begin investigating and testing these techniques.
5. The snowplow training modules for operators and supervisors training will begin this fall.

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