ANNUAL WINTER MAINTENANCE REPORT

2013-2014

Keeping Wisconsin Moving During the Polar Vortex

Wisconsin Department of Transportation
Division of Transportation System Development
Bureau of Highway Maintenance
Winter Operations Unit

October 2014

Acknowledgments

Many people at Wisconsin DOT contributed to the development of this report, including:

- Todd Matheson, Bureau of Highway Maintenance
- Mike Sproul, Bureau of Highway Maintenance
- Mike Adams, Bureau of Highway Maintenance
- Cathy Meinholz, Bureau of Highway Maintenance
- Lisa Meinholz, Bureau of Highway Maintenance
- Donald Lyden, Bureau of Transportation Safety
- Michael Sillence, Transportation Modeling & Information Unit

We wish to thank these individuals for their contributions to and assistance with this report.

In addition, we extend our thanks to Jay Wells of Washington State DOT for the use of his map of nationwide salt costs (see page 58).

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1 Introduction

To our partners

The severe winters just keep coming. The 2013-2014 winter blew away the record winter maintenance cost total (set in 2012-13) by over $10 million dollars, making it by far the most costly winter in Wisconsin history. The 2013-14 winter required additional money from the legislature in the form of a 13.10 request. Without the additional money many summer activities would have been reduced or eliminated, but the request was approved and summer maintenance activities went on as scheduled.

We commend the county maintenance crews for their dedicated response to this difficult winter. We also want to recognize the role of WisDOT regional staff in coordinating these efforts and providing the counties with priorities. We continually stress the importance of improving processes and procedures for snow removal and especially applaud the counties for working closely with us in partnership to give the taxpayers in Wisconsin an acceptable level of service for a reasonable cost. To capture these efforts, this report features:

- Five sections that correspond to the key components of winter and the counties' response, including Introduction, Winter Weather, Snow and Ice Control, Performance, and Looking Ahead.
- Two key tables that summarize important data at a glance: Winter by the Numbers (page 6) highlights statewide facts and figures. Winter in Wisconsin (pages 13-17) compiles key data for all 72 counties. These tables should be a first point of reference throughout the year whenever you need a winter statistic.
- Three maps that compare key data for this winter with the previous five years. These maps put each county's experience with winter severity (page 21), salt use (page 57) and total costs (page 98) in the context of what's normal for that county.
- Two graphs that put Wisconsin's experience with salt costs in the context of what other states pay (pages 36 and 37), and a map of salt cost data for all snowy states compiled by Washington State DOT (page 60).
- Best Practices sidebars throughout the report that highlight efficient practices.

Because this report has a wide and diverse audience, the text includes some explanations of winter maintenance technologies and best practices, such as anti-icing, pre-wetting, and use of the new AVL-GPS Systems. The State Highway Maintenance Manual is the first resource for more information on any of these items, and there are other resources available on WisDOT's extranet site. Links to these resources are provided throughout this report. For more information, contact your regional WisDOT representative or Mike Sproul, WisDOT's State Winter Operations Engineer, at michael.sproul@dot.wi.gov.

Sincerely,

Rose Phetteplace, Director
Bureau of Highway Maintenance

Table 1.1. Statewide Summary: This Winter Versus Last Winter, by the Numbers

		2012-2013 Winter	2013-2014 Winter
Infrastructure	Lane miles	33,192 miles	34,339 miles
	Patrol sections	769	753.5
	Average patrol section length	44.46 lane miles	45.57 lane miles
Weather	Average statewide Winter Severity Index	115.13	133.64
	Number of storms, statewide average and range across counties	Average: 36 Range: 23 to 65	Average: 43 Range: 30 to 69
	Snowfall, statewide average and range across counties	Average: 93.2 inches Range: 43 to 249 inches	Average: 101.5 inches Range: 56 to 233 inches
Materials[1]	Salt used	621,207 tons 18.1 tons per lane mile	669,807 tons 19.5 tons per lane mile
	Average cost of salt	$58.34 per ton	$60.40 per ton
	Prewetting liquid used	2,124,834 gal.	2,970,166 gal.
	Anti-icing agents used	1,110,886 gal.	887,415 gal.
	Sand used	18,589 cubic yd.	58,870 cubic yd.
Costs, Equipment and Performance	Total winter costs[2]	$94,982,937	$113,473,270
	Total winter costs per lane mile	$2,778	$3,304
	Average crew reaction time from start of storm	2.42 hours	7.03 hours
	Percentage of roads to bare/wet pavement (Within WisDOT target times)	73%	63%
	Road Weather Information System (RWIS) stations	60	58
	Counties with salt spreaders equipped with on-board prewetting unit	58 of 72 (80%)	58 of 72 (80%)
	Counties with salt spreaders equipped with ground-speed controller unit	67 of 72 (93%)	69 of 72 (96%)
	Underbody plows	658	658
	Counties with underbody plows	55 of 72 (76%)	56 of 72 (78%)
	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	65 of 72 (90%)	63 of 72 (88%)
Labor and Services	Regular county winter labor hours[3]	212,090 hrs.	244,602 hrs.
	Overtime county winter labor hours	137,225 hrs.	182,311 hrs.
	Public service announcements aired	7,154 total 5,919 radio; 1,235 TV	3,184 total 2,704 radio; 480 TV
	Cost of public service announcements	$36,000 ($241,380 market value)	$36,000 ($109,140 market value)

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 reflec salting, sanding, plowing and anti-icing efforts.

About This Report

Every year, WisDOT gathers a multitude of data on winter weather and the state's response to it. Tracking and analyzing this data helps us become more efficient by identifying good performance as well as areas that need improvement. In this way we use our limited resources to achieve the greatest benefit.

Through this report, WisDOT's Bureau of Highway Maintenance shares data with the department's regional maintenance staff and with our partners in the county highway departments. This allows regional and county staff to compare resource use with that of their peers across the state. The report has also been shared with the WisDOT Secretary's Office, the state legislature, national organizations such as Clear Roads, and the general public.

Report Structure and Data Sources

Following this section, this report is divided into four main sections:

- Section 2: Weather
- Section 3: Winter Operations
- Section 4: Performance
- Section 5: Looking Ahead

Each section has several subsections; refer to the Table of Contents for more detail. To improve readability, this year's report includes more statewide summary tables within the text, while county-by-county data appears at the end of each section.

Within many of the county-by-county tables in this report, the counties are grouped by region, in acknowledgement of the role that WisDOT's regional staff plays in coordinating winter maintenance in their counties. In some tables, counties are divided by Winter Peer Group (Groups A, B, C , D, E and F), which reflec the difference in the level of service provided on roads in these counties and facilitate comparisons within these groups. See Tables 1.3 and 1.4 on page 9 for more information on Winter Service Groups.

In most tables, raw numbers (such as total salt used) are presented along with data that has been adjusted for differences between counties (such as salt used per lane mile per Winter Severity Index point). This allows more accurate comparisons between regions in different parts of the state.

This report presents data from several sources:

- The weekly winter storm reports completed by the county highway departments, which detail the counties' estimates of the weather they faced and the materials, equipment and labor they used in responding to it. (See Section 4 for more information about storm reports.)
- Final cost and materials data as billed to WisDOT.
- Data on weather, crashes, travel and other topics from other bureaus within WisDOT and other agencies.

The final billed amounts are considered the most accurate source of cost and materials data, and are presented wherever possible. The source of the data in each table is indicated in the table's heading.

When interpreting the data in this report, readers should remember that many factors affect a county's response to winter, including the local Winter Severity Index, local traffic generators, the mix of highway types and classifications in a county, the type of equipment being used, and the length of patrol sections. Some tables in this report give data that is adjusted for one or more of these factors (for example, salt use per lane mile per severity index point), while others provide raw data.

Working with County Highway Departments

WisDOT's Bureau of Highway Maintenance, in partnership with the five WisDOT regional offices, is responsible for the maintenance of the state trunk and Interstate highway system. This system includes 34,339 lane miles of highway and about 4,570 bridges.

WisDOT contracts with the state's 72 county highway departments to provide snow and ice control on all state and U.S.-owned highways in Wisconsin, including the Interstate system. This partnership was set up more than 100 years ago and is unique to the nation.

This relationship benefits both WisDOT and the county highway departments. WisDOT receives the services of a skilled, experienced work force at fair labor rates, and the counties are able to purchase more pieces and types of equipment than they could otherwise afford. This equipment is then available for use on both county and state roads, an arrangement that allows WisDOT and the counties to avoid duplicating equipment and facilities. This arrangement also allows for increased efficiencies in work crews, thus reducing labor costs to taxpayers.

Staff at WisDOT's five regional offices work closely with the county highway departments. Regional managers administer the contracts with the counties, and work with the counties to plan maintenance activities and set priorities. Regional staff oversee county highway departments' maintenance expenditures, and are responsible for ensuring that the counties use resources efficiently and adhere to state guidelines for materials use. Regional staff also serve as a resource for the counties on state and federal rules and regulations, and can provide training assistance.

Figure 1.1. WisDOT Regional Divisions

Snow Removal Strategy

In order to gain the most benefit from limited resources, counties provide different levels of service on highways according to the amount of daily traffic they receive. High-volume roads typically receive 24-hour coverage, while lower-volume roads receive 18-hour coverage. On 18-hour routes the service hours are adjusted based on timing of the storms. On lower-volume four-lane highways, the passing lanes may receive less attention than the driving lanes and ramps.

Table 1.2. Highway Categories for Winter Maintenance

Category	Definition	Lane miles	% of total
1	Major urban freeways and most highways with six lanes and greater	3,013	9%
2	High volume four-lane highways (Average Daily Traffic ≥ 25,000) and some four-lane highways (ADT < 25,000), and some 6-lane highways.	3,151	9%
3	All other four-lane highways (ADT < 25,000)	8,992	26%
4	Most high volume two-lane highways (ADT ≥ 5,000) and some 2-lanes (ADT <5000)	4,603	13%
5	All other two-lane highways	14,580	42%
Total		34,339	

Table 1.2 above shows how WisDOT categorizes the state's highways for winter maintenance. For more detail on the categories and which category each highway is assigned to, see the map on page 117 in the Appendix.

To facilitate comparisons between counties that provide similar levels of service, WisDOT divides the 72 counties into six Winter Peer Groups — A, B, C, D, E and F, with A being the most urban and F the most rural. Table 1.3 below explains the divisions between the groups. This table also shows which counties are assigned to each service group. In many tables throughout this report, the counties are arranged according to these groups. Group A contains the fewest counties, while Group B has the most.

In addition, each county highway department divides its highways into winter patrol sections. One snowplow truck is generally assigned to each patrol section. This winter, there were 753.5 patrol sections on state-maintained highways, with an average of 45.57 lane miles per patrol section. Patrol section length is another factor that can affect performance; see Section 4 for a complete discussion of patrol sections

Table 1.3. County Winter Peer Groups

Winter Service Group	Definitio	County Names	Number of Counties	% of Counties
A	• 1,000 or more lane miles and all counties have some roads with six or more lanes • 900,000 or more square feet of bridge deck • 20 or more plow routes; most routes are 24 hour routes	Dane, Milwaukee,Waukesha	3	4%
B	• 600 to 1,000 lane miles; some counties have roads with six or more lanes; all counties have high mileage on four-lane roads • 400,000 to 900,000 square feet of bridge deck • 14 to 20 plow routes; most routes are 24 hour routes	Brown, Chippewa, Columbia, Dodge, Eau Claire, Fond du Lac, Grant, Jefferson, Kenosha, Marathon, Monroe, Outagamie, Portage, Racine, Rock, Sauk, St. Croix, Walworth, Washington, Waupaca, Winnebago	21	29%
C	• 450 to 600 lane miles; some counties have roads with six or more lanes; all counties medium mileage on four-lane roads • 170,000 to 450,000 square feet of bridge deck • 7 to 14 plow routes; mix of 18 and 24 hour routes	Barron, Clark, Crawford, Douglas, Dunn, Iowa, Jackson, Juneau, La Crosse, Lincoln, Manitowoc, Oconto, Pierce, Shawano, Sheboygan, Vernon, Wood	17	24%
D	• 325 to 450 lane miles; no counties have roads with six or more lanes; all counties have low to medium mileage on four-lane roads; highest mileage is in two-lane roads • 140,000 to 170,000 square feet of bridge deck • 4 to 7 plow routes; mix of 18 and 24 hour routes	Bayfield, Buffalo, Door, Green, Green Lake, Lafayette, Marinette, Marquette, Oneida, Ozaukee, Polk, Richland, Trempealeau, Washburn, Waushara	15	21%
E	• 175 to 325 lane miles; no counties have roads with six or more lanes; few counties have four-lane roads; medium to high mileage on two-lane roads • 50,000 to 140,000 square feet of bridge deck • 2 to 4 plow routes; nearly all with 18 hour routes	Ashland, Burnett, Calumet, Forest, Iron, Langlade, Pepin, Price, Rusk, Sawyer, Taylor, Vilas	12	17%
F	• 90 to 175 lane miles; no counties have roads with six or more lanes; counties have 0 to 5 lane miles of four-lane roads; two-lane roads have low to medium mileage • Less than 50,000 square feet of bridge deck • Fewer than 2 plow routes; all 18 hour routes	Adams, Florence, Kewaunee, Menominee	4	6%

This Winter in Wisconsin

Table 1.5 on pages 13-17 summarizes key data from this winter for all 72 counties, including total salt use and cost data. This table facilitates comparisons in these core areas across regions and counties, and serves as a quick reference for commonly used data. The table uses a similar format to the Storm Report Summary (Table A-1 on page 119 of the Appendix), but the cost data in Table 1.5 are actual billed costs as submitted to WisDOT by the counties, rather than estimates from the storm reports.

County-by-County
Quick Reference Winter Summary Table
for Section 1: Introduction

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Table 1.5. Winter in Wisconsin, 2013-2014

County	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used (tons) per lane mile per Severity Index	Total salt costs	Total salt costs per lane mile	Total winter costs	Total winter costs per lane mile	Total winter costs per lane mile per Severity Index
North Central Region											
Adams	193.82	129.06	64.00	2,760	14.24	0.11	$198,207	$1,023	$540,321	$2,788	$21.60
Florence	141.07	166.58	154.20	3,254	23.07	0.14	$194,135	$1,376	$490,403	$3,476	$20.87
Forest	312.38	187.34	154.70	7,617	24.38	0.13	$440,499	$1,410	$1,106,365	$3,542	$18.91
Green Lake	156.94	127.98	67.80	1,034	6.59	0.05	$63,142	$402	$269,319	$1,716	$13.41
Iron	249.56	225.36	233.40	6,777	27.16	0.12	$431,684	$1,730	$1,205,460	$4,830	$21.43
Langlade	299.21	155.70	107.20	3,671	12.27	0.08	$204,386	$683	$723,497	$2,418	$15.53
Lincoln	415.19	162.14	132.80	6,080	14.64	0.09	$377,993	$910	$1,287,331	$3,101	$19.12
Marathon	868.57	159.65	95.30	13,873	15.97	0.10	$929,335	$1,070	$2,789,024	$3,211	$20.11
Marquette	245.09	106.49	69.30	3,106	12.67	0.12	$192,900	$787	$465,304	$1,899	$17.83
Menominee	90.26	98.47	83.10	1,675	18.55	0.19	$89,695	$994	$206,368	$2,286	$23.22
Oneida	396.79	187.76	144.50	10,363	26.12	0.14	$691,027	$1,742	$1,633,888	$4,118	$21.93
Portage	581.81	156.85	88.70	6,405	11.01	0.07	$417,856	$718	$1,701,766	$2,925	$18.65
Price	322.26	160.02	133.40	5,240	16.26	0.10	$341,837	$1,061	$965,032	$2,995	$18.71
Shawano	519.55	137.08	111.00	8,806	16.95	0.12	$480,025	$924	$1,507,580	$2,902	$21.17
Vilas	305.24	138.04	176.00	8,755	28.68	0.21	$615,302	$2,016	$1,302,675	$4,268	$30.92
Waupaca	547.06	120.84	88.90	10,012	18.30	0.15	$545,154	$997	$1,581,196	$2,890	$23.92
Waushara	345.01	108.92	84.50	4,120	11.94	0.11	$243,972	$707	$718,278	$2,082	$19.11
Wood	429.88	152.25	96.90	7,117	16.55	0.11	$470,980	$1,096	$1,194,099	$2,778	$18.24
Region total	**6,419.69**			**110,665**			**$6,928,130**		**$19,687,907**		
Region average	**356.65**	**148.92**	**115.9**	**6,148**	**17.24**	**0.12**	**$384,896**	**$1,079**	**$1,093,773**	**$3,067**	**$20.59**

Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data is taken from WisDOT's Salt Inventory Reporting System.

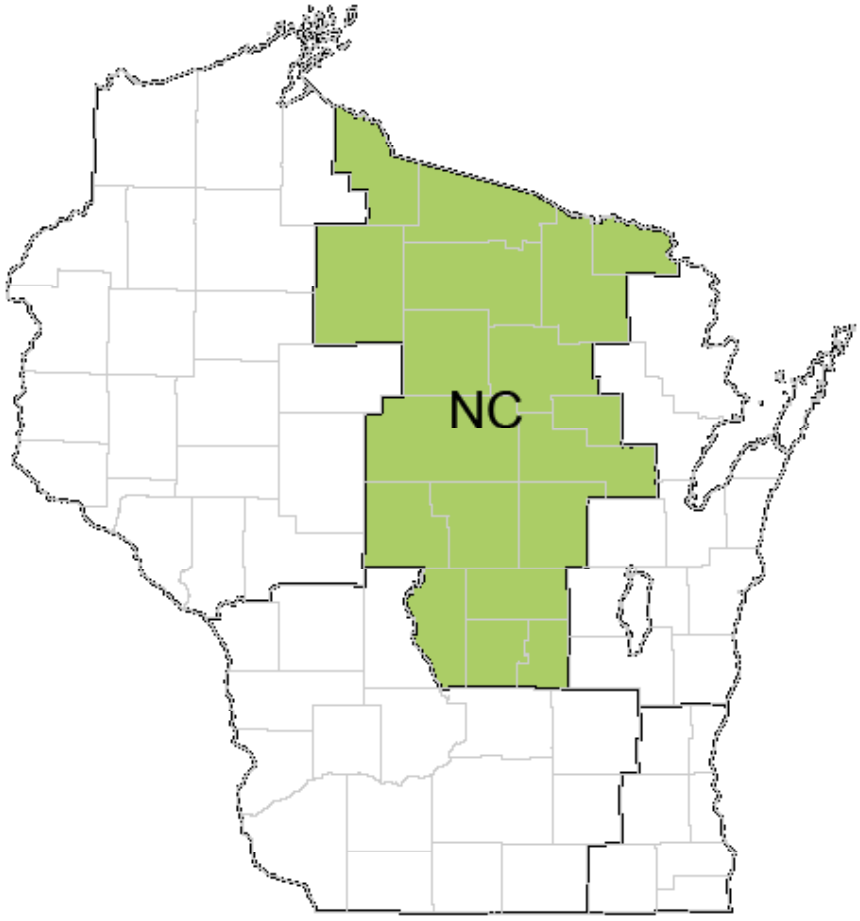


Table 1.5. Winter in Wisconsin, 2013-2014

County	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used (tons) per lane mile per Severity Index	Total salt costs	Total salt costs per lane mile	Total winter costs	Total winter costs per lane mile	Total winter costs per lane mile per Severity Index
Northeast Region											
Brown	765.86	117.49	82.70	11,193	14.62	0.12	$573,106	$748	$2,269,647	$2,964	$25.22
Calumet	201.71	118.63	95.50	2,592	12.85	0.11	$136,004	$674	$522,542	$2,591	$21.84
Door	268.55	122.48	91.10	4,990	18.58	0.15	$278,478	$1,037	$955,948	$3,560	$29.06
Fond du Lac	597.30	123.33	81.20	10,379	17.38	0.14	$639,216	$1,070	$1,752,593	$2,934	$23.79
Kewaunee	110.41	119.09	92.70	1,251	11.33	0.10	$66,766	$605	$303,393	$2,748	$23.07
Manitowoc	424.85	125.35	80.60	7,560	17.80	0.14	$402,210	$947	$1,319,731	$3,106	$24.78
Marinette	421.42	139.54	124.60	5,367	12.74	0.09	$316,038	$750	$1,101,275	$2,613	$18.73
Oconto	467.45	120.11	118.90	6,820	14.59	0.12	$394,789	$845	$1,267,488	$2,711	$22.58
Outagamie	535.83	108.23	94.80	9,793	18.28	0.17	$520,218	$971	$1,858,656	$3,469	$32.05
Sheboygan	522.38	128.42	63.40	10,473	20.05	0.16	$641,035	$1,227	$1,719,982	$3,293	$25.64
Winnebago	622.41	105.96	63.80	11,861	19.06	0.18	$675,717	$1,086	$1,988,792	$3,195	$30.16
Region total	**4,938.17**			**82,278**			**$4,643,577**		**$15,060,046**		
Region average	**448.92**	**120.78**	**89.9**	**7,480**	**16.66**	**0.14**	**$422,143**	**$940**	**$1,369,095**	**$3,050**	**$25.25**

Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data is taken from WisDOT's Salt Inventory Reporting System.

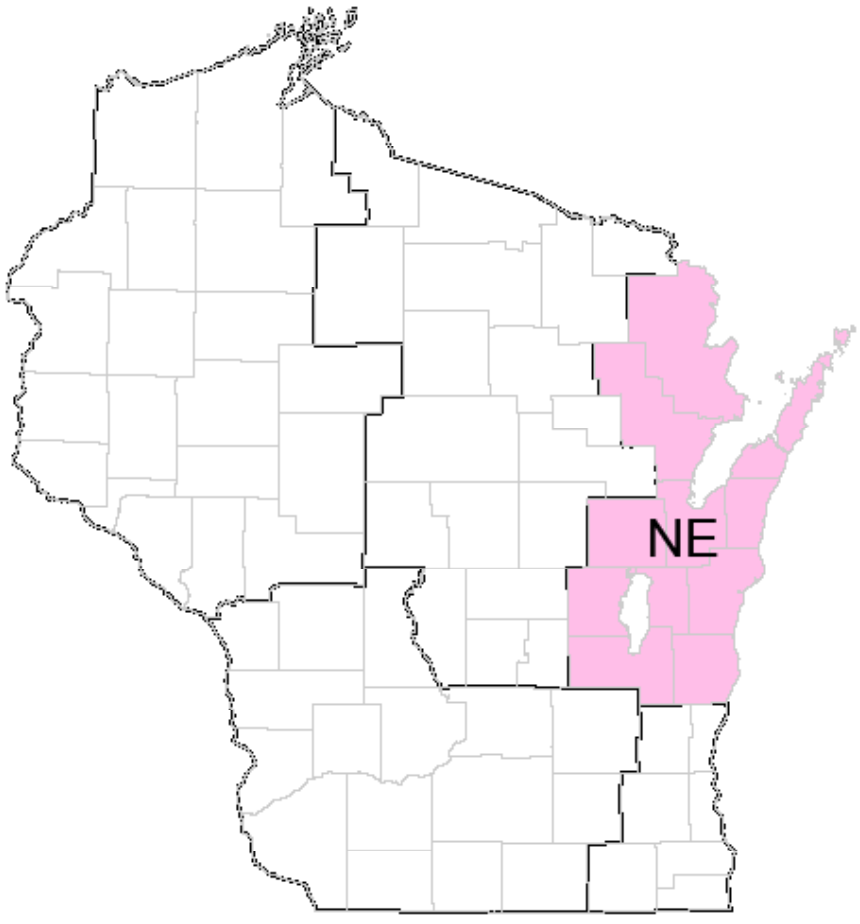


Table 1.5. Winter in Wisconsin, 2013-2014

County	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used (tons) per lane mile per Severity Index	Total salt costs	Total salt costs per lane mile	Total winter costs	Total winter costs per lane mile	Total winter costs per lane mile per Severity Index
Northwest Region											
Ashland	249.49	195.59	190.00	3,710	14.87	0.08	$232,882	$933	$860,706	$3,450	$17.64
Barron	423.09	169.25	144.40	4,576	10.82	0.06	$289,346	$684	$1,333,117	$3,151	$18.62
Bayfield	316.88	199.27	222.00	5,688	17.95	0.09	$334,464	$1,055	$1,051,760	$3,319	$16.66
Buffalo	317.02	100.49	67.00	2,130	6.72	0.07	$132,067	$417	$514,931	$1,624	$16.16
Burnett	234.95	142.01	140.70	3,662	15.59	0.11	$213,550	$909	$734,756	$3,127	$22.02
Chippewa	654.65	107.19	91.30	13,937	21.29	0.20	$917,468	$1,401	$2,430,442	$3,713	$34.64
Clark	402.56	131.24	106.40	5,455	13.55	0.10	$375,315	$932	$1,034,121	$2,569	$19.57
Douglas	440.87	168.42	218.30	9,590	21.75	0.13	$540,390	$1,226	$1,582,587	$3,590	$21.31
Dunn	516.58	111.04	98.50	11,418	22.10	0.20	$746,182	$1,444	$1,797,899	$3,480	$31.34
Eau Claire	537.78	122.71	96.50	10,122	18.82	0.15	$671,814	$1,249	$1,924,093	$3,578	$29.16
Jackson	515.00	134.38	73.80	8,941	17.36	0.13	$630,310	$1,224	$1,439,642	$2,795	$20.80
Pepin	112.38	98.18	68.00	968	8.62	0.09	$65,040	$579	$233,658	$2,079	$21.18
Pierce	365.50	128.79	90.70	5,144	14.07	0.11	$316,760	$867	$1,038,875	$2,842	$22.07
Polk	385.05	181.61	134.70	7,590	19.71	0.11	$490,463	$1,274	$1,313,709	$3,412	$18.79
Rusk	213.47	109.54	114.20	3,077	14.41	0.13	$204,258	$957	$620,782	$2,908	$26.55
Saint Croix	630.22	142.70	91.30	13,811	21.91	0.15	$839,029	$1,331	$960,940	$1,525	$10.69
Sawyer	367.44	140.76	149.20	5,404	14.71	0.10	$367,459	$1,000	$2,291,978	$6,238	$44.31
Taylor	233.90	157.57	107.80	3,056	13.07	0.08	$228,193	$976	$688,398	$2,943	$18.68
Trempeleau	441.05	99.56	65.30	6,496	14.73	0.15	$408,057	$925	$1,124,194	$2,549	$25.60
Washburn	372.14	153.27	202.20	7,732	20.78	0.14	$459,142	$1,234	$1,285,654	$3,455	$22.54
Region total	**7,730.02**			**132,507**			**$8,462,190**		**$ 24,262,243**		
Region average	**386.50**	**139.68**	**123.6**	**6,625**	**16.14**	**0.12**	**$423,109**	**$1,095**	**$1,213,112**	**$3,139**	**$22.47**

Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data is taken from WisDOT's Salt Inventory Reporting System.

Table 1.5. Winter in Wisconsin, 2013-2014

County	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used (tons) per lane mile per Severity Index	Total salt costs	Total salt costs per lane mile	Total winter costs	Total winter costs per lane mile	Total winter costs per lane mile per Severity Index
Southeast Region											
Kenosha	653.56	120.43	74.00	13,267	20.30	0.17	$720,921	$1,103	$2,250,893	$3,444	$28.60
Milwaukee	1,888.71	122.76	58.60	54,921	29.08	0.24	$2,882,804	$1,526	$9,236,511	$4,890	$39.84
Ozaukee	308.71	118.36	62.30	9,910	32.10	0.27	$534,442	$1,731	$1,248,683	$4,045	$34.17
Racine	698.11	136.76	91.40	18,694	26.78	0.20	$1,027,402	$1,472	$2,778,973	$3,981	$29.11
Walworth	706.03	102.90	79.90	16,462	23.32	0.23	$854,707	$1,211	$2,501,408	$3,543	$34.43
Washington	603.45	125.97	63.00	16,167	26.79	0.21	$931,032	$1,543	$2,224,148	$3,686	$29.26
Waukesha	1,112.03	107.92	85.80	25,115	22.59	0.21	$1,363,018	$1,226	$3,836,631	$3,450	$31.97
Region total	**5,970.60**			**154,535**			**$8,314,325**		**$ 24,077,246**		
Region average	**852.94**	**119.30**	**73.6**	**22,076**	**25.88**	**0.22**	**$1,187,761**	**$1,393**	**$3,439,607**	**$4,033**	**$33.80**

Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data is taken from WisDOT's Salt Inventory Reporting System.

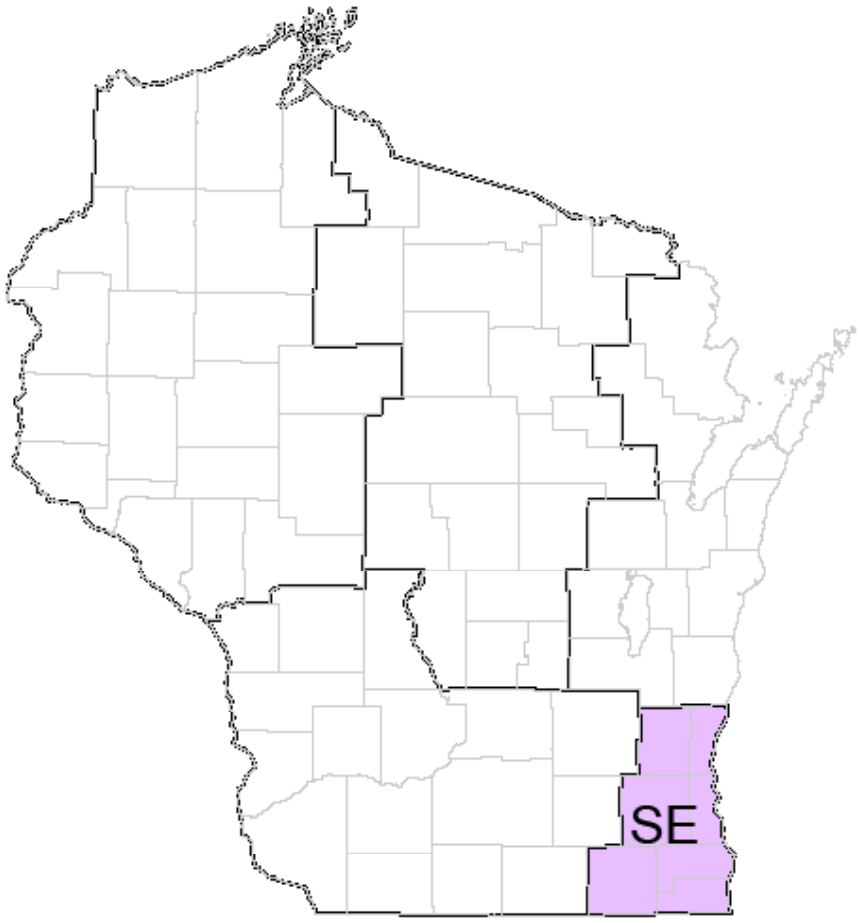
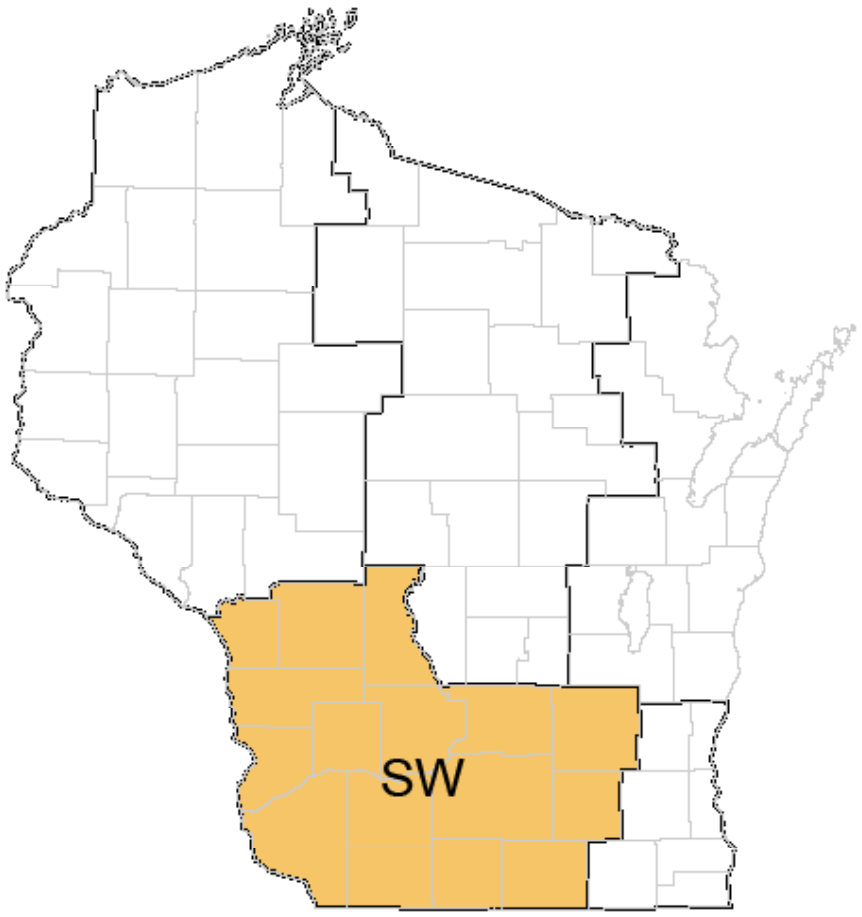


Table 1.5. Winter in Wisconsin, 2013-2014

County	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used (tons) per lane mile per Severity Index	Total salt costs	Total salt costs per lane mile	Total winter costs	Total winter costs per lane mile	Total winter costs per lane mile per Severity Index
Southwest Region											
Columbia	792.92	155.67	98.90	22,997	29.00	0.19	$1,617,874	$2,040	$3,208,478	$4,046	$25.99
Crawford	394.99	122.31	59.90	4,564	11.56	0.09	$284,216	$720	$886,393	$2,244	$18.35
Dane	1,535.50	131.56	59.80	53,531	34.86	0.26	$3,381,043	$2,202	$7,592,467	$4,945	$37.58
Dodge	630.41	116.82	77.60	15,113	23.97	0.21	$935,186	$1,483	$2,095,374	$3,324	$28.45
Grant	622.06	105.96	81.40	9,074	14.59	0.14	$549,634	$884	$1,528,281	$2,457	$23.19
Green	312.72	111.91	68.90	2,120	6.78	0.06	$138,525	$443	$628,645	$2,010	$17.96
Iowa	457.98	132.61	74.20	6,586	14.38	0.11	$403,620	$881	$1,339,357	$2,924	$22.05
Jefferson	549.15	122.01	95.00	11,883	21.64	0.18	$717,265	$1,306	$1,822,099	$3,318	$27.19
Juneau	494.25	133.90	91.30	8,298	16.79	0.13	$589,870	$1,193	$1,339,063	$2,709	$20.23
LaCrosse	488.80	122.13	74.10	8,325	17.03	0.14	$474,035	$970	$1,480,607	$3,029	$24.80
Lafayette	293.88	111.13	90.10	2,026	6.89	0.06	$122,188	$416	$877,238	$2,985	$26.86
Monroe	653.65	129.96	67.40	10,100	15.45	0.12	$669,700	$1,025	$1,588,388	$2,430	$18.70
Richland	330.10	98.60	55.70	3,273	9.92	0.10	$219,975	$666	$660,231	$2,000	$20.28
Rock	678.82	126.63	75.30	13,250	19.52	0.15	$754,218	$1,111	$2,286,606	$3,369	$26.60
Sauk	578.72	128.42	86.00	11,714	20.24	0.16	$805,476	$1,392	$1,800,338	$3,111	$24.22
Vernon	467.04	134.35	87.20	6,966	14.91	0.11	$446,912	$957	$1,252,263	$2,681	$19.96
Region total	**9,280.99**			**189,822**			**$12,109,738**		**$ 30,385,828**		
Region average	**580.06**	**124.00**	**77.7**	**11,864**	**20.45**	**0.16**	**$756,859**	**$1,305**	**$1,899,114**	**$3,274**	**$26.40**
Statewide total	**34,339.47**		**101.5**	**669,807**	**19.51**		**$40,457,960**	**$1,178**	**$113,473,270**	**$3,304**	
Statewide average		**133.64**									

Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data is taken from WisDOT's Salt Inventory Reporting System.



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2 Winter Weather

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Every winter is different. The number and type of storms, the range of temperatures, the amount of snow – these factors, along with many others, combine to create varying challenges for Wisconsin's county highway departments each year.

The 2013-14 winter season was one of the most severe on record. Snowfall was much heavier than normal, with a statewide average of 101 inches. This was approximately **42 percent** above the five-year statewide average, a figure which itself was inflated by the 93-inch statewide snowfall average during the severe winter of 2012-13

This section describes the weather Wisconsin experienced during the 2013-14 winter, and the tools and methodologies WisDOT uses to analyze individual storms and the winter as a whole. The Winter Severity Index is one such tool – WisDOT uses it to facilitate comparisons from one winter to the next, and from county to county within the same season.

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. *See page 71 for more information.*

Winter Weather, 2013–2014

	Statewide average	Range across counties
Total snowfall[1]	**101 inches**	**56-222 inches**
Winter Severity Index	**134**	**98-225**
Winter storms	**24.5**	**16-46**
Frost events	**3.8**	**0-22**
Freezing rain events	**3.1**	**0-12**

1.All data in this table is from Winter Storm Reports, 2013–2014.

Winter Weather Challenges

Each year, county highway departments face unique combinations of temperatures and storms, and draw on their experience in deciding what combination of snow and ice control strategies to employ. The number of storms has a more significant impact on resources expended than snowfall totals, since staff and equipment may be mobilized even if only 0.1 inches of snow or freezing rain falls. Weekend and evening storms may also be more costly than weekday storms because of overtime pay.

Storms with low temperatures can be difficult for crews because deicing agents become less effective at lower temperatures. Storms with high winds also are a challenge, because snow blows back onto the roadway quickly after the plows pass.

Counties in the northern half of the state tend to face colder temperatures and heavier snowfall than those in the southern half. Wisconsin's average annual snowfall ranges from about 40 inches in the south to as much as 160 inches along the shores of Lake Superior. The statewide average annual snowfall is 52.4 inches (30-year normal as recorded by the Wisconsin State Climatology Office).

On average, about 35 to 40 winter weather events hit Wisconsin each winter. While only a couple of large freezing rain events normally strike the state each winter, the state experiences numerous freezing drizzle and freezing fog events that cause roads to ice over.

This Winter's Weather

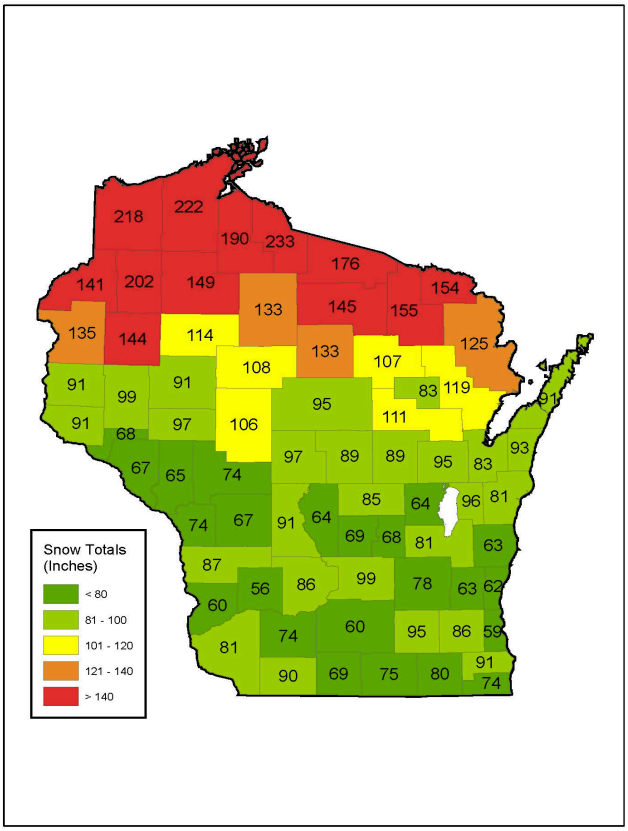
The 2013-14 winter season was the most severe in recent history for most of Wisconsin. Heavier-than-average snowfall combined with extremely cold temperatures to create a winter maintenance nightmare. Numerous fairly light snow events impacted the state almost non-stop from December into early April.

After a relatively benign November, winter once again began in earnest in early December. Numerous events impacted the state, with the most severe of them hitting northwest Wisconsin. Peshtigo set an all-time daily snowfall record with 22.9 inches on December 23. Numerous other daily snowfall records were also set throughout the month.

January brought a continuation of the snowy conditions as well as bitterly cold temperatures. Average daily low temperatures were below zero across all but far southeastern Wisconsin. Snowfall continued to be well above average. Two significant snowfalls hit the state on January 25 and 30, both dropping more than 6 inches in many locations.

February brought little change. Two more major snow events struck the state. On February 4, the south was hit. Then much heavier snow blanketed the northwest with

Figure 2.1. Statewide Snowfall, 2013-14
From Winter Storm Reports



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

as much as 18 inches on February 20. Temperatures continued to average well below normal.

The well-below-average temperatures lingered into March. Several snow events also hit, especially across northern Wisconsin. These trends continued even into April, as several additional snow events impacted the northern areas.

During the 2013–2014 winter season, county highway departments responded to:

- A statewide average of 43 snow events per county, with a high of 69 in Iron County and a low of 30 in Kewaunee County.
- A statewide average of 4 frost events.
- A statewide average of 6 freezing rain events.

Figure 2.1 shows the total snowfall received in Wisconsin this winter based on storm report data. Snowfall varied quite a bit across the state; the highest snowfall recorded was in Iron County, at 233 inches; the lowest was in Richland County, at 56 inches. Statewide, this winter's total snowfall was well above average.

Winter Severity Index

WisDOT's Winter Severity Index is a management tool that allows the department to maximize winter maintenance efficiency by evaluating the materials, labor and equipment used based on the severity of the winter in a given county or region.

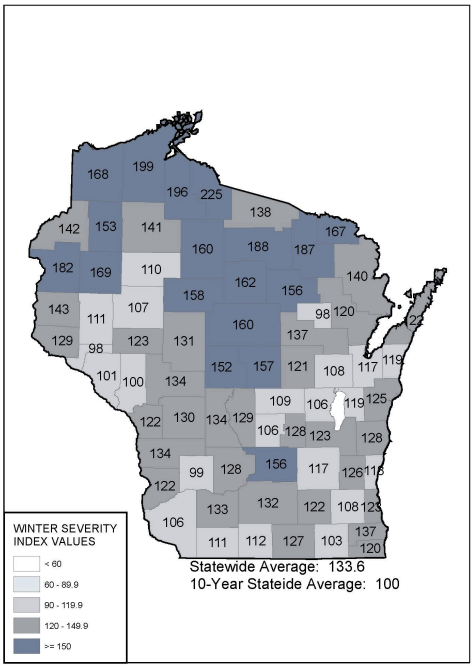
Developed in 1995, the severity index is calculated using a formula that includes:

- Number of snow events
- Number of freezing rain events
- Total snow amount
- Total storm duration
- Total number of incidents

Since all of these factors can affect materials use, the severity index gives the department a simple way to quantify severity that incorporates multiple factors into a single number. WisDOT uses the severity index in two ways:

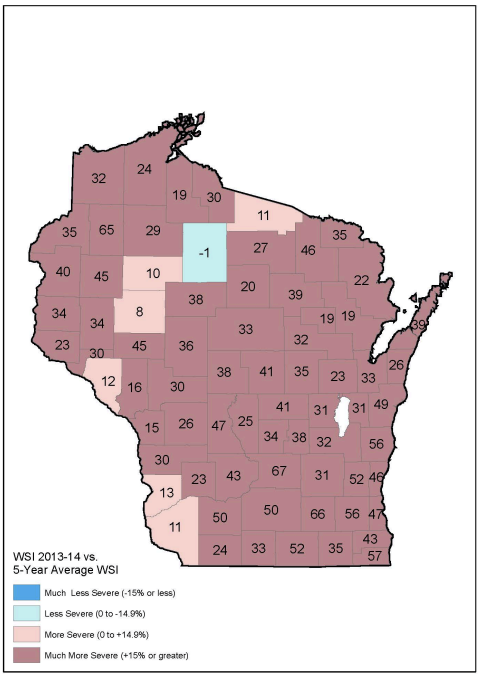
1. Season-to-season comparisons. This lets the department compare apples to apples when evaluating materials use and costs over several seasons, and identify trends in winter weather that can be useful in planning materials purchases. In the case of cost trends, adjusting cost data for severity index ranking can help WisDOT separate cost increases due to more severe winters from those due to increased labor costs, equipment costs, lane miles and other factors.

Figure 2.2. 2013-14 Winter Severity Index



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

Figure 2.3. 2013-14 Winter Severity Index vs. 5-Year Average (2008–09 thru 2012-13)



2. Regional comparisons. Since snowfall, number of storms, and other factors vary widely across the state, the severity index also helps WisDOT compare resources use from one region or county to another within a single winter. This allows WisDOT to assess whether materials are being used consistently, whether counties have enough staff, and other factors that affect each region's response to winter.

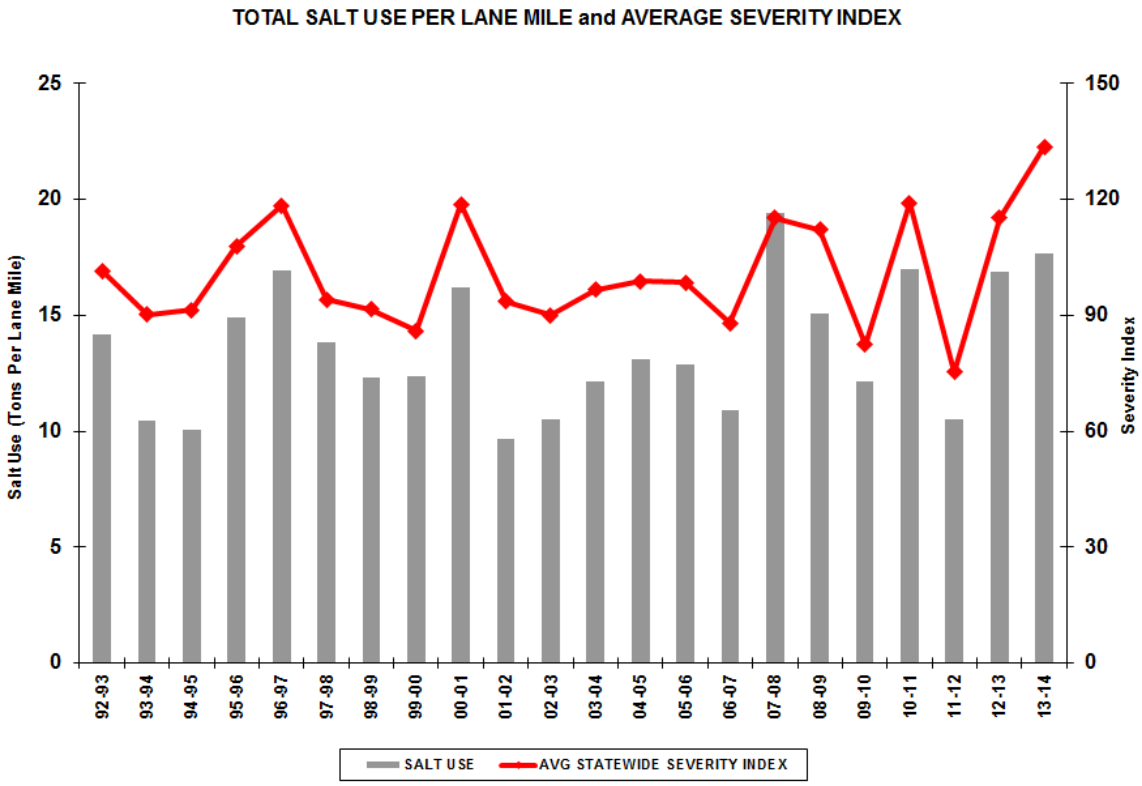
Data from weekly storm reports are used to calculate the Winter Severity Index for each county according to a weighted formula. Results are scaled such that the 5-year average is 100. A number above 100 indicates higher-than-average severity; a number below 100 indicates lower-than-average severity. We have begun scaling severity this way in order to make the numbers more easily understood. This winter:

- The statewide average Winter Severity Index was 133.64, which was 33 percent higher than the statewide average of the previous five winters (100).
- Iron County had the highest severity index (225), and Ashland and Bayfield Counties were both over 190.
- Pepin County had the lowest severity index (98.18), and only three other counties (Menominee, Richland and Trempealeau) had a severity index under 100.

With very few exceptions across the state, this winter was much more severe than normal. Figure 2.2 on the previous page shows how severity index varied by county this winter, while Figure 2.3 shows how this winter's severity index for each county compares to the average of the previous five years in that county (as a percentage difference); only Price County had a winter severity index lower than its previous 5-year average.

Figure 2.4 below shows average statewide salt use per lane mile versus the average statewide Winter Severity Index. Normally, salt use tends to increase as the severity index increases. Salt use per lane mile in 2013-14 was only about 4 percent higher than salt use during the winters of 2010-11 and 2012-13, despite this year's much higher severity index. This winter's salt use was 17 percent lower than 2007-08, which had a lower severity index.

Figure 2.4. Salt Use per Lane Mile and Average Severity Index
(From Salt Inventory Reporting System, 1992–2014)



Since the Winter Severity Index is an important tool for comparing cost and materials data from year to year, this report includes several charts that compare trends in winter measures over time with changes in severity index. These include Figure 2.4 on the previous page, as well as Figure 3.2 (salt used per lane mile; page 35), Figure 4.1 (winter costs; page 74), and Figure 4.6 (winter crashes; page 81).

Because of concerns about consistency across all counties in reporting incidents, beginning with the 2005–2006 winter WisDOT adjusted the formula for computing the severity index to remove cleanup and bridge deck snow removal as components in the calculation. The effect of this change is slight, but readers should be aware of it when comparing severity index data from the last several winters against earlier data. The severity index for some counties may appear slightly lower using the new formula.

More information on the severity index is available by request from WisDOT:

- A report describing the process that was used to develop the severity index, including data on the five-year average severity index for each county (March 1998).
- A table showing Winter Severity Index values for each county for the previous 10 winter seasons.

On page 27, Table 2.1 gives details about the types of storms and other incidents (such as frost, ice, and drifting or blowing snow) that each county experienced this winter, as reported by the counties in their winter storm reports.

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County-by-County
Tables for Section 2
Winter Weather

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Table 2.1. Storms and Incidents

From Winter Storm Reports, 2013-2014

Region	County	Snow Depth	Lane Miles	Salt Used	Tons /LM	Number of Storms	Types of Storms				Number of Incidents	Types of Incidents						Anti-Icing applic.
							Wet Snow	Dry Snow	Freezing Rain	Sleet		Drifting Snow	Blowing Snow	Frost	Ice	Bridge Decks	Clean Up	
NC	ADAMS	50.7	192.72	2465	12.79	21	19	17	12	16	13	7	5	3	4	0	2	18
	FLORENCE	68.6	141.07	1862	13.20	31	9	24	6	0	13	2	5	0	1	2	9	5
	FOREST	67.3	312.38	4351	13.93	24	7	15	3	1	22	15	13	2	0	1	14	1
	GREEN LAKE	61.6	151.30	758	5.01	23	19	4	2	3	16	10	10	1	3	1	10	3
	IRON	209.4	250.91	3892	15.51	45	16	27	5	2	17	2	0	4	4	2	8	4
	LANGLADE	46.0	292.69	2451	8.37	20	12	13	2	3	22	16	9	1	8	1	9	6
	LINCOLN	65.0	418.33	3439	8.22	29	11	26	4	5	16	7	8	7	4	3	7	8
	MARATHON	34.1	880.19	7329	8.33	24	11	12	5	1	29	8	9	7	9	2	16	20
	MARQUETTE	55.0	244.53	3420	13.99	16	5	15	1	2	9	1	1	6	1	1	6	9
	MENOMINEE	68.8	90.26	1251	13.86	26	9	17	0	1	11	4	1	2	2	0	9	0
	ONEIDA	77.7	396.79	3726	9.39	29	11	14	5	2	19	2	0	14	4	3	4	9
	PORTAGE	38.6	547.20	5278	9.65	29	5	21	3	0	18	12	0	4	7	3	4	4
	PRICE	56.1	320.57	3103	9.68	31	15	20	7	8	21	10	1	3	12	4	11	10
	SHAWANO	61.6	515.09	5454	10.59	28	11	17	1	5	24	16	12	7	2	8	10	4
	VILAS	99.1	305.24	3712	12.16	46	25	23	4	6	7	0	0	2	4	1	2	4
	WAUPACA	54.9	546.64	5388	9.86	20	11	9	0	0	19	5	7	3	5	0	6	2
	WAUSHARA	40.9	345.71	2393	6.92	19	7	10	2	2	3	2	2	0	0	0	3	7
	WOOD	42.3	372.22	3357	9.02	25	16	20	7	3	10	8	8	12	2	1	6	16
Region Average		66.5	351.32	3535	10.58	27	12	17	4	3	16	7	5	4	4	2	8	7

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2013-2014

Region	County	Snow Depth	Lane Miles	Salt Used	Tons /LM	Number of Storms	Types of Storms				Number of Incidents	Types of Incidents						Anti-Icing applic.
							Wet Snow	Dry Snow	Freezing Rain	Sleet		Drifting Snow	Blowing Snow	Frost	Ice	Bridge Decks	Clean Up	
NE	BROWN	43.2	711.91	9577	13.45	21	13	7	2	6	3	0	0	18	2	0	0	17
	CALUMET	56.0	201.29	1225	6.09	29	8	25	1	2	22	14	1	2	4	0	12	12
	DOOR	43.9	268.55	3073	11.44	21	7	14	0	6	24	21	14	10	1	2	8	13
	FOND DU LAC	55.9	599.20	6251	10.43	25	10	25	1	3	10	4	0	3	1	1	6	14
	KEWAUNEE	54.5	110.41	995	9.01	17	5	13	1	1	22	17	8	0	8	0	15	1
	MANITOWOC	70.1	417.99	6089	14.57	22	18	4	0	5	14	10	11	0	10	12	14	2
	MARINETTE	63.9	417.29	3495	8.38	25	20	5	5	8	24	15	13	3	8	5	20	16
	OCONTO	73.1	471.83	4403	9.33	30	17	14	1	4	23	11	11	0	0	8	17	10
	OUTAGAMIE	51.5	523.98	6298	12.02	24	14	14	2	3	15	11	11	2	3	5	6	6
	SHEBOYGAN	57.0	520.30	6970	13.40	18	10	14	4	4	20	12	5	3	2	6	11	10
	WINNEBAGO	43.4	568.31	6952	12.23	23	4	19	0	1	17	4	5	1	0	7	14	6
Region Average		55.7	437.37	5030	10.94	23	11	14	2	4	18	11	7	4	4	4	11	10

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2013-2014

Region	County	Snow Depth	Lane Miles	Salt Used	Tons /LM	Number of Storms	Types of Storms				Number of Incidents	Types of Incidents						Anti-Icing applic.
							Wet Snow	Dry Snow	Freezing Rain	Sleet		Drifting Snow	Blowing Snow	Frost	Ice	Bridge Decks	Clean Up	
NW	ASHLAND	190.3	247.57	2417	9.76	35	17	18	3	7	16	6	0	17	5	5	8	14
	BARRON	58.0	423.09	1596	3.77	31	13	13	7	5	35	4	6	6	4	3	25	8
	BAYFIELD	127.4	316.90	3170	10.00	34	11	24	4	8	25	13	3	9	7	11	17	4
	BUFFALO	43.4	316.05	1768	5.59	21	10	12	2	2	16	13	0	4	3	0	9	6
	BURNETT	56.6	233.64	1708	7.31	18	16	7	3	8	20	15	13	7	18	12	19	6
	CHIPPEWA	49.4	669.29	7176	10.72	25	9	15	2	2	19	11	13	1	3	7	14	0
	CLARK	55.4	402.28	3187	7.92	25	7	15	4	2	13	9	2	4	2	1	5	6
	DOUGLAS	125.2	439.23	3591	8.18	25	18	11	2	3	26	13	4	4	14	21	12	9
	DUNN	46.9	516.55	5182	10.03	20	5	14	1	1	17	5	3	0	6	1	2	0
	EAU CLAIRE	45.1	537.26	5382	10.02	19	9	10	2	1	35	5	1	5	4	3	31	9
	JACKSON	77.0	514.30	5763	11.21	30	27	1	0	22	19	11	13	22	2	1	17	23
	PEPIN	39.5	111.05	730	6.57	21	4	16	3	2	12	3	4	2	6	2	2	0
	PIERCE	53.9	366.08	3238	8.85	27	8	18	7	8	22	15	8	8	7	10	18	7
	POLK	52.1	385.05	3840	9.97	18	7	11	0	1	34	20	13	2	27	4	9	0
	RUSK	70.4	213.47	1740	8.15	26	11	11	4	4	31	8	16	0	17	11	21	0
	SAINT CROIX	53.4	618.98	6051	9.78	27	20	4	4	4	13	4	3	4	7	7	8	1
	SAWYER	77.1	367.44	2292	6.24	36	19	12	4	1	10	0	2	0	1	2	5	0
	TAYLOR	43.8	233.25	2071	8.88	22	6	15	4	5	25	15	10	2	14	9	16	9
	TREMPEALEAU	22.7	434.99	4288	9.86	19	12	9	3	1	21	6	3	6	7	3	9	7
	WASHBURN	58.0	372.14	2454	6.59	23	9	11	3	1	18	1	3	1	4	2	10	8
Region Average		67.3	385.93	3382	8.47	25	12	12	3	4	21	9	6	5	8	6	13	6

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2013-2014

Region	County	Snow Depth	Lane Miles	Salt Used	Tons /LM	Number of Storms	Types of Storms				Number of Incidents	Types of Incidents						Anti-Icing applic.
							Wet Snow	Dry Snow	Freezing Rain	Sleet		Drifting Snow	Blowing Snow	Frost	Ice	Bridge Decks	Clean Up	
SE	KENOSHA	50.4	573.11	6770	11.81	22	7	13	3	1	5	2	1	0	0	0	5	10
	MILWAUKEE	40.4	1,784.17	25769	14.44	21	17	4	2	2	6	0	1	3	0	5	0	3
	OZAUKEE	55.9	304.03	5282	17.37	23	5	16	1	1	23	2	4	1	1	3	16	5
	RACINE	72.4	704.86	8517	12.08	27	9	21	2	1	16	13	12	0	1	3	8	20
	WALWORTH	59.9	682.81	11354	16.63	19	8	13	3	0	11	5	5	0	3	0	3	1
	WASHINGTON	69.1	581.11	8034	13.83	27	12	13	1	3	13	10	5	2	0	3	9	5
	WAUKESHA	29.2	1,070.09	17426	16.28	19	10	10	3	2	7	1	0	1	2	0	4	6
Region Average		53.9	814.31	11879	14.64	23	10	13	2	1	12	5	4	1	1	2	6	7

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2013-2014

Region	County	Snow Depth	Lane Miles	Salt Used	Tons /LM	Number of Storms	Types of Storms				Number of Incidents	Types of Incidents						Anti-Icing applic.
							Wet Snow	Dry Snow	Freezing Rain	Sleet		Drifting Blowing Snow	Frost	Ice	Bridge Decks	Clean Up		
SW	COLUMBIA	55.5	743.95	13808	18.56	26	13	12	1	0	22	12	6	0	1	5	18	26
	CRAWFORD	43.6	385.21	3082	8.00	21	3	16	6	4	25	16	11	3	6	1	17	6
	DANE	41.8	1,501.97	36131	24.06	22	7	12	3	0	3	1	0	3	0	0	0	1
	DODGE	54.6	606.62	9823	16.19	23	6	17	1	1	12	9	1	0	4	0	8	8
	GRANT	56.1	624.14	7175	11.50	25	8	12	4	2	35	5	14	5	4	1	16	5
	GREEN	56.6	311.37	2751	8.84	24	8	10	6	1	30	8	2	0	4	1	24	0
	IOWA	55.1	451.03	5946	13.18	24	12	9	4	1	14	5	7	2	2	0	8	0
	JEFFERSON	45.1	458.21	9095	19.85	22	13	7	1	2	5	4	1	1	1	0	0	0
	JUNEAU	49.9	498.79	7765	15.57	22	17	2	4	1	12	9	1	1	0	0	8	10
	LA CROSSE	59.9	488.24	7324	15.00	21	12	13	2	2	28	16	11	14	5	3	14	13
	LAFAYETTE	58.3	293.88	2074	7.06	21	6	11	4	1	12	8	1	2	1	0	0	3
	MONROE	56.0	646.13	5996	9.28	26	13	14	4	3	17	9	7	5	6	4	10	8
	RICHLAND	49.1	328.72	3155	9.60	23	10	7	7	2	13	6	3	0	9	4	11	4
	ROCK	47.4	598.50	10397	17.37	19	11	9	4	1	12	7	6	1	3	0	5	16
	SAUK	55.9	591.55	9006	15.22	21	14	11	4	1	15	3	0	2	4	0	14	26
	VERNON	58.4	450.00	5242	11.65	24	18	2	4	0	20	15	7	7	6	0	7	9
Region Average		52.7	561.14	8673	13.81	23	11	10	4	1	17	8	5	3	4	1	10	8

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2013-2014

Region	County	Snow Depth	Lane Miles	Salt Used	Tons /LM	Number of Storms	Types of Storms				Number of Incidents	Types of Incidents						Anti-Icing applic.
							Wet Snow	Dry Snow	Freezing Rain	Sleet		Drifting Snow	Blowing Snow	Frost	Ice	Bridge Decks	Clean Up	
Statewide Averages		--	466	5674	11.16	24.5	11.4	13.3	3.1	3.1	17.6	8.2	5.5	3.8	4.6	3.2	10.0	7.5

3 Winter Operations

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Wisconsin county highway departments use an array of strategies to combat winter storms. Materials, equipment and labor are three key pieces of the puzzle; county patrol superintendents use their skills and experience to combine these pieces in the most efficient way possible for each storm.

This section describes the counties' response to the 2013-2014 winter season, including materials use, best practices in equipment and technology, and training efforts. Most counties have added prewetting and anti-icing to their arsenal of best practices – strategies that help them use materials efficiently, save money and minimize environmental impacts.

Statewide Materials Use, 2013-2014

Total salt used[1]	669,807 tons
Total salt used per lane mile	19.5 tons
Total cost of salt used[2]	$40,457,960
Average cost per ton of salt	$60.40
Total prewetting agents used[3]	2,970,166 gal.
Counties prewetting salt	66 of 72 (92%)
Total abrasives used	58,870 cubic yards
Counties prewetting abrasives	13 of 62 using sand (21%)
Total anti-icing agents used	887,415 gal.
Counties equipped to use anti-icing	66 of 72 (92%)

1. Salt use data is final data from WisDOT's Salt Inventory Reporting System.
2. Cost data is actual salt costs as billed to WisDOT by the counties.
3. Prewetting, abrasives and anti-icing data are estimates from Winter Storm Reports.

There's More on the Web!

Looking for more information about winter maintenance in Wisconsin? WisDOT's extranet site features detailed reports on prod-ucts, equipment, best practices and more.

See https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm.

3A. Materials

Salt

The 2013-14 winter was especially challenging because although there was enough salt under contract to get through the season, it was not always in the right locations when needed. In late December, some counties indicated they would run out of early and seasonal fill salt and asked the Department to order their vendor reserve. It was unprecedented to order vendor reserve that early in the season, but it reflected the extreme low temperatures resulting from the polar vortex. Although salt does not work at very low temperatures, some counties had no other alternative than to apply more salt. To insure enough salt would be available in the right locations when needed, the Department entered into several emergency salt and trucking contracts at a total cost of $2.2 million dollars (i.e. $1.9 million for salt and $300,000 for trucking)

Salt is a critical part of a highway crew's response to winter storms. When salt combines with ice or snow, it creates a brine solution with a lower freezing point than water. This solution then acts to break the bond between the ice or packed snow and the pavement, which allows the snow to be removed more easily through plowing. Because of cost and environmental concerns, maintenance crews strive to use the smallest amount of sale necessary to provide an appopriate level of service for each roadway. Using anti-icing agents can help reduce overall material use; see pages 41-43 for details on statewide anti-icing use.

Historically, counties have used more salt during more severe winters; see Figure 2.4 on page 22 for a detailed comparison. This winter 's statewide Winter Severity Index of 133.34 was 33 percent higher than the previous 10-year average of 100.16. Salt use in 2013-14 was 7.8 percent higher than the winter of 2012-13, at 669,807 tons. See Table 1.5 on page 13 for county-by-county salt use data for this winter.

Wisconsin counties applied a statewide average of 19.5 tons of salt per lane mile on state highways, an increase of 7.8 percent from the winter of 2012-2013. (See Figure 3.10 on page 59 for a county-by-county comparison.) Compared with nearby states, which differ by winter severity and level of service standards, Wisconsin salt use is relatively high.

In the last year for which comparable data was available (2009- 10) Wisconsin used 12.2 tons of salt per lane mile on state highways. 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. Several factors may contribute to other states' lower rates of salt used per lane mile, including salt shortages that prevented several states from obtaining the quantity of salt that they would normally use. In addition, some states provide a lower level of service that prescribes less salt and more sand use. Winter severity also varies from state to state. Data on total salt use (not adjusted for lane miles) for most states is available on page 60 in a map of salt use and costs produced by Washington State DOT.

Figure 3.1 Salt Used per Lane Mile

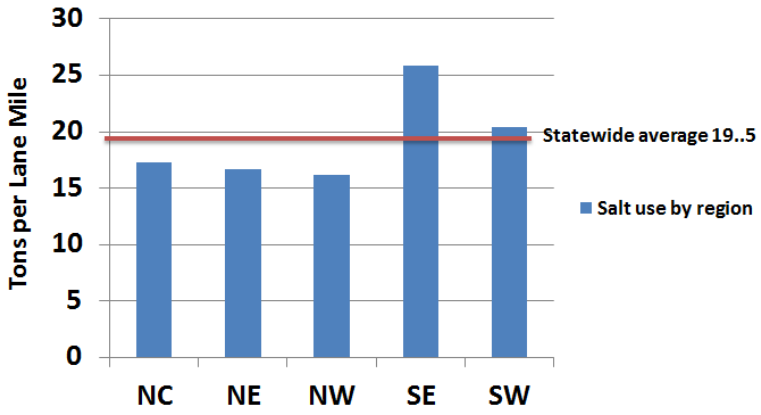


Figure 3.1 shows salt use per lane mile by region. Counties in the Southeast Region used an average of 25.9 tons of sale per lane mile, which reflecte the greater number of highways in these counties receiving 24-hour service. Figure 3.2 on page 35 shows salt use per lane mile in each county by Winter Peer Group, overlaid with severity index to allow a further "apples to apples" comparison of salt use in each county. The counties in Winter Peer Groups A and B have more urban highways and tend to use more salt per lane mile for a given level of severity.

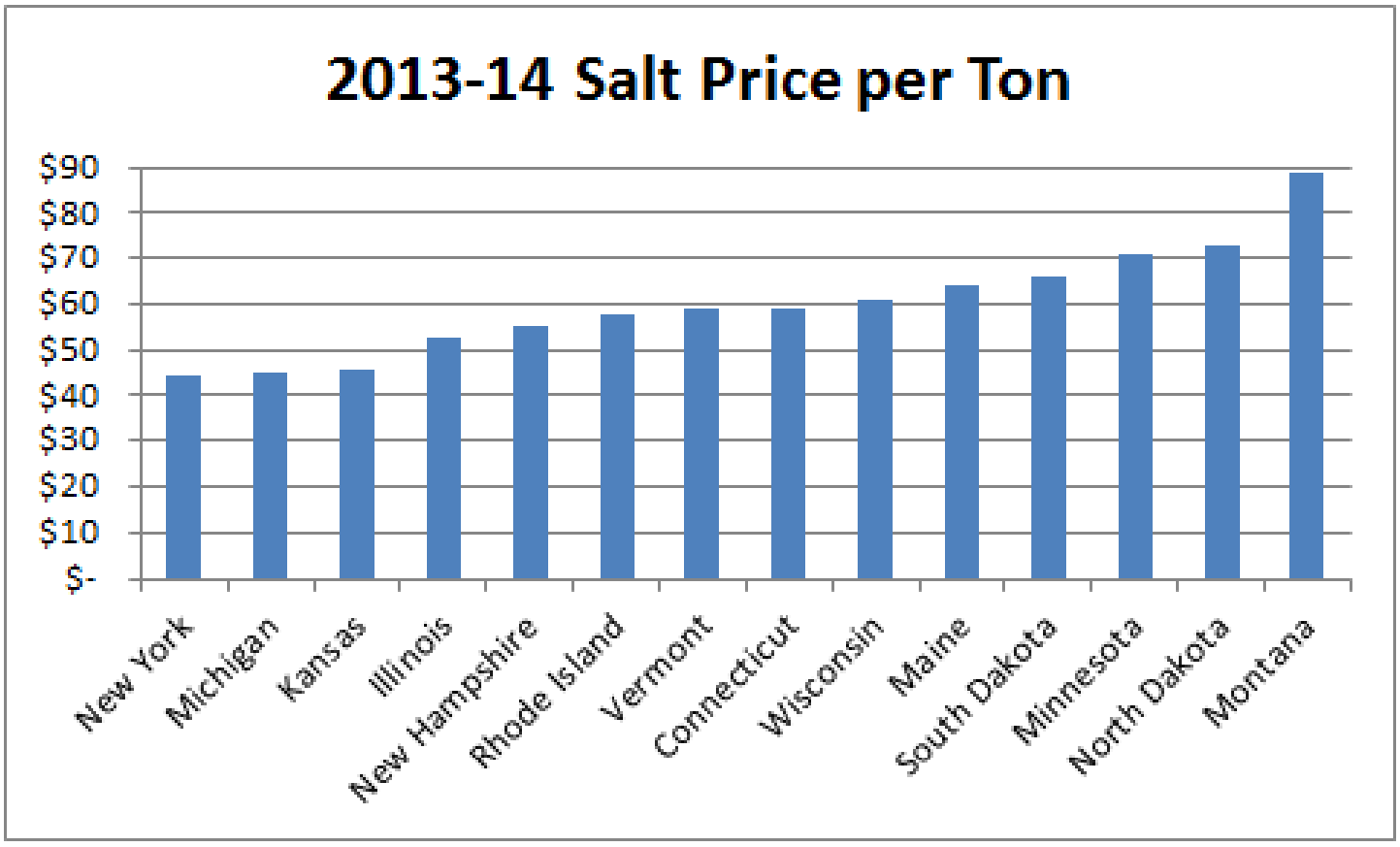
For more detail on salt use in previous years, see Table A-9, "History of Salt Use on State Trunk Highways," on page 171 of the Appendix.

Figure 3.2. Salt Used per Lane Mile and Severity Index by Winter Peer Group

From Salt Inventory Reporting System, 2013-2014

Figure 3.3. Salt Prices Across the United States

Source: Clear Roads



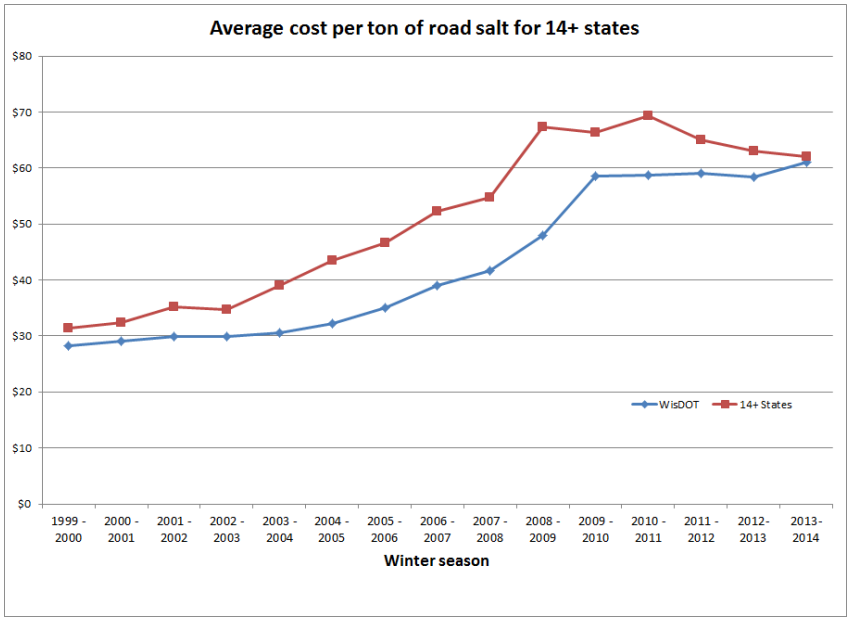
Cost of Salt

Salt prices continue to remain high, which WisDOT's salt vendors attribute to multi-year supply and demand issues. Prices have generally leveled out, however, after several years of large increases. This winter, WisDOT spent $40,457,960 on salt statewide, purchasing salt at an average of $60.40 per ton.

Fuel prices have contributed to higher salt transportation costs in recent years: The $60.40 cost per ton in 2013-14 was only a 3.5 percent increase from $58.34 per ton in 2012-13, but 71 percent higher than the average of $35.22 cost per ton just eight winters ago in 2005-06.

Despite this increase, WisDOT pays less per ton for salt than do most other snowy states across the country, according to data compiled by Washington State DOT. Only 13 states pay less on average per ton; one state (Connecticut) pays about the same; and, 27 states pay more – See Figure 3.3. Washington State DOT created a map of per ton salt costs and average salt use across the country, which is reproduced on page 58. Per ton costs for straight rock salt range from $31 (Utah) to $130 (California) and $145 (Alaska). Figure 3.4 shows that Wisconsin historically paid les for salt than other states.

Figure 3.4. Salt Prices in 19 States Surveyed (1999-2000 thru 2013-14)



Source: Historical data compiled by Iowa DOT based on responses from Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, North Dakota, New York, Ohio, Pennsylvania, Utah, Virginia, Washington, West Virginia and Wisconsin. The number of states providing data has grown from 14 to 19.

The Department believes the flexibility of its contracting method accounts for some of these cost savings. Wisconsin's contracts include a 100 percent provision, which means the Department guarantees it will purchase 100 persent of the contracted amount of salt. Some other states' constracts include an 80/120 provision that requires the salt vendor to keep 120 percent of the contracted salt amount on reserve, but commits the state to purchasing only 80 percent of the contracted amount. It is possible this 40 percent spread may translate into higher costs for states that use an 80/120 contracting method.

For more on winter maintenance costs, see Section 4 starting on page 69.

A Note About Materials Data

This winter marks the fifth year that all salt data in this report comes from WisDOT's Salt Inventory Reporting System (SIRS). In previous years, some tables used preliminary salt use data collected in the weekly winter storm reports. Sand use data continues to come from the storm reports, as does some detailed anti-icing and prewetting data. These materials use estimates are included in this report because they provide a level of detail and correlation with storm events not available from SIRS or final financial data. The source of each table's data is indicated below the table title.

Abrasives

County highway departments sometimes use sand and other abrasives to improve vehicles' traction on icy or snowy roads when temperatures are too low for salt to be effective. Abrasives are somewhat effective in low-speed trouble spots and intersections. Abrasives should be prewetted with a liquid agent for better adherence to the roadway.

A total of 58,870 cubic yards of sand was used on state highways this winter, which was 172 percent higher than the average of the five previous winters (21,661 cubic yards), but was still 27 percent lower than 2007–2008's record-setting 80,133 cubic yards.

In 2008, the Bureau of Highway Maintenance commissioned a synthesis report, "Limitations of the Use of Abrasives in Winter Maintenance Operations", to substantiate WisDOT's guidance to Wisconsin counties on reducing sand use. The report cited factors recommending against the use of sand that have been supported by research, and offered the following general conclusions:

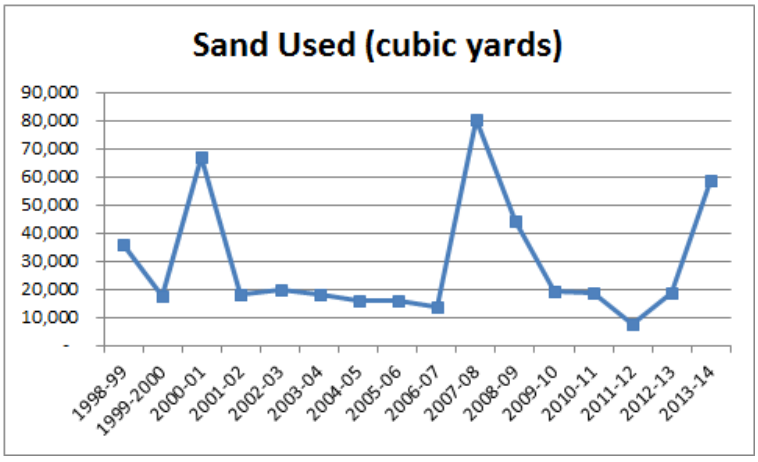
- Sand exhibits limited effectiveness at higher vehicle speeds, especially when it has not been prewetted. Mixing sand with salt to keep it from freezing also limits sand's effectiveness.
- Sand used in a salt-abrasive mixture does not contribute to accident reductions.
- Salt is more cost-effective than sand in winter maintenance operations.

The 2008 synthesis report is available on-line at:
http://www.clearroads.org/synthesisreports_files/tsrlimitationsofabrasives.pdf

Figure 3.5 shows statewide sand use every winter since 1998-99. Spikes in sand usage during the winters of 2000-01 and 2007-08 reflected greater use of sand/salt mixes due to low salt supplies during the end of those winter seasons. Unusually high sand usage during the winter of 2008-09 reflected, in part, the use of sand left over from the prior winter. The 2013-14 spike in sand usage reflected extreme cold temperatures rendering salt ineffective, plus some counties went to a sand/salt mix when salt supplies ran short.

Refer to Table A-8 on page 163 of the Appendix for county-by-county sand use data for the 2013-14 winter.

Figure 3.5 Cubic Yards of Sand Used



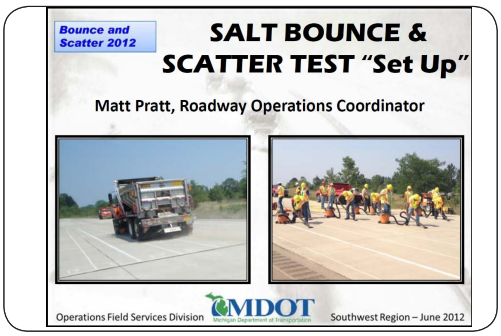
The billed cost of sand varies greatly across the state, depending on the local availability of the sand and transportation costs. In 2011–12, the last year for which data is available, counties paid an average about $18 per cubic yard, with a statewide range of $5.15 to $52.00 per cubic yard. It should be noted that sand is typically mixed with 5 percent salt to keep it from freezing. The cost of the added salt and the mixing of the two together is typically not reported.

For more information on using and storing abrasives, see Chapter 35 of the State Highway Maintenance Manual. A Wisconsin Transportation Bulletin on salt and sand use is also available at:
https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/best-practices/pdf/iie6.pdf.

BEST PRACTICES: Prewetting

WisDOT requires counties to prewet both salt and sand before applying it to the roadway. Agencies across the country and worldwide consider prewetting a best practice, and some require that all material be prewetted before it is placed.

A 1973-74 study by Michigan DOT concluded that as much as 32 percent more salt stays on the roadway when prewetted versus dry salt. In 2012, another Michigan DOT study verified the results of their earlier research with respect to bounce and scatter. It concluded:
1) Speed is the biggest factor effecting salt bounce and scatter (25 mph speeds retain the most salt in the target zone, by far)
2) Treated salt scatters less than untreated salt
3) Rear cross conveyors outperform y-chute systems.



The Michigan study can be found at: http://www.michigan.gov/documents/mdot/Final_ReportNov2012_404228_7.pdf

For more information on prewetting, see Chapter 6 of the State Highway Maintenance Manual.

Prewetting

Prewetting salt and sand with liquid deicing agents before or during their application to the pavement has several advantages. When used with salt, prewetting reduces loss of salt from bouncing and traffi action, which reduces the amount of material needed. Prewetting also improves salt penetration into ice and snow pack, and begins dissolving the salt, which allows it to work more quickly. When used with abrasives, prewetting helps keep the sand on the pavement and may allow crews to use higher truck spreading speeds.

WisDOT encourages all county highway departments to prewet their salt and sand, and to explore stocking more than one deicing agent so that different agents can be used as conditions warrant. For example, salt brine can be reasonably used at pavement temperatures down to about 15°F, whereas agents such as magnesium chloride and calcium chloride are effective at lower pavement temperatures, to about 0°F. See Table 3.1 for details on statewide prewetting agent use.

Salt brine is a relatively inexpensive choice for prewetting. Its use has increased significantly since counties first tested it about a decade ago. Last winter, 60 counties used salt brine for prewetting (see Table A-6 on page 155 of the Appendix for details). Counties' use of salt brine for prewetting continues to increase. The nearly 2.5 million gallons used in 2013-14 was 32 percent more than the amount used statewide in 2012-13 and 160 percent more than was used in 2011-12.

In addition to salt brine, some counties used calcium chloride, magnesium chloride, or agricultural-based products for prewetting this year. See Table A-7 on page 157 for details. Organic blends seem to be preferred over the straight chemical products. The addition of the organics helps reduce corrosion to equipment.

Table 3.1. Statewide Prewetting Agent Use for Salt

Deicing Agent	Gallons Used	Counties Using
Salt brine	2,468,522	60
Calcium chloride-based products		
Calcium chloride – liquid	225,729	11
Calcium chloride w/rust inhibitor	13,844	3
Magnesium chloride-based products		
Magnesium chloride	18,188	8
Freeze Guard	35,243	12
Agricultural-based products		
BioMelt64	2,960	1
IceBrite 55	7,639	5
MC95	30,631	12
GeoMelt	167,410	10
Total	2,970,166 gallons of liquid	66

Although once the only option for prewetting, calcium chloride is a more corrosive chemical than other prewetting liquids, and can damage equipment and be more difficult for operators to handle. WisDOT encourages counties to explore other options for prewetting, such as salt brine.

Several counties have also tested pretreated salt, in which a liquid prewetting agent is spray-applied to the salt supply before the salt is placed in storage. See https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm for details.

While prewetting salt is the best practice in Wisconsin — 66 of 72 counties (92 percent) prewetted their salt this winter — prewetting abrasives is far less common. Of the 47 counties that used sand this winter, only 13 counties prewetted it (see Table A-8 on page 163 for details). WisDOT strongly encourages counties to prewet their sand, since keeping sand on the pavement can reduce the amount of material used, which saves money and reduces environmental impacts.

BEST PRACTICES: Anti-icing

Anti-icing is a best practice not only nationwide, but across the globe. Agencies are fi ding that this technique, once reserved for bridge decks and trouble spots, yields excellent results on highways as well. More agencies are turning to anti-icing to help them use labor and materials efficie tly, especially as salt prices continue to rise.

This winter, Wisconsin counties used 887,145 gallons of anti-icing liquid – a decrease of 20 percent from last winter's total. Yet at 0.5 percent of total winter expenditures, anti-icing continues to represent a small fraction of winter costs.

For more information on anti-icing, see WisDOT's Winter Information Web page at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/ex-tranet/winter/index.shtm (click "Best Practices," then "Anti-icing").

Anti-icing

Anti-icing is a proactive snow and ice control strategy that involves applying a small amount of liquid deicing agent to pavements and bridge decks before a storm to prevent snow and ice from bonding with the surface. It is often used prior to light snowfall or freezing drizzle, and is also effective at preventing frost from forming on bridge decks and pavements.

Anti-icing can reduce salt use, reduce materials costs, and improve safety. The benefits of anti-icing also include:

- Less chemicals are required to prevent ice bonding than to remove ice after it has bonded to the pavement.
- Clean-up after a storm may be easier with less ice bonded to pavement.
- Application can be made during regular working hours, reducing some overtime costs.
- Anti-icing applications may last for several days, particularly in preventing frost on bridge decks.
- Better pavement conditions (improved friction) can be achieved, reducing the number of crashes.
- It aids in providing more time for the initial response to storms.

This past winter, Wisconsin counties used nearly 900,000 gallons of anti-icing liquid (see Table A-4 on page 140 for details). Currently, 66 of 72 counties (92 percent) are equipped to perform anti-icing operations, and this winter 68 counties made at least one anti-icing application. (Counties may choose not to anti-ice if weather conditions do not warrant it.) On the whole, anti-icing use has steadily increased in Wisconsin since the technology became part of winter operations in the state in 1999. Use of anti-icing materials was down by about 20 percent from last year. However, throughout the past five winters, use of anti-icing materials has generally increased. Salt brine, the most commonly used anti-icing agent, has limited effectiveness at temperatures below 15°F. Some counties are mixing agents such as magnesium chloride and GeoMelt with salt brine to lower the working temperature of the salt brine. GeoMelt is a natural, agricultural product with ice control performance equal to or greater than salt brine. It has a freezing point 38.8° lower than salt brine.

Accurate weather forecast information is critical to the success of anti-icing – if a forecasted storm does not arrive, resources may be wasted; if a storm hits sooner than expected, the opportunity for anti-icing may be lost. Through Wisconsin's Road Weather Information System, counties have access to detailed weather information, including the Maintenance Decision Support System (MDSS), and 58 weather stations with pavement sensors across the state. See page 47 for more information on RWIS.

Anti-icing Costs

In Wisconsin, proactive anti-icing applications for possible frost events are about three times less costly than reactive deicing operations for actual frost events. Table 3.2 on page 42 compares the two strategies based on storm reports data. Costs vary from year to year in part because of variations in the number of counties reporting this data and the number of events represented.

At $575,468, anti-icing costs made up only 0.5 percent of total winter maintenance costs this winter (see Figure 3.6 on page 42). This was a decrease from recent years, during which the percentage was a fairly steady one percent of total statewide winter costs. Investing in anti-icing is a cost-effective way to reduce overall material usage.

Table 3.2. Cost of Anti-icing vs. Deicing

Winter Service Group	Average cost of anti-icing treatment for possible frost					Counties reporting anti-icing costs	Average cost of deicing treatment for frost event					Counties reporting deicing costs
	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014		2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	
A	$2,263	$1,984	$3,949	$3,630	$2,088	2	$8,509	$18,284	$19,126	$16,382	$61,801	2
B	$898	$1,060	$1,186	$1,437	$932	7	$4,082	$4,459	$3,889	$4,240	$5,984	16
C	$790	$799	$686	$653	$710	8	$1,987	$3,583	$2,051	$1,567	$3,100	14
D	$826	$745	$739	$692	$789	9	$1,521	$1,854	$2,607	$1,734	$2,661	10
E	$531	$479	$531	$793	$486	4	$1,103	$1,962	$1,526	$1,770	$2,395	6
F	$331	$340	$485	$614	$620	1	$240	$1,694	$927	NA	$878	3

Anti-icing Agents

As with prewetting, the use of salt brine as an anti-icing agent has increased significantly since its introduction a decade ago. However, although 63 of 72 counties used salt brine for anti-icing this past winter (two more counties than did so in 2012-13), the total statewide brine usage (864,851 gallons) was actually a 21 percent decrease from the total used in 2012-13. See Table A-6 on page 155 of the Appendix for county-by-county data on salt brine use.

WisDOT encourages counties to explore stocking more than one agent for prewetting and anti-icing, so that a choice of agents is available for use according to pavement temperature and weather conditions. Table 3.3 shows the agents used for anti-icing in Wisconsin this winter; see Table A-4 on page 147 of the Appendix for county-by-county anti-icing data.

Figure 3.6 Anti-icing as a Percentage of Winter Costs

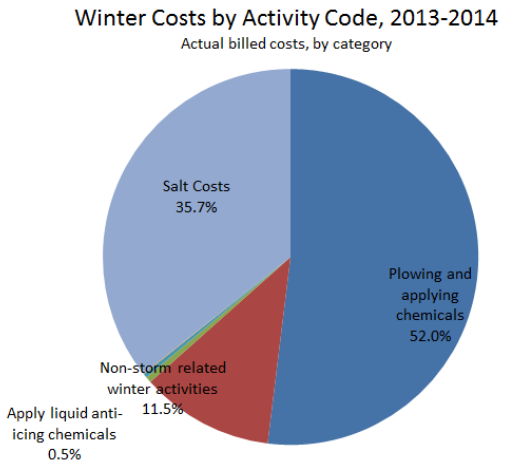


Table 3.3. Statewide Anti-icing Agent Use

Chemical	Gallons Used	Counties Using
Salt brine	864,851	63
Calcium chloride – liquid	755	3
Magnesium chloride	1,325	1
Freeze Guard	16,070	4
IceBite55	1,069	1
MC95	1,255	4
GeoMelt	2,090	5
TOTAL	**887,415**	

Figure 3.7 Counties Using Anti-Icing

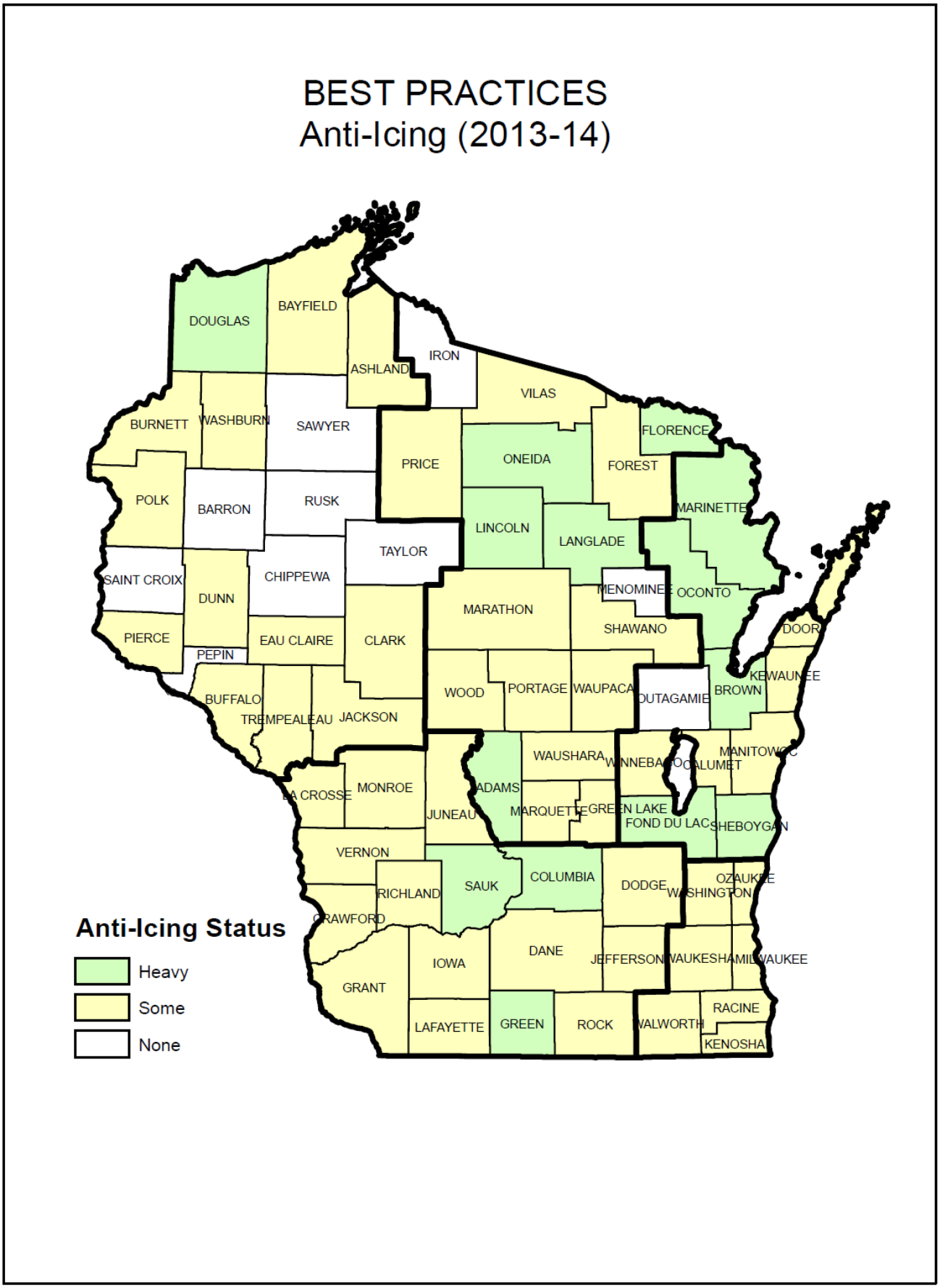


Figure 3.8 Counties Using Closed Loop Ground Speed Controllers

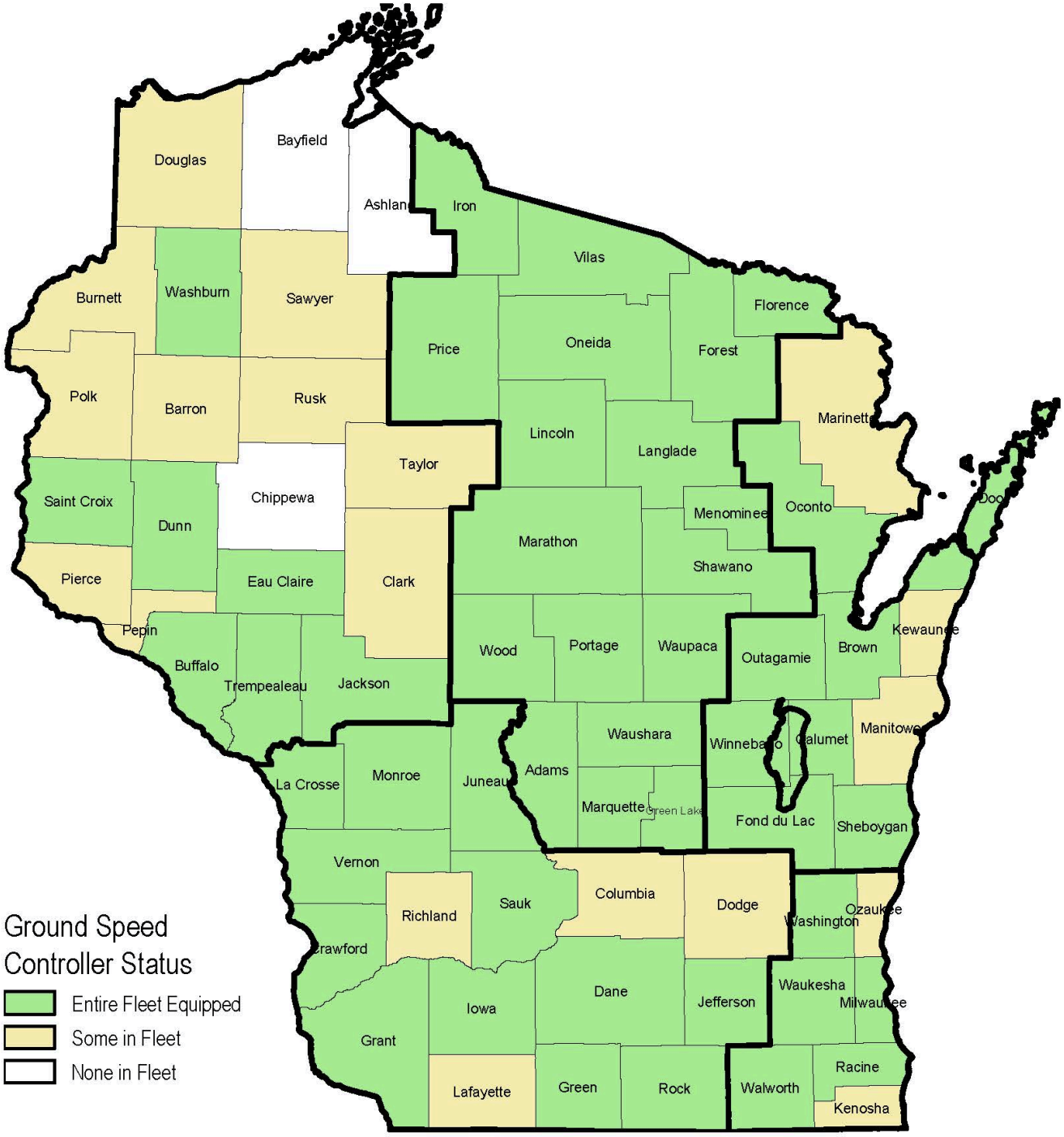


Figure 3.9 Counties Using Underbody Plows

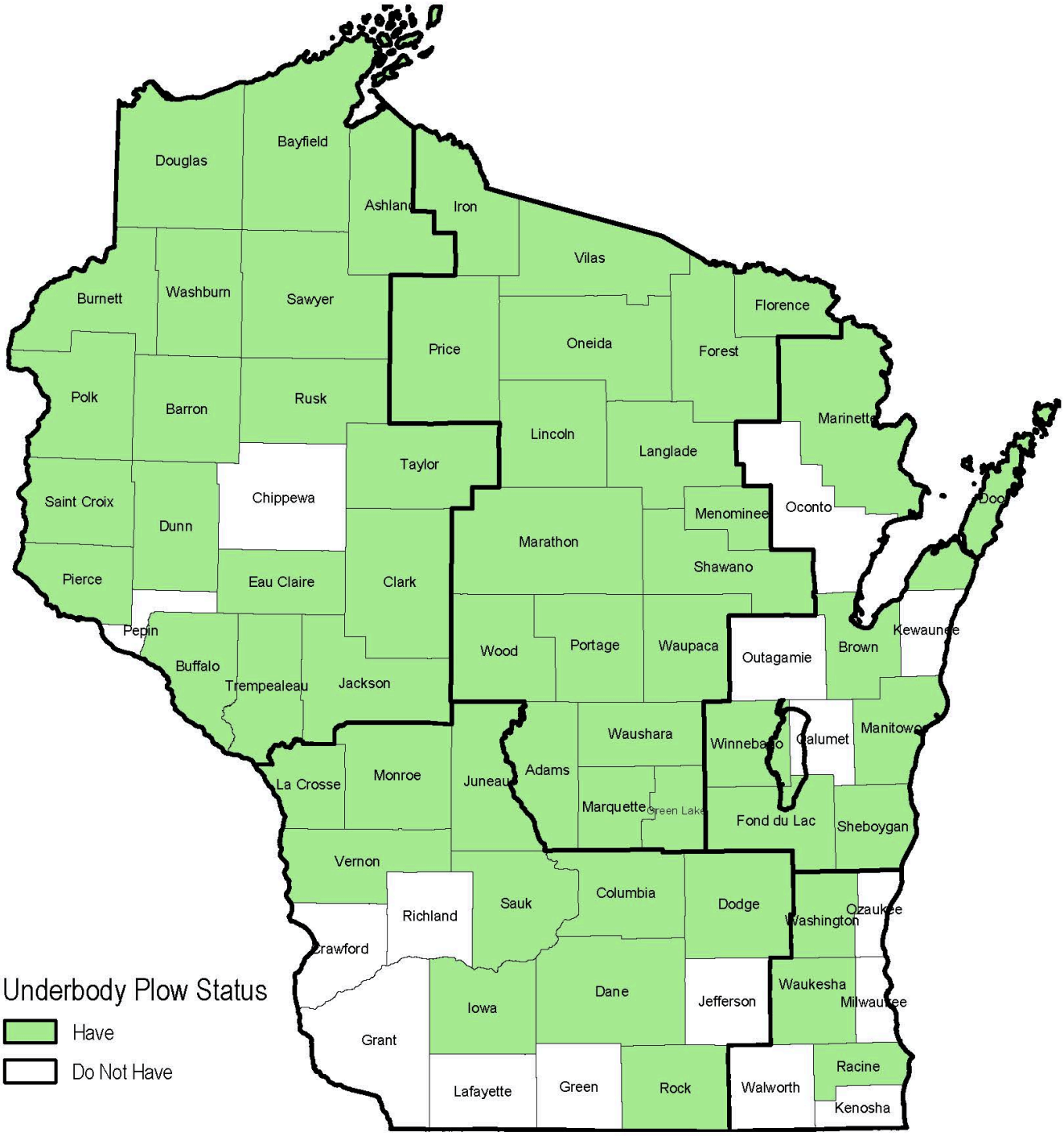
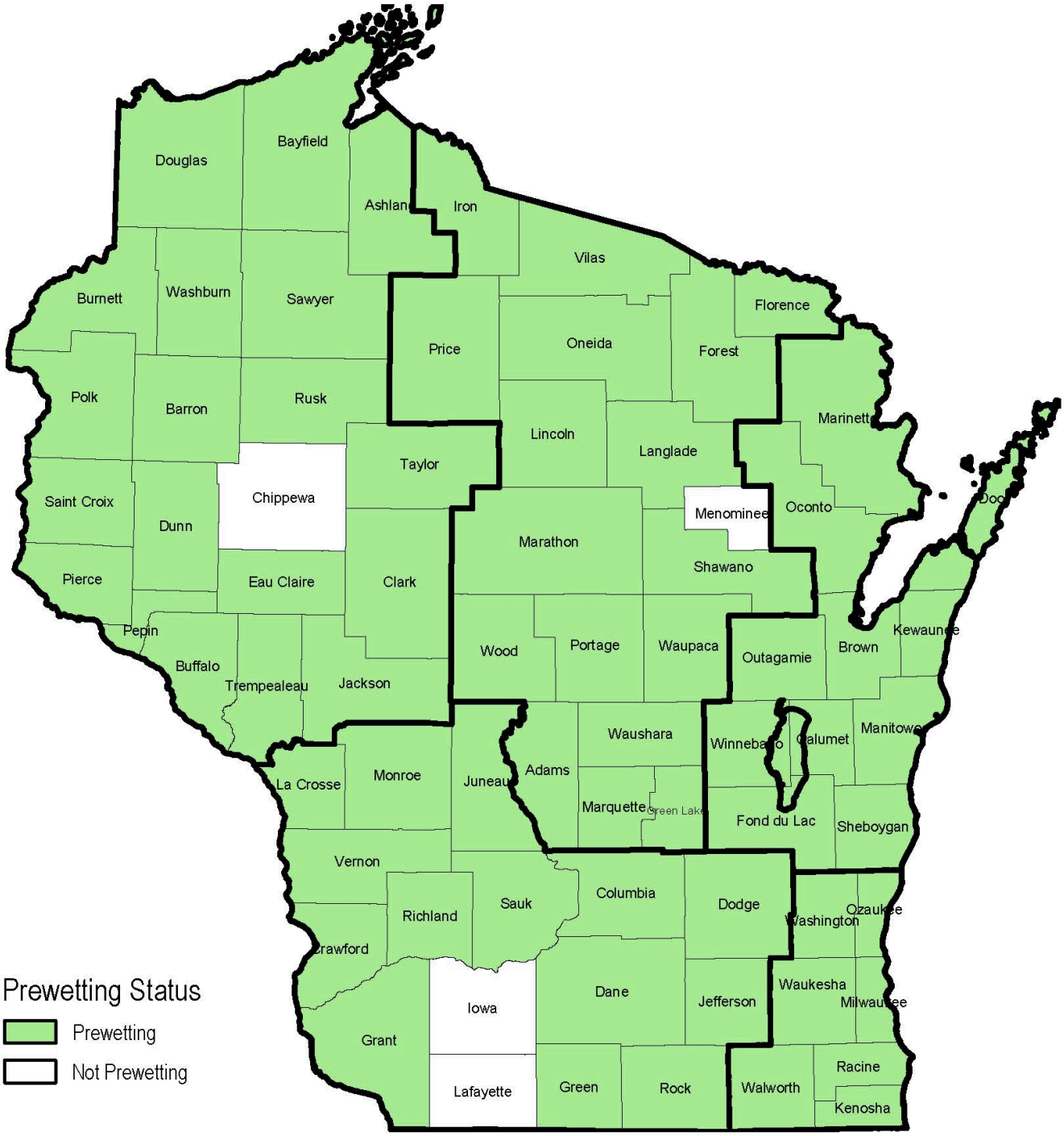


Figure 3.10 Counties Prewetting



3B. Equipment and Technology

As winter maintenance technology and practices evolve, the counties are continually expanding their arsenal of snow and ice control strategies. Some of the counties' snowplows are equipped with underbody plows, which can be used in place of the front plow for removing lighter snowfalls of up to 4 inches. A portion of the counties' salt spreaders are equipped with ground speed controllers, and some have on-board prewetting units. In recent years, Road Weather Information Systems have become an increasingly important part of counties' efforts.

Road Weather Information Systems (RWIS)

WisDOT has had a Road Weather Information System in place since 1986, and continues to expand and enhance the information available through this system. Designed to provide maintenance crews with the most accurate information about current and future weather conditions, WisDOT's RWIS system includes:

- 58 weather and pavement condition sensors along state highways.
- Detailed weather forecasts via the Maintenance Decision Support System (MDSS).
- A winter storm warning service for WisDOT and county highway departments.
- Over 1,000 mobile infrared pavement temperature sensors on patrol trucks around the state.

WisDOT contracts with an RWIS consultant to manage its RWIS program. This onsite consultant serves as WisDOT's staff meteorologist and RWIS program manager, and provides ongoing technical and administrative support for the state's RWIS system

Major activieis in WisDOT's RWIS program this year included:

- Management of the MDSS, as well as attending gthree meetings of the MDSS Pooled Fund Technical Panel
- Assisting with WisDOT's AVL-GPS implementation
- Coordinating with Iteris on forecast services
- Performing an annual weather forecast verification study, monthly interim reports, and monitoring comments from counties using the service
- Providing MDSS and RWIS training for regional operations staff, the State Traffic Operations Center (STOC) and county highway departments
- Overseeing maintenance and repair of the department's RWIS equipment
- Managing WisDOT's rest area weather program
- Representing WisDOT on the Aurora Program board

In addition, the RWIS program manager works to coordinate WisDOT's RWIS activities within Wisconsin and with other state and national agencies, including:.

- Coordinating activities with the National Weather Service
- Participating in national RWIS initiatives, such as MADIS
- Providing RWIS presentations to WisDOT groups and agencies outside WisDOT

Other ongoing services provided by the RWIS program manager include:

- Managing contracts for weather forecast and winter storm warning services, and for system maintenance.
- Coordinating use of Winter Severity Index data as an accurate tool to measure the relative severity of winter seasons.
- Establishing a plan for replacement of aging infrastructure, such as roadside towers and televistion monitors at rest areas
- Ongoing assessment of new RWIS technology

- Supporting counties use of vehicle-mounted infrared pavement temperature sensors
- RWIS program management (budgeting, billing, planning, etc.)
- Developing enhanced methods of data display using GIS technology

Major activities in WisDOT's RWIS program this year included:

- Management of the MDSS program.
- Assisting with WisDOT's AVL-GPS implementation.
- Coordinating with Iteris (Wisconsin's contracted weather forecast provider) on forecast services.
- Performing an annual weather forecast verification study, and monitoring comments from counties using the service.
- Providing MDSS and RWIS training for regional operations staff and county highway departments.
- Overseeing maintenance and repair of the department's RWIS equipment.
- Managing WisDOT's rest area weather program.
- Representing WisDOT on the Aurora Program board. Aurora is a group of states and Canadian provinces whose mission is to perform RWIS-related research.

In addition, the RWIS program manager works to coordinate WisDOT's RWIS activities within Wisconsin and with other state and national agencies, including:

- Coordinating activities with the National Weather Service.
- Participating in national RWIS initiatives, such as Clarus, which is an FHWA initiative to gather and quality check all RWIS observations.
- Providing RWIS presentations to WisDOT groups and agencies outside WisDOT.

Other ongoing services provided by the RWIS program manager include:

- Managing contracts for weather forecast and winter storm warning services, and for system maintenance.
- Coordinating use of Winter Severity Index data as an accurate tool to measure the relative severity of winter seasons.
- Establishing a plan for replacement of aging infrastructure, such as roadside towers and television monitors at rest areas.
- Ongoing assessment of new RWIS technology.
- Supporting counties' use of vehicle-mounted infrared pavement temperature sensors.
- RWIS program management (budgeting, billing, planning, etc.).

BEST PRACTICES: Ground speed controllers

Ground speed controllers have been shown to reduce salt use by controlling the amount of salt spread according to the speed of the truck. These controllers can also provide accurate data on salt use.

In addition to reducing costs, controlling salt application can help limit the amount of chlorides that get into the environment, minimizing the degradation of plant species and water quality near roadways. See Guideline 36.25 in the Winter Maintenance Manual for more information.

Maintenance Decision Support System (MDSS)

MDSS is a major project undertaken by WisDOT since 2009. Initial deployment took place in 2009 along the Interstate corridors. The bulk of the second phase of deployment occurred in 2010-11. During this phase, WisDOT added four or five "representative" routes in each county so that county highway departments could get an accurate weather forecast and treatment recommendation for the various types of routes in their county. In 2011, BHM input the remainder of the state's routes into MDSS. These will be used for tracking purposes only.

Capabilities. MDSS provides hourly forecasts of all weather conditions. It also provides constantly-updated treatment recommendations based on what actions have already been performed and what weather is predicted into the future. It has a module that provides decision support for summertime operations. It has a robust reporting ability that allows managers to track performance on a storm-by-storm, operator-by-operator, or seasonal basis.

Last winter, Iteris deployed a new web version of MDSS that is much easier to use than the original version. WisDOT envisions transitioning many users to this version. New mobile apps for both Apple and Android devices were also developed. Many county highway department personnel are now using them.

MDSS Pooled Fund. At the time of the initial deployment, WisDOT joined the MDSS Pooled Fund. This group of states had been in existence since 2003 with the goal of researching and deploying the MDSS technologies developed by FHWA. They contracted with Iteris to provide the service. At the time Wisconsin was beginning its deployment, the MDSS Pooled Fund was operating the only fully functional, commercially available MDSS. That remains the case today.

Configuration. In order for MDSS to function properly, accurate descriptions of plow routes are required. One major issue that has arisen is the cycle times associated with the routes. If these times are not accurate, the treatment recommendations generated by MDSS will likewise be inaccurate. BHS continues to work closely with the regions and counties to resolve discrepancies.

Integration with AVL/GPS. A patent issue between Iteris and another vendor led to a reduction in the number of routes for which live data from the plow vehicles was being ingested into MDSS. In FY 2014, WisDOT ceased having any live data flowing from trucks into MDSS, greatly reducting the accuracy of treatment recommendations. The licensing fee being charged to Iteris (which they passed along to WisDOT) made it far too costly to feed live truck data into MDSS. WisDOT sent a letter to FHWA outlining the negative impacts the patent issue is having on winter operations

MDSS Training. Training was a major focus of the MDSS deployment in 2013-14. WisDOT BHM and Iteris teamed up to provide MDSS training to the counties and regions. There was an introductory session for new users, followed by a session that demonstrated how to use MDSS in a major winter event. The training also included a session on the storm planning process. BHS once again provided MDSS training to the STOC, as well as to four individual counties.

Current Status

Forecast Routes (no live truck data): 404 in MDSS
Tracking Routes: 330 in MDSS

Future Priorities. Ongoing training will continue, for both new and advanced users. This will again be provided by Iteris and Weather Management Solutions. WisDOT will more fully employ the MDSS management tools to track material usage and crew deployments compared to MDSS recommendations. WisDOT will also work with the MDSS Pooled Fund to develop more a mobile and web-friendly user interface so that supervisors can have easy access, including remote access from the field.

Weather Forecast Service Use and Satisfaction

The weekly winter storm reports ask the counties to report whether they used the Iteris forecast service, and ask them to rate the quality of the forecast if they did use it. The Iteris forecast was used in 67 percent of winter storm events this year, down from the previous winter. Regionally, the usage rate varied from a high of 78 percent in the North Central Region to a low of 55 percent in the Northwest Region.

The Northwest Region rated the service the highest (2.31 on a scale of 1 to 3), while the Southeast Region rated it lowest (at 1.89). The statewide average was 2.12, about the same as last year's 2.17.

For more details on the evaluation of the Iteris forecast service, see a summary report on page 125 of the Appendix, or view the full report at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm. For more detail on the use of the service, see Table A-2 on page 131 of the Appendix.

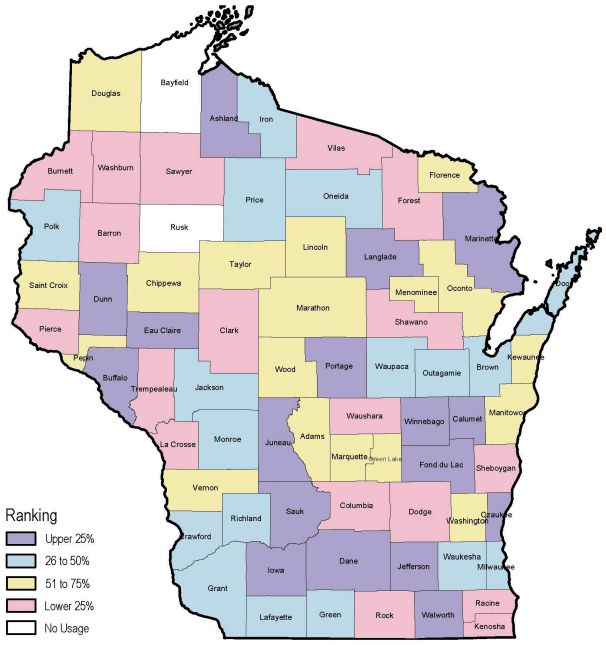
For more information on RWIS activities in Wisconsin, see the program's annual report at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm.

BEST PRACTICES: MDSS

The Maintenance Decision Support System (MDSS) was originally developed by the Federal Highway Administration and several National Laboratories beginning in 1999. The basic concept combines small-scale weather forecasts with an agency's rules of practice to produce treatment recommendations for winter weather. MDSS is a constantly evolving technology that has been proven to reduce salt usage in states with large deployments. A study conducted by the TOPS Lab showed a cost savings/benefi associated with MDSS.

The MDSS Pooled Fund (which WisDOT participates in) took the concept several steps beyond that. Its version of MDSS includes management tools, tracking of maintenance vehicles, and numerous other enhancements. Currently, 23 states and several local agencies nationwide are using some version of MDSS. WisDOT has fielded the system to a much greater extent than any other state except Minnesota, which is close to Wisconsin's usage.

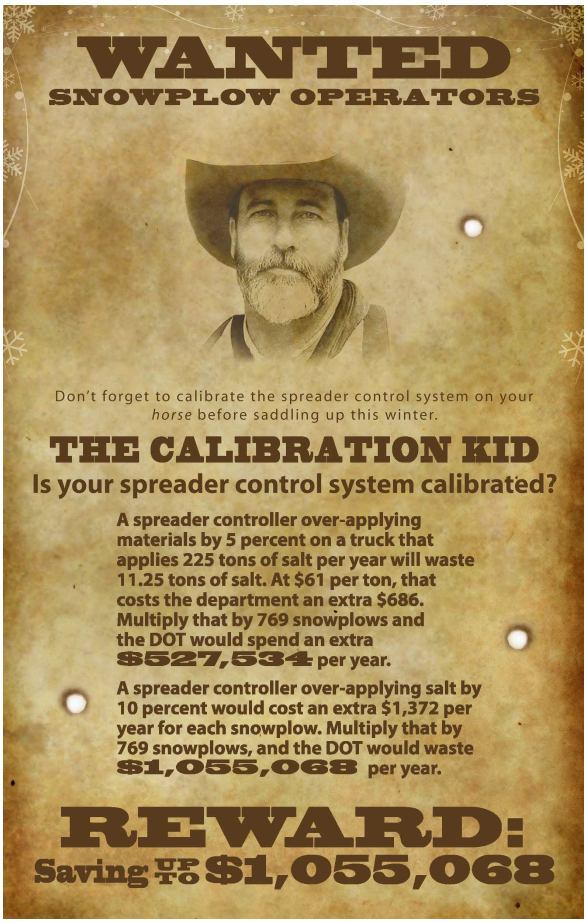
MDSS Usage
Winter 2013-2014



Equipment Calibration

Ensuring correct calibration of winter operations equipment – including salt spreaders, anti-icing applicators, and prewetting application equipment – is a key step in providing precise, consistent materials application, which reduces waste and saves money. Winter vehicles should be calibrated prior to the start of the season and whenever equipment is repaired. WisDOT regional staff are tasked with working with the counties to ensure proper calibration.

Calibrating Scales – Proper calibration has and always be an important part of winter maintenance. If the calibration is off by even 10 percent, thousands of dollars' worth of salt can be wasted in one winter season. The purchase of the three ScaleTech scales has shown that to be a benefit with respect to the process of calibrating salt spreaders. The scales increase the accuracy, speed up the process, and make the process safer for the technicians doing the work. Originally there was going to be a two year study on the scales but after calibrating a few spreaders it was very obvious that the scales would help the process. Therefore the study was discontinued and an email was sent to all the counties recommending that each county should consider adding a scale to their inventory. At about $3k per scale the costs of the scales can be recovered in less than one winter season.



Product and Equipment Testing

Winter maintenance is a continuously evolving field — new technology and innovations are developed each year. In previous years, WisDOT managed test and evaluation projects of the most promising new equipment by the counties. These test results are available on the WisDOT extranet.

WisDOT encourages county highway departments to consider new technologies when purchasing equipment. Testing new products — both equipment and materials — can lead to improved processes and more efficient operations. This year, WisDOT released a video Field Guide to Testing Deicing Chemicals. BHO staff are available to assist counties in structuring a testing and evaluation program for any products they wish to test.

Recent product and equipment evaluation projects have included:

- Alternative anti-icing and deicing materials:
  - Pretreated salt, where a liquid prewetting agent is spray-applied to the salt supply before the salt is placed in storage, exhibited good results in county tests.
  - Counties reported that prewetting salt with a mixture of salt brine and GeoMelt has been effective as an anti-icing agent. GeoMelt is less corrosive than traditional brines.
  - Counties have reported that blending pre-wetting materials with calcium and other mixes have made them more effective in lower temperatures.

More information on many test projects is available at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm (scroll to the "Winter maintenance research reports" heading).

Winter maintenance technology and equipment

TowPlow – TowPlow is one of the technologies implemented by the Wisconsin Department of Transportation to improve the efficiency and reduce the cost of winter maintenance operations. Findings suggest that the TowPlow can reduce the cost of winter maintenance during a snow event. When compared to regular plows, TowPlow can result in operational cost (labor and fuel) savings between 32 to 43 percent. Based on the storm report database for the last 10 years, TowPlow could have been used by a county for 270 hours in a year on average. The resultant cost savings are estimated to be $14,500 per year, and the TowPlow could pay for itself in five years. For counties with greater snowfall, savings per year would be greater and cost recovery time shorter. A plow truck with a minimum of 350 hp engine is required to operate the TowPlow.

Winter Maintenance Research

In an effort to stay informed of the latest methods, equipment and materials, WisDOT joins other state DOTs in funding research projects of common interest. These pooled fund projects allow WisDOT to leverage its research dollars to support projects at a higher funding level that are important to all research partners. WisDOT participates in these three pooled fund projects:

Clear Roads. In 2008–2009, Wisconsin handed over the role of lead state in this pooled fund project to Minnesota. The pooled fund project focuses on rigorous testing of winter maintenance materials, equipment and methods for use by highway maintenance crews. Launched in 2004, Clear Roads now has 18 member states and has initiated 37 research projects, many of which address topics that may be of interest to Wisconsin counties and WisDOT regional staff. For example, see the Clear Roads Web site (http://www.clearroads.org) for a final report and two-page research brief on a project that evaluated the calibration accuracy of manual and ground-speed-control spreaders. The report provides guidelines to help snowplow operators establish and maintain accurate calibration of ground speed controllers. The project also included the development of a Calibration Guide for use in the field. See http://www.clearroads.org/research-projects/05- 02calibration.html.

Wisconsin is also the lead state in the Snowplow Operator and Supervisor Training project. In 2015, the Bureau of Highway Maintenance will discuss implementing the training.

CLEAR ROADS
research for winter highway maintenance

Other projects that have been completed:

- *Synthesis of Best Practices for Eliminating Fogging and Icing on Winter Maintenance Vehicles*
  Results: The report compiles a range of solutions, both long-term and short-term, for keeping snow plow glass and mirror surfaces clean of winter precipitation.
- *Determining Effectiveness of Deicing Materials and Procedures*
  Results: A practical field guide for testing the effectiveness of deicers.
- *Calibration Accuracy of Manual and Ground-Speed-Control Spreaders*
  Results: The report provides guidelines to help snow plow operators establish and maintain accurate calibration of ground speed controllers. The project also included the development of a Calibration Guide for use in the field
- *Development of a Toolkit for Cost-benefit Analysis of Specific Winter Maintenance Practices, Equipment and Operation*
  Results: A standard web-based tool and manual for cost-benefit analysis of specific winter maintenance practices, equipment and operations.

Transportation Synthesis Reports compile research and best practices on topics including:

- Snow and ice control at extreme temperatures
- Limitations of abrasives
- Post-storm meetings
- Recording material use
- Training winter operations supervisors
- Material spreader use

These reports are available for download at http://www.clearroads.org/synthesis-reports.html.

An e-newsletter of winter maintenance news items, publications and research in progress. Read the newsletter online at http://www.clearroads.org/winter-maintenance-news.html.

Clear Roads also initiated a national multimedia winter safety campaign designed to educate drivers about the importance of driving safely in winter conditions. The Clear Roads Web site houses sample campaign materials, photos and videos with the "Ice and Snow…Take It Slow" slogan developed for the campaign. WisDOT used the campaign this winter, both on its Web site and as part of its public service announcements.

Aurora. Aurora is an international pooled fund partnership of public agencies that work together to perform joint research on road weather information systems (RWIS). Membership includes 16 state DOTs, FHWA and one international agency. WisDOT attended two meetings in person and participated in two web conferences. WisDOT remained the champion of a project to assess MDSS costs, and took over as project champion of a project to study a pavement precipitation estimation system. That project was subsequently completed. WisDOT was also a member of the technical panels on several other projects. That entailed participating in numerous project-related conference calls.

See http://www.aurora-program.org/ for more information about this pooled fund project.

SICOP. The Snow and Ice Pooled Fund Cooperative Program sponsors testing of new winter maintenance technologies that are developed in the U.S. and internationally. SICOP was developed by AASHTO and is overseen by AASHTO's Winter Maintenance Technical Service Program. WisDOT has been involved in several SICOP programs, including:

- Revising the computer-based training program on anti-icing practices and RWIS systems for snowplow drivers, managers and operators to make it web-compatible.
- Participating in a survey about the use of automatic vehicle location systems and GPS technology in winter maintenance.
- Participating in a survey about the use of Fixed Anti-icing Spray System Technology (FAST).
- Contributing to the Snow and Ice Listserv, a community of hundreds of winter maintenance professionals. The listserv provides a forum for discussing a wide range of winter maintenance issues.

See http://www.sicop.net/ for more information about this pooled fund project.

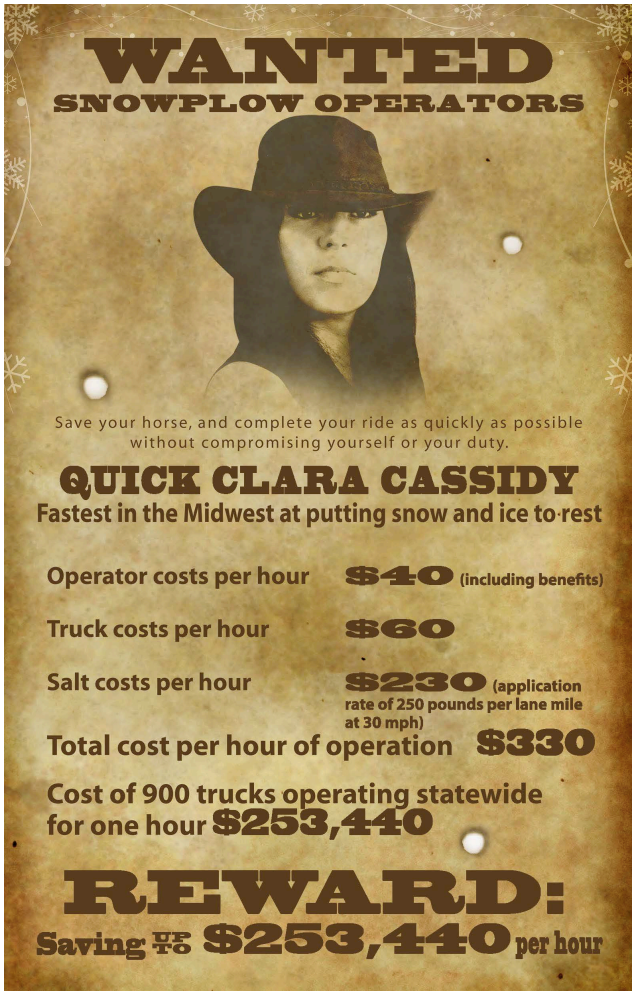
Clarus/MADIS. A joint effort of FHWA and the National Weather Service, this initiative aims to consolidate all road weather data into a national database. A key feature of this database is the quality checking of all RWIS observations. A WisDOT representative attended the annual project meeting in Little Rock, AR in July, 2013. The Clarus transition to the National Weather Service Meteorological Assimilation Data Ingest System (MADIS) is ongoing. As of June 30, 2014, they have yet to integrate pavement variables into their quality checking routines and displays. Once that happens, WisDOT will begin using MADIS to retrieve and display RWIS data.

See http://www.clarusinitiative.org/ for more information.

3C. Labor

Over 1,500 employees of Wisconsin's county highway departments are licensed to operate a snowplow, and over 1,000 of them are permanently assigned to the state highway system. Because a snowstorm can hit at any time of day, snowplow operators frequently put in overtime, and may plow for extended periods during heavy snowfall.

Labor costs vary from county to county according to each area's contracts, which also define when overtime hours can be charged. This winter, counties spent $28.8 million on labor, for an average of $838 per lane mile. Per-lane-mile labor expenditures increased 18 percent compared with last year's winter. Statewide, an average of 25 percent of counties' winter maintenance costs were spent on labor, with a high of 32 percent in the Southeast Region, where hourly labor rates tend to be higher. Statewide, labor hours were up 15 percent for regular hours and 33 percent for overtime hours compared with last winter, which is no doubt a reflection of the increase in the winter severity index. See Table 4.10 on page 93 for county-by-county labor expenditures, and see Table 3.4 on page 61 for county-by-county estimated labor hours and costs from the winter storm reports.



Winter Operations Training

Before each winter season, BHO provides and supports a variety of training efforts for WisDOT regional staff and county highway departments. Recent efforts have included:

- AASHTO Computer-Based Training. AASHTO offers seven computer-based training courses that can be completed by winter maintenance staff at their own pace as schedules permit. Course topics include anti-icing/RWIS, mitigating environmental impacts, equipment maintenance, plowing techniques, deicing, mitigating blowing snow, performance measures, and winter maintenance management. Counties are encouraged to have their operators complete the appropriate training courses, including courses for supervisors. For more information, see http://www.transportation.org/sites/sicop/docs/CBT_Handout.pdf.
- RWIS Training. WisDOT's RWIS program manager provides training for both WisDOT regional operations staff and county highway departments. A summary of these training activities can be found in the RWIS Annual Report, available at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm.
- Regional Operations/County Fall Training Sessions. These sessions are held in all regions in preparation for the upcoming winter season, at some locations in conjunction with Snowfighters' Roadeos. WisDOT provided support and participated in some of these training sessions.
- Snowfighters' Roadeos. These events are held by some counties annually, with some roadeos held jointly by two or three counties. WisDOT prepared a Roadeo Manual in August 1997 to assist counties in organizing these roadeos (see https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/best-practices/pdf/vib1.pdf). In addition, organizations such as the Wisconsin chapter of the American Public Works Association and the Wisconsin County Highways Association periodically host statewide Snowfighters' Roadeos.
- MDSS Training. Training was a major focus of the MDSS deployment in 2013-14. BHM worked closely with Iteris to develop a comprehensive training plan. The training was completed in larger groups than the previous year, with emphasis on new features and storm examples. Some one-on-one sessions were also held to bring new users up to speed. Attendees included county patrol superintendents, state patrol, a few highway commissioners, and WisDOT Region personnel.

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County-by-County Tables and Figures for Section 3: Snow and Ice Control

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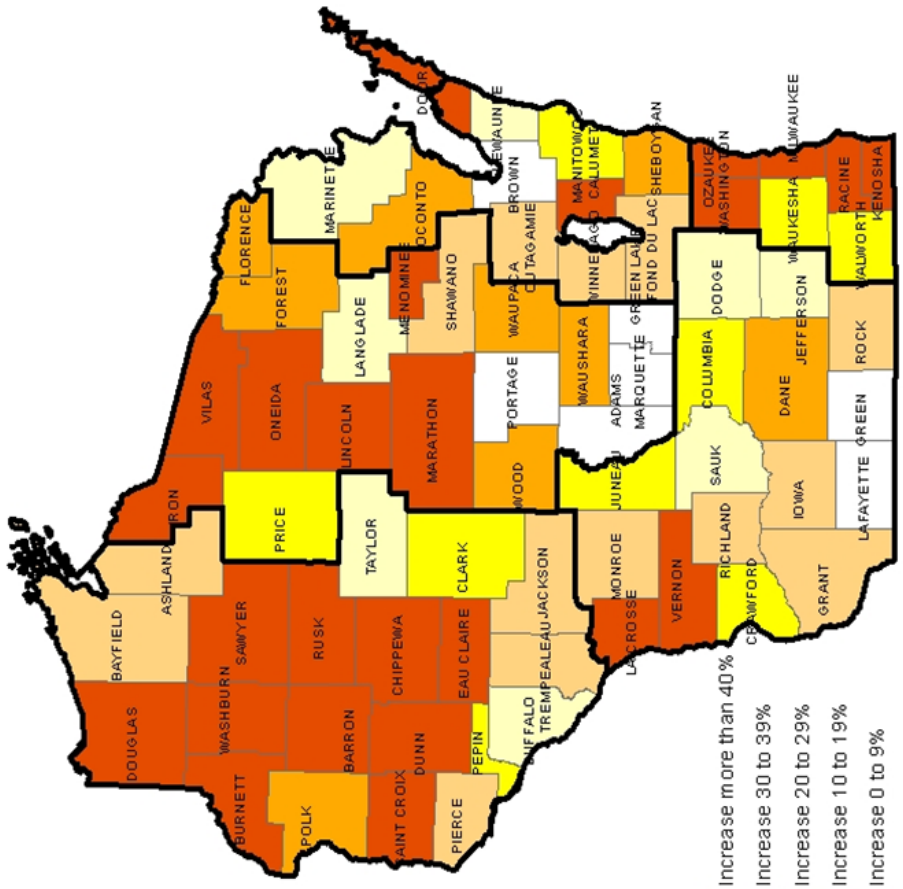
Figure 3.11 2013-2014 Salt Use per Lane Mile vs. 5-Year Average



County	Departure	County	Departure
Racine	77	Bayfield	27
Menominee	77	Pierce	26
Washburn	72	Monroe	25
Oneida	67	Winnebago	24
Door	63	Trempealeau	24
Douglas	56	Grant	23
Saint Croix	55	Richland	23
Iron	54	Jackson	22
Burnett	53	Fond du Lac	22
Dunn	52	Iowa	21
Chippewa	52	Rock	21
Rusk	51	Ashland	20
Sawyer	51	Clark	20
Barron	50	Walworth	19
Kenosha	50	Columbia	18
Vilas	49	Waukesha	18
Washington	49	Pepin	18
Lincoln	48	Crawford	16
Ozaukee	47	Price	14
Vernon	46	Manitowoc	13
Milwaukee	45	Juneau	11
Eau Claire	44	Marinette	9
La Crosse	44	Buffalo	8
Marathon	44	Taylor	8
Calumet	43	Langlade	6
Polk	37	Kewaunee	6
Forest	37	Jefferson	5
Florence	36	Dodge	4
Oconto	36	Sauk	1
Waupaca	35	Brown	-6
Dane	34	Portage	-9
Waushara	31	Adams	-9
Wood	31	Lafayette	-10
Sheboygan	30	Green	-11
Shawano	29	Green Lake	-11
Outagamie	28	Marquette	-15

Figure 3.12 2013-14 Nationwide Salt Price Comparison Map

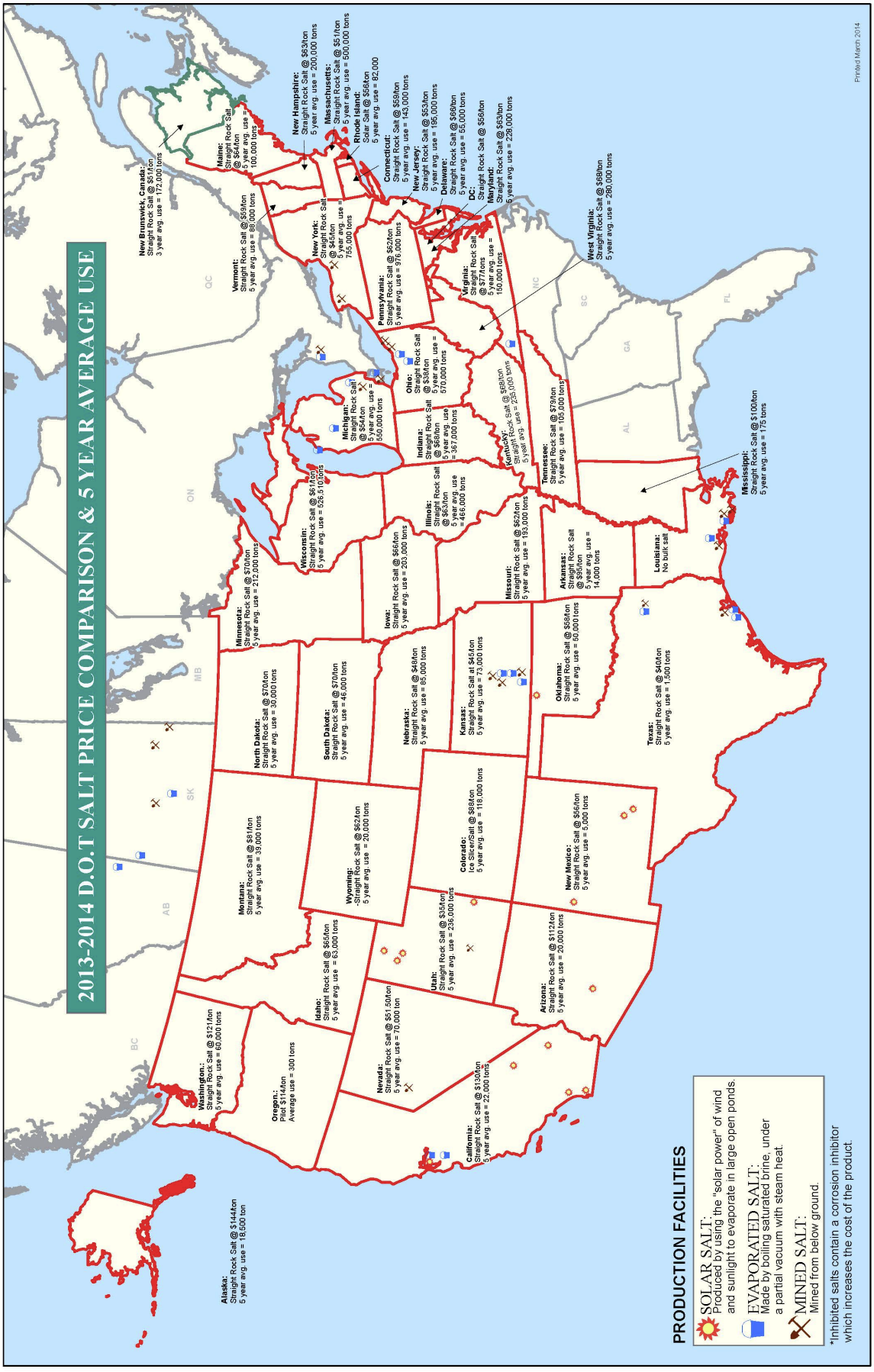


Table 3.4 Labor Hours/Lane Miles/Severity Index Ranking (Group A)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Salt per Lane Mi	Labor Cost per Lane Mi	Reg Hrs	OT Hrs	Total Hours	% OT	Total Hrs per Lane Mi	Total Hrs per Lane Mi/SI
MILWAUKEE	SE	1888.71	122.76	29.08	$1,182	13514	18400	31914	57.7%	16.90	0.14
DANE	SW	1535.50	131.56	34.86	$992	7334	16320	23654	69.0%	15.40	0.12
WAUKESHA	SE	1112.03	107.92	22.58	$676	8606	6049	14655	41.3%	13.18	0.12
Group A Avg		1,512.08	120.75	28.84	$950	9818	13590	23408	56.0%	15.16	0.13

Table 3.4 Labor Hours/Lane Miles/Severity Index Ranking (Group B)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Salt per Lane Mi	Labor Cost per Lane Mi	Reg Hrs	OT Hrs	Total Hours	% OT	Total Hrs per Lane Mi	Total Hrs per Lane Mi/SI
RACINE	SE	698.11	136.76	26.78	$852	4584	5407	9991	54.1%	14.31	0.10
KENOSHA	SE	653.56	120.43	20.30	$815	6506	3373	9879	34.1%	15.12	0.13
EAU CLAIRE	NW	537.78	122.71	18.82	$751	7586	2399	9985	24.0%	18.57	0.15
CHIPPEWA	NW	654.65	107.19	21.29	$696	4709	4310	9019	47.8%	13.78	0.13
ROCK	SW	678.82	126.63	19.52	$678	3642	4859	8501	57.2%	12.52	0.10
PORTAGE	NC	581.81	156.85	11.01	$676	6073	2876	8949	32.1%	15.38	0.10
MARATHON	NC	868.57	159.65	15.97	$652	7636	4102	11738	34.9%	13.51	0.08
BROWN	NE	765.86	117.49	14.61	$645	5440	4327	9767	44.3%	12.75	0.11
SAINT CROIX	NW	630.22	142.70	21.91	$629	3642	4169	7811	53.4%	12.39	0.09
WALWORTH	SE	706.03	102.90	23.32	$626	6744	2436	9180	26.5%	13.00	0.13
WINNEBAGO	NE	622.41	105.96	19.06	$609	4014	3661	7675	47.7%	12.33	0.12
COLUMBIA	SW	792.92	155.67	29.00	$607	3946	5142	9088	56.6%	11.46	0.07
FOND DU LAC	NE	597.30	123.33	17.38	$602	3254	3550	6804	52.2%	11.39	0.09
JEFFERSON	SW	549.15	122.01	21.64	$586	2941	3281	6222	52.7%	11.33	0.09
WASHINGTON	SE	603.45	125.97	26.79	$575	2667	4118	6785	60.7%	11.24	0.09
OUTAGAMIE	NE	535.83	108.23	18.28	$548	4214	2111	6325	33.4%	11.80	0.11
DODGE	SW	630.41	116.82	23.97	$528	3553	3118	6671	46.7%	10.58	0.09
SAUK	SW	578.72	128.42	20.24	$521	3622	3383	7005	48.3%	12.10	0.09

Table 3.4 Labor Hours/Lane Miles/Severity Index Ranking (Group B)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Salt per Lane Mi	Labor Cost per Lane Mi	Reg Hrs	OT Hrs	Total Hours	% OT	Total Hrs per Lane Mi	Total Hrs per Lane Mi/SI
GRANT	SW	622.06	105.96	14.59	$506	4229	3330	7559	44.1%	12.15	0.11
WAUPACA	NC	547.06	120.84	18.30	$484	3836	1965	5801	33.9%	10.60	0.09
KEWAUNEE	NE	110.41	119.09	11.33	$479	759	271	1030	26.3%	9.33	0.08
MONROE	SW	653.65	129.96	15.45	$410	3235	2921	6156	47.4%	9.42	0.07
Group B Avg		619.04	125.25	19.53	$612	4401	3414	7816	43.6%	12.50	0.10

Table 3.4 Labor Hours/Lane Miles/Severity Index Ranking (Group C)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Salt per Lane Mi	Labor Cost per Lane Mi	Reg Hrs	OT Hrs	Total Hours	% OT	Total Hrs per Lane Mi	Total Hrs per Lane Mi/SI
BARRON	NW	423.09	169.25	10.82	$748	5459	2153	7612	28.3%	17.99	0.11
DOUGLAS	NW	440.87	168.42	21.75	$694	4292	1991	6283	31.7%	14.25	0.08
DUNN	NW	516.58	111.04	22.10	$644	3358	2747	6105	45.0%	11.82	0.11
MANITOWOC	NE	424.85	125.35	17.79	$608	3456	1504	4960	30.3%	11.67	0.09
IOWA	SW	457.98	132.61	14.38	$572	2708	3135	5843	53.7%	12.76	0.10
PIERCE	NW	365.50	128.79	14.07	$570	2649	1320	3969	33.3%	10.86	0.08
LINCOLN	NC	415.19	162.14	14.64	$559	3852	1406	5258	26.7%	12.66	0.08
LA CROSSE	SW	488.80	122.13	17.03	$556	3014	2508	5522	45.4%	11.30	0.09
SHEBOYGAN	NE	522.38	128.42	20.05	$554	3386	2018	5404	37.3%	10.34	0.08
SHAWANO	NC	519.55	137.08	16.95	$530	4695	2038	6733	30.3%	12.96	0.09
OCONTO	NE	467.45	120.11	14.59	$527	2943	2016	4959	40.7%	10.61	0.09
WOOD	NC	429.88	152.25	16.56	$511	2572	2202	4774	46.1%	11.11	0.07
CLARK	NW	402.56	131.24	13.55	$501	2394	1708	4102	41.6%	10.19	0.08
JUNEAU	SW	494.25	133.90	16.79	$451	2326	2255	4581	49.2%	9.27	0.07
VERNON	SW	467.04	134.35	14.92	$428	2544	1829	4373	41.8%	9.36	0.07
CRAWFORD	SW	394.99	122.31	11.55	$398	2066	1517	3583	42.3%	9.07	0.07
JACKSON	NW	515.00	134.38	17.36	$392	2952	2111	5063	41.7%	9.83	0.07

Table 3.4 Labor Hours/Lane Miles/Severity Index Ranking (Group C)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Salt per Lane Mi	Labor Cost per Lane Mi	Reg Hrs	OT Hrs	Total Hours	% OT	Total Hrs per Lane Mi	Total Hrs per Lane Mi/SI
Group C Avg		455.64	136.10	16.17	$544	3216	2027	5243	39.1%	11.53	0.08

Table 3.4 Labor Hours/Lane Miles/Severity Index Ranking (Group D)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Salt per Lane Mi	Labor Cost per Lane Mi	Reg Hrs	OT Hrs	Total Hours	% OT	Total Hrs per Lane Mi	Total Hrs per Lane Mi/SI
BAYFIELD	NW	316.88	199.27	17.95	$726	3399	1732	5131	33.8%	16.19	0.08
ONEIDA	NC	396.79	187.76	26.12	$688	5767	648	6415	10.1%	16.17	0.09
DOOR	NE	268.55	122.48	18.58	$681	1124	1946	3070	63.4%	11.43	0.09
MARINETTE	NE	421.42	139.54	12.74	$608	4067	862	4929	17.5%	11.70	0.08
POLK	NW	385.05	181.61	19.71	$589	2950	1829	4778	38.3%	12.41	0.07
WASHBURN	NW	372.14	153.27	20.78	$589	2403	1967	4370	45.0%	11.74	0.08
LAFAYETTE	SW	293.88	111.13	6.89	$567	1381	2256	3637	62.0%	12.38	0.11
OZAUKEE	SE	308.71	118.36	32.10	$542	2161	1062	3223	33.0%	10.44	0.09
GREEN	SW	312.72	111.91	6.78	$464	2099	1540	3639	42.3%	11.64	0.10
TREMPEALEAU	NW	441.05	99.56	14.73	$403	2247	1641	3888	42.2%	8.82	0.09
RICHLAND	SW	330.10	98.60	9.92	$392	1782	1171	2953	39.7%	8.95	0.09
BUFFALO	NW	317.02	100.49	6.72	$359	1825	787	2612	30.1%	8.24	0.08
GREEN LAKE	NC	156.94	127.98	6.59	$343	862	289	1151	25.1%	7.33	0.06
MARQUETTE	NC	245.09	106.49	12.67	$297	897	693	1590	43.6%	6.49	0.06
WAUSHARA	NC	345.01	108.92	11.94	$285	2282	180	2462	7.3%	7.14	0.07
Group D Avg		327.42	131.16	14.95	$502	2350	1240	3590	35.6%	10.74	0.08

Table 3.4 Labor Hours/Lane Miles/Severity Index Ranking (Group E)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Salt per Lane Mi	Labor Cost per Lane Mi	Reg Hrs	OT Hrs	Total Hours	% OT	Total Hrs per Lane Mi	Total Hrs per Lane Mi/SI
IRON	NC	249.56	225.36	27.16	$824	2593	1317	3910	33.7%	15.67	0.07
VILAS	NC	305.24	138.04	28.68	$636	2474	1369	3843	35.6%	12.59	0.09
FOREST	NC	312.38	187.34	24.38	$613	3026	1457	4483	32.5%	14.35	0.08
RUSK	NW	213.47	109.54	14.41	$607	2218	721	2939	24.5%	13.77	0.13
PRICE	NC	322.26	160.02	16.26	$582	2500	1439	3939	36.5%	12.22	0.08
ASHLAND	NW	249.49	195.59	14.87	$553	2291	1024	3315	30.9%	13.29	0.07
TAYLOR	NW	233.90	157.57	13.07	$531	1847	848	2695	31.5%	11.52	0.07
BURNETT	NW	234.95	142.01	15.59	$531	1451	1098	2549	43.1%	10.85	0.08
LANGLADE	NC	299.21	155.70	12.27	$507	2292	1079	3371	32.0%	11.27	0.07
SAWYER	NW	367.44	140.76	14.71	$482	2307	1258	3565	35.3%	9.70	0.07
CALUMET	NE	201.71	118.63	12.85	$451	1784	601	2385	25.2%	11.82	0.10
PEPIN	NW	112.38	98.18	8.61	$413	692	398	1090	36.5%	9.70	0.10
Group E Avg		258.50	152.40	16.90	$561	2123	1051	3174	33.1%	12.23	0.08

Table 3.6 Labor Hours/Lane Miles/Severity Index Ranking (Group F)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Salt per Lane Mi	Labor Cost per Lane Mi	Reg Hrs	OT Hrs	Total Hours	% OT	Total Hrs per Lane Mi	Total Hrs per Lane Mi/SI
FLORENCE	NC	141.07	166.58	23.07	$573	1355	339	1694	20.0%	12.01	0.07
ADAMS	NC	193.82	129.06	14.24	$389	1204	351	1555	22.6%	8.02	0.06
MENOMINEE	NC	90.26	98.47	18.56	$162	368	72	440	16.4%	4.87	0.05
Group F Avg		141.72	131.37	18.62	$375	976	254	1230	19.6%	8.30	0.06

4 Performance

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Since weather can vary drastically from year to year, planning and budgeting for winter highway maintenance can be challenging. Throughout the winter, WisDOT staff and county highway departments evaluate progress in several areas, including materials use, money spent, and response time. When the season is complete, WisDOT can gather all the data and analyze this winter's performance across all regions and compared to previous winters.

This section begins with a description of the winter maintenance portion of Compass, WisDOT's operations performance measurement program, which measures trends in areas like response time and winter costs per lane mile. This section also discusses costs, using charts to visually compare spending in different categories from region to region and from year to year, and presents winter crash rates and customer satisfaction data.

Performance and Costs, 2013-2014

Total lane miles	34,339
Total patrol sections	753.5
Average lane miles per patrol section	40.57
Roads to bare/wet pavement within WisDOT targets[1]	63%
Average crew reaction time from start of storm	7.03 hours
Total winter costs[2]	$113,473,270
Total winter costs per lane mile	$3,304
Total winter crashes[3]	11,837
Total winter crashes per 100 million VMT	44

1. Time to bare/wet pavement and crew reaction time data are from storm reports.
2. Cost data are actual costs as billed to WisDOT by the counties.
3. Crash data are from WisDOT's Bureau of Transportation Safety.

An Economical Choice

Proactive anti-icing operations are about three times less costly than treating frost once it has formed. Anti-icing costs made up only 0.5 percent of total winter maintenance costs this year. *See page 42 for more informationon anti-icing costs.*

4A. Compass

Developed in 2001, Compass is WisDOT's quality assurance and asset management program for highway maintenance operations. Annual Compass reports provide information on winter maintenance activities as well as other aspects of highway operations.

Measures for winter operations were established in 2003, and data from the winter of 2003–04 was used to establish baseline measures for future winter seasons. The measures that were chosen included:

- time to bare/wet pavement
- winter weather crashes per vehicle miles traveled
- cost per lane mile per Winter Severity Index point

Table 4.1 gives the statewide average values for these measures for the last six winters. More detail on these measures is provided later in this section.

WisDOT has gathered several years of baseline data and plans to establish targets for these measures. Until then, the data can be used to make a year-to-year comparison in these areas. Other winter measures that are being investigated for possible future use include:

- Percent of winter operations equipment that is calibrated before winter begins
- Average traffic speed recovery after a storm event (progress reports are available from WisDOT)

Table 4.1. Statewide Compass Measures for Winter

	2009-10	2010-11	2011-12	2012-13	2013-14
Percentage of roads to bare/wet pavement within WisDOT target times	67%	79%	79%	73%	63%
Cost per lane mile	$2,222	$2,696	$1.656	$2.778	$3,304
Winter Severity Index	82.4	119.2	75.4	115.2	1336
Cost per lane mile per Winter Severity Index point	$26.97	$22.62	$21.96	$24.11	$24.73
Winter weather crashes	22 per 100 million VMT	35 per 100 million VMT	20 per 100 million VMT	29 per 100 million VMT	44 per 100 million VMT

Annual Compass reports are available at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/compass/reports/index.shtm.

4B. Winter Maintenance Management

History of Snow and Ice Control in Wisconsin

The counties' plowing and salting strategies have evolved considerably over the past several decades. For many years beginning in the 1950s, WisDOT maintained a "bare pavement" policy for state highways, striving to ensure that the roadways were kept essentially clear of ice and snow during winter. Snowplows operated continuously during storms and simultaneously applied deicing salts. In the 1970s, however, economic and environmental concerns compelled the department to modify this policy. The national energy crisis and the high cost of employee overtime strained the maintenance budget, and WisDOT made the decision to reduce winter maintenance coverage on less traveled state highways. To address the risk of environmental damage by chloride chemicals, the policy was modified further to include provisions calling for the prudent use of chemicals, and limiting each application of salt to 300 pounds per lane mile.

In 2002, a detailed salt application table was added to the maintenance manual's winter guidelines. The table provides variable salt application rates for initial and repeated applications, depending on the type of precipitation, pavement temperature, wind speeds, and other weather variables. Anti-icing application rates were also established; county highway departments were instructed to perform anti-icing applications prior to predicted frost, black ice, or snow events in order to minimize the amount of salt used during the event. With the implementation of MDSS, this process has become more automated. Patrol superintendents receive treatment recommendations based on the characteristics of the route, such as traffi volume and pavement type, residual de-icers, and forecasted weather.

Storm Reports

One way WisDOT has worked to increase efficiency in recent years is through the Winter Storm Reports. Every week during the winter, the county highway departments complete online storm report forms. These storm reports let county and WisDOT staff track the season's weather and the counties' response to it throughout the season, which allows the counties to adjust their resource use midseason if necessary. Storm reports track data such as types of storm events, salt use, anti-icing applications, labor hours, and cost estimates. Uses for this data include:

WisDOT Central Office

- Create weekly reports and maps that track salt use and costs. These can help identify inconsistencies in service levels provided by neighboring counties.
- Calculate the severity index; use this to justify additional funding if conditions are more severe than normal
- MAAPS measures
- DTSD Performance Measures

WisDOT Regional Offices

- Justify additional funding if conditions are more severe than normal
- Manage salt inventory
- Post-storm analysis of county's response
- Training tool for new staff

Counties

- Post-storm analysis of crew's response
- Compare their response (materials use, anti-icing, labor hours, etc.) to that of neighboring counties
- Justify funding to county boards

BEST PRACTICES: MDSS

MDSS combines current weather observations and forecasts with WisDOT's winter maintenance rules of practice to provide users with storm treatment recommendations. These recommendations are based on plow route characteristics like traffi volume, pavement structure, and levels of service.

Weather forecasts, pavement conditions, and treatment recommendations are continuously updated during the storm based on inputs from AVL-GPS and weather and pavement models. When treatment recommendations are followed, salt is used more efficiently.

See https://transportal.cee.wisc.edu/storm-report/ for more detail on how to use the storm report data.

WisDOT relies on the county highway departments to make the storm reports a reliable tool by entering data accurately each week. Historically, the cost and salt use data in the storm reports has been relatively accurate when compared with final costs billed to WisDOT and end-of-season salt inventory figures. In 2010 the UW TOPS Lab took over the storm report input programming. As a result the data entry has been restricted to the point that erroneous entries have been nearly eliminated. This will result in even more accuracy going forward.

Winter Patrol Sections

Many factors influe ce a county's response to winter storms, including the timing of snow events, the mix of highway types and classifications in a county, and the type of equipment being used. Another important factor is the length of each county's patrol sections.

Each county highway department divides the state highways it is responsible for plowing into patrol sections. In general, one snowplow operator is assigned to each patrol section. This winter, the state highway system was divided into 753.5 winter patrol sections, an average of 10.5 sections per county. The length of patrol sections varies, with counties that are more urban (Group A) tending to have shorter patrol sections than more rural counties (Groups D, E and F). Local traffic patterns, highway geometrics, number of traffic lanes, intersections, interchanges, and other factors affect the length of patrol sections in each county.

In responding to a storm, operators in longer patrol sections may use more salt in an effort to melt any snow that accumulates between plowings. In addition, drivers may notice that some roads appear to be cleared faster than others, since the longer a patrol section, the longer it takes a snowplow operator to clear all the roads in his section. Three counties have undertaken snowplow route optimization studies in the past to make their patrol section lengths as efficient as possible; see https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm for details.

Table 4.2 shows the average patrol section length for the counties in each Winter Service Group. For county-by-county patrol section data, see Table 4.8 on page 85.

Table 4.2. Average Patrol Section Lengths by Winter Service Group, 2013-2014

Winter service group	Average patrol section length (lane miles)	Range of average patrol section lengths by county (lane miles)
A	52.1	44 - 59
B	45.6	32 - 63
C	43.6	31 - 57
D	48.2	30– 59
E	48.8	34 - 61
F	41.9	37 - 47
Statewide average	45.6	30 - 63

4C. Response Time

WisDOT tracks two types of response time data — the time it takes a maintenance crew to get on the road after the start of a storm, and the time it takes the pavement to return to a bare/wet condition after the end of a storm. The first measure can impact the second. In general, a quicker response means the crews are dealing with less packed snow. However, WisDOT guidelines dictate that lower-volume highways receive 18-hour winter maintenance coverage rather than 24-hour coverage, so slower average reaction times are expected on 18-hour roads.

Maintenance Crew Reaction Time

Being proactive in getting on the road — even before the start of a storm — can result in bare/wet pavement being achieved faster and with less effort. Knowing this, county highway departments are becoming more proactive in their response to winter storms. Plows and salt spreader trucks are often on the road before a storm starts or shortly afterward.

Using data from the weekly winter storm reports, Table 4.3 below shows the average reaction time to storm events in each Winter Service Group. While counties have become quicker in responding to winter storm events over the past few winter seasons, this winter the average reaction time in every Service Group was much worse than any winter in the past decade. As expected, average reaction times for Group A counties, which provide the highest level of service (24-hour coverage), were less than those counties that provide 18-hour coverage.

In recent winters, the statewide average crew reaction time had improved (decreased) slightly, but this past year broke that trend with average reaction time soaring from 2.4 hours to 7 hours, which was by far the slowest reaction time recorded since the Department began tracking this metric. The much slower reaction times this year in every winter service group probably reflected the extreme cold temperatures experience across the state. Many times, counties would wait until the sun came out so their salting and plowing would be more be more effective. In some situations, such as blowing snow, the roadway was so cold that the snow would simply blow across the pavement, but once traffic began to pick up in the morning and the sun began to shine, the snow would begin to stick and then the crews would react.

Table 4.3. Maintenance Crew Reaction Time

(From winter storm reports, 2004-05 thru 2013-14)

	Average Reaction Time (hours)											
Winter Service Group	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**Average Reaction Time 2004-05 thru 2012-13**	**Percent Difference 2013-14 vs. 9-year Average**
A	1.03	0.56	1.24	0.61	1.02	1.74	0.49	0.19	0.63	2.31	0.83	77%
B	1.46	1.65	1.57	1.38	1.46	1.78	1.60	1.11	1.27	4.48	1.48	204%
C	2.35	2.44	2.75	2.87	2.70	3.37	2.87	2.15	2.38	4.99	2.65	88%
D	2.45	2.95	3.35	2.89	3.46	4.23	3.25	2.54	3.77	6.23	3.21	94%
E	3.78	3.81	3.71	4.05	4.00	4.71	3.48	3.16	2.99	9.36	3.74	150%
F	3.66	3.99	3.94	5.04	5.08	5.79	5.68	3.39	3.79	14.81	4.48	230%
Statewide Average (unweighted)	2.37	2.55	2.69	2.66	2.78	3.38	2.74	2.08	2.42	7.03	2.63	167%

Time to Bare/Wet Pavement

As explained in Section 1, county highway departments provide different levels of effort during and after a storm according to each highway's category rating, as determined by average daily traffic It should be expected that an urban freeway would receive more materials, labor and equipment — and would show a quicker recovery to bare/wet pavement — than a rural, two-lane highway. For more information on these categories, see page 8.

"Time to bare/wet pavement" is measured from the reported end time of a storm. The performance expectation is that at least 70 percent of the time the highway category target time will be met. As shown in Table 4.4, on the whole, the more heavily traveled highways (24-hour roads) consistently experience a better time to bare/wet pavement performance than do the more lightly traveled highways (18-hour roads), despite the shorter target time for clearance (4 hours vs. 6 hours, respectively). From storm to storm, some variability occurs within the highway categories, mostly reflecting weather effects (type, duration and severity), according to analysis performed through the Compass program.

Table 4.4 Percentage to Bare/Wet Pavement

Percent of Time the Highway Category Target Time to Bare/Wet Pavement was Met						
(Target Times: 4 hours for 24-Hour Roads; 6 hours for 18-Hour Roads)						
Highway Category	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**
24-Hour Roads	61%	70%	83%	83%	75%	66%
18-Hour Roads	56%	65%	75%	76%	70%	59%
Statewide	58%	67%	79%	79%	73%	63%
Target Percentage	*70%*	*70%*	*70%*	*70%*	*70%*	*70%*

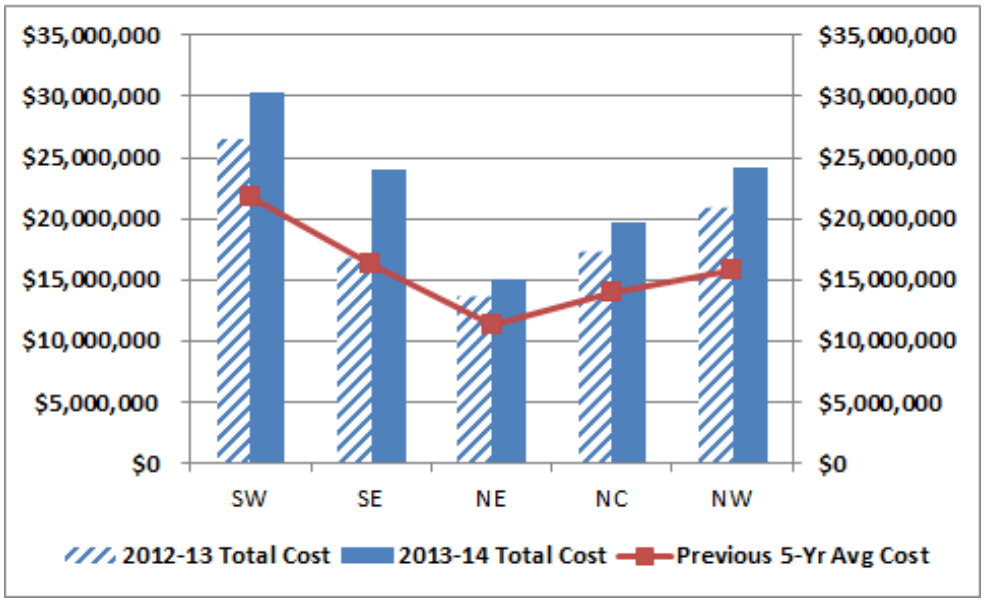
The percentage of roadways cleared to bare/wet pavement decreased in the challenging winter of 2012-13, and decreased even more in 2013-14. The decrease this past winter reflected the extremely low temperatures brought on by the polar vortex incursion into the Upper Midwest. When the salt could not work due to exremely low temperature, the counties often had to wait until the sun came out following a storm in order to get the roadways back to bare pavement.

4D. Costs

The total billed cost of statewide winter operations this winter was $113.5 million, making it 19 percent more costly than 2012-13. A number of factors drive the cost of winter maintenance, including both the nature and severity of the winter (i.e. how much work has to be performed), as well as the unit costs of the component elements of winter maintenance (i.e. cost per lane mile for salt, labor, and equipment).

As Figure 4.1 below shows, in 2013-14, all regions experienced winter maintenance cost increases from 2012-13, and all regions had costs that were higher than their most recent 5-year average. This year's 16 percent increase in winter severity over the 2012-13 winter probably contributed to these cost increases.

Figure 4.1 Total Winter Mintenance Cost by Region,
2013-14 vs. 2012-13 vs. Previous 5-Year Average



Winter maintenance costs per lane mile increased in 2013-14 by about 19 percent from 2012-13. Figure 4.2 below shows the statewide average winter cost per lane mile and Winter Severity Index since the 1997-98 winter.

Figure 4.2 Statewide Average Winter Costs per Lane Mile and Winter Severity Index, 1997-98 thru 2013-14

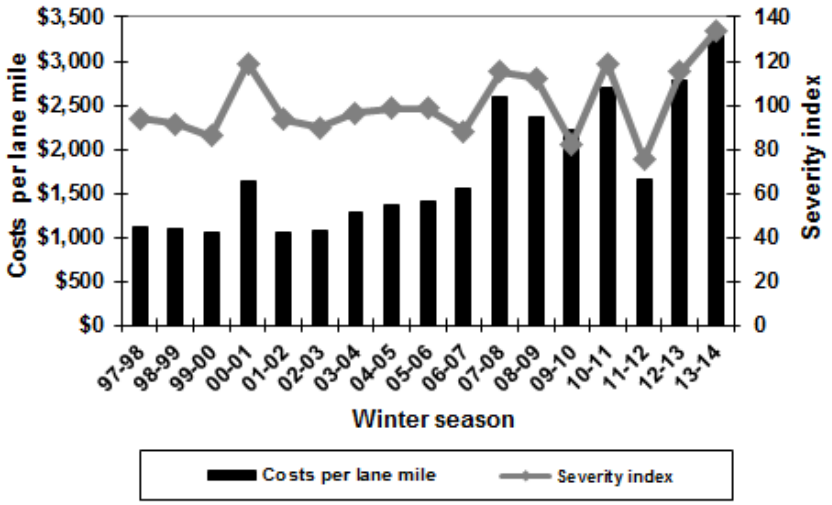


Table 4.5 below shows total winter maintenance costs statewide and for each region per lane mile, as well as relative to the region's average Winter Severity Index. The level of service provided in each county affects total costs, and the mix of countiies in a region affects the overall comparative costs – which is one reason the Southeast Region historically has had a higher cost per lane mile relative to winter severity than the other regions.

Table 4.5. Total Winter Costs Relative to Winter Severity, 2013-2014

Region	Average Winter Severity Index	Actual cost per lane mile	Relative cost per severity index point
SW	124.00	$3,274	$26.40
SE	119.30	$4,033	$33.81
NE	120.78	$3,050	$25.25
NC	148.92	$3,067	$20.59
NW	138.68	$3,139	$22.63
Statewide	**133.64**	**$3,304**	**$24.72**

This winter's statewide average cost per lane mile of $3,304 was a record high for Wisconsin, and was 19 percent higher than the previous record high set in 2012-13 at $2,778 per lane mile. Figure 4.1 showed the trends in winter costs per lane mile and severity index over the last 15 winters. On the whole, winter costs per lane mile tend to increase as statewide average winter severity increases. Increases in labor rates and salt pricing will affect overall winter maintenance cost. Since the 2013-14 winter was one for the record books on so many levels, it is no surprise that a record was also set in the per lane mile cost.

There are five major cost categories in the Department's winter maintenance billing system. These include: cost of salt used, labor costs, equipment costs, cost of other materials furnished by the county, and administration costs. Figure 4.3 below shows the breakdown of the $113 million in 2013-14 statewide winter maintenance costs by these billing categories.

Figure 4.3. Statewide Winter Costs by Category, 2013-14

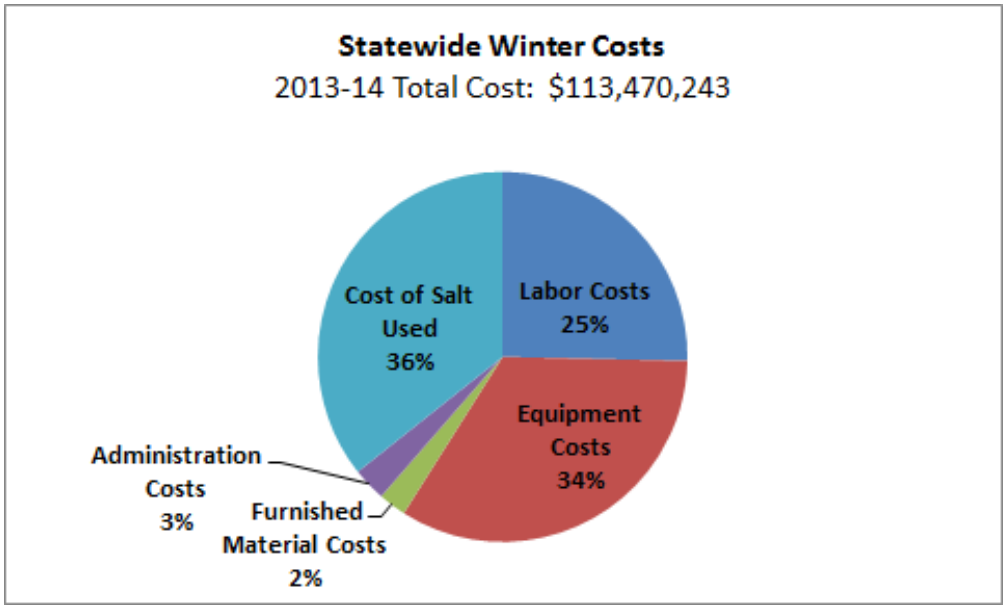


Figure 4.4 on page 77 shows the breakdown of costs by billing category for each of the five regions. More specific, detailed cost figures by region and for the state as a whole are shown in Table 4.6 on page 78.

In the five individual winter maintenance expenditure categories for 2013–2014 statewide, the following trends were noted:

- Salt expenditures totalled $40.5 million, a 7 percent increase from 2012-13. However, two regions (Southwest and Northwest) had virtually no change in their salt expenditures, while the Southeast Region had a 37 percent increase and the Northeast region had a 12 percent increase.

- Equipment expenditures were $38.2 million, a 30 percent increase from 2012-13. The Northeast Region experienced the smallest increase at nearly 18 percent, while the Southeast Region had the largest increase at 57 percent.

- Labor expenditures were $28.8 million, a 22 percent increase from 2012-13. The smallest increase (10 percent) was in the North Central Region, while the Southeast Region had the largest increase (40 percent).

- Expenditures for county-furnished materials other than salt were only $2.8 million statewide, but this was a 95 percent increase from 2012-13.

- Administration expenditures totalled only $3.3 million statewide, a 7 percent increase from 2012-13.

Figure 4.4. Regional Winter Costs by Category, 2013-14

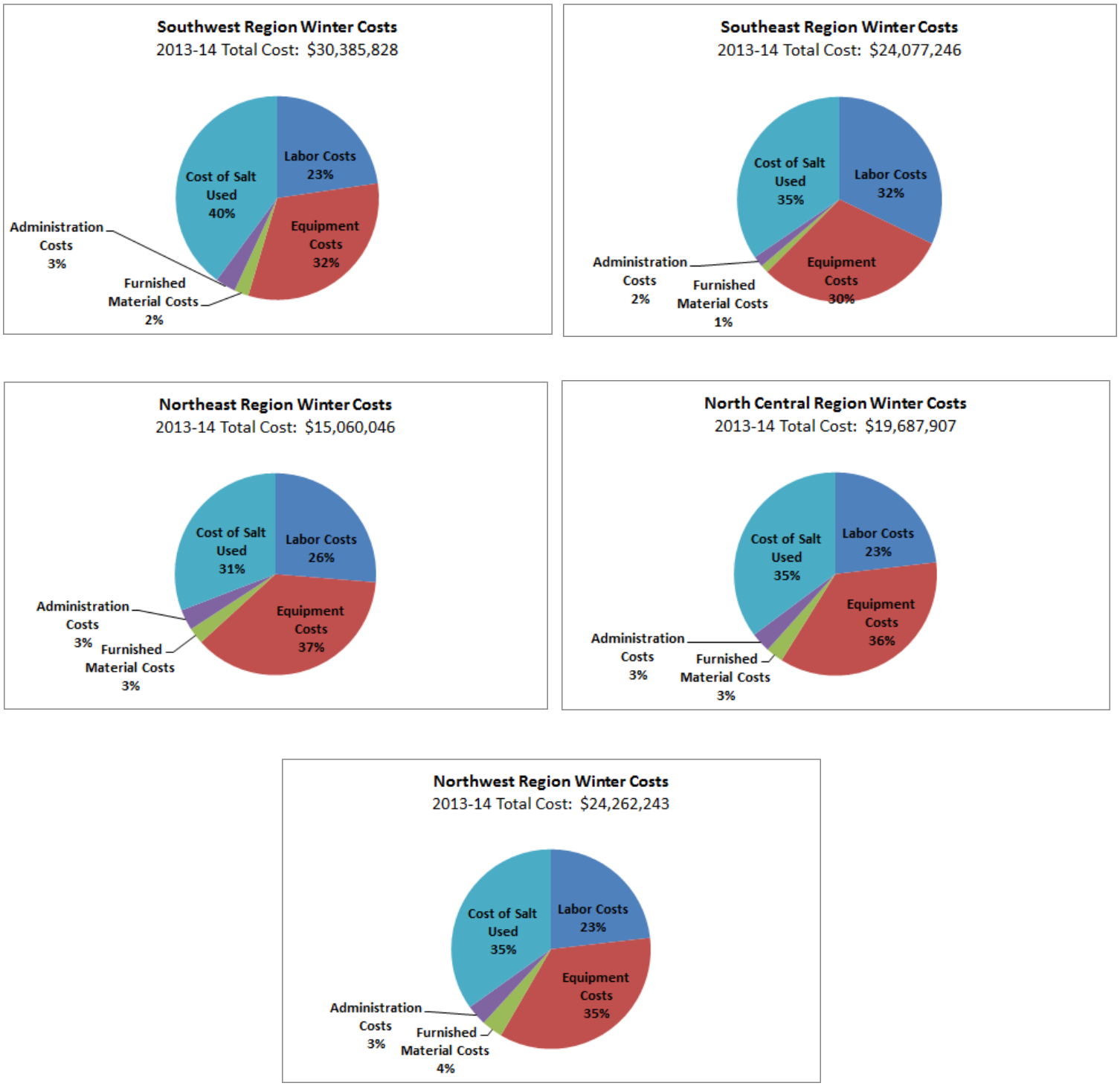


Table 4.6

Winter 2013-14 Experience for County Services

	Labor Costs	Equipment Costs	County Furnished Material Costs	Administration Costs	Cost of Salt Used	Total Costs for Winter	Five Year Avg Cost for Winter ('09-'13 avg)	% Costs over Five Year Average
Region 1 / Southwest	$6,892,470	$9,702,870	$698,041	$982,709	$12,109,738	$30,385,828	$21,798,700	139%
Region 2 / Southeast	$7,727,235	$7,318,489	$302,925	$414,272	$8,314,325	$24,077,246	$16,358,500	147%
Region 3 / Northeast	$3,959,141	$5,562,795	$393,275	$501,258	$4,643,577	$15,060,046	$11,251,600	134%
Region 4 / Northcentra	$4,560,261	$7,036,578	$537,230	$625,708	$6,928,130	$19,687,907	$14,022,700	140%
Region 5 / Northwest	$5,627,813	$8,534,713	$830,014	$807,513	$8,462,190	$24,262,243	$15,783,700	154%
Region Totals	**$28,766,920**	**$38,155,445**	**$2,761,485**	**$3,331,460**	**$40,457,960**	**$113,473,270**	**$79,215,200**	**143%**

Figure 4.5. Costs per Lane Mile by Category

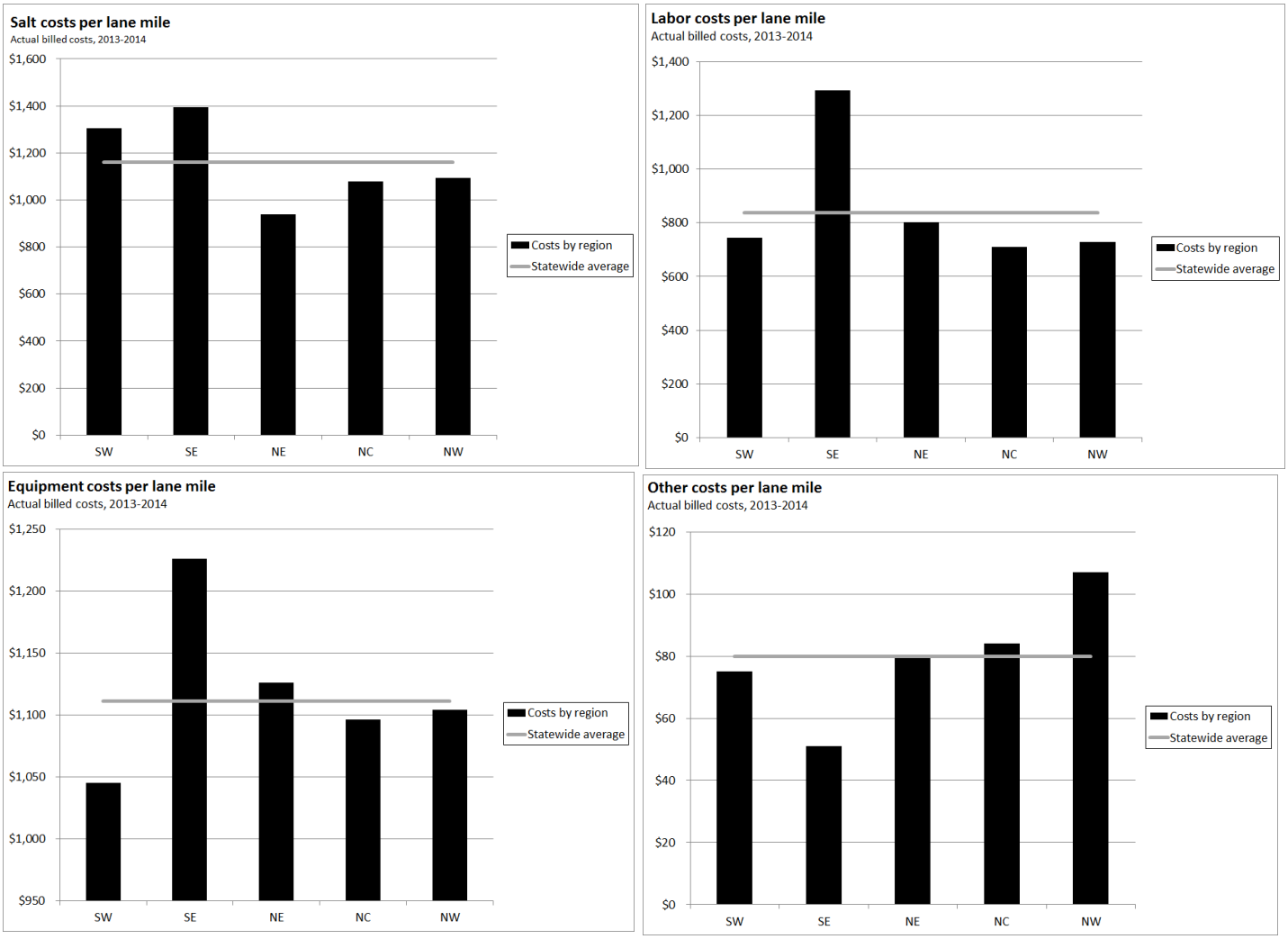


Table 4.5 on page 75 lists the total cost per lane mile for winter maintenance in each region, along with the region's Winter Severity Index. The level of service provided in each county affects total costs, as do the factors listed below. For these reasons, the Southeast Region historically experiences significantly higher costs relative to winter severity than the other regions.

Components of Winter Costs

Major components of winter costs include labor, equipment, salt, other materials such as sand and chemicals, and administrative costs. A region's expenditures in each area are affected by the severity of its winter and the portion of its highways receiving 24-hour coverage. In addition:

- Labor costs are based on rates set in each county's union contracts. Hourly rates tend to be higher in more urban counties. Timing of storms can increase labor costs if more overtime hours are required.
- Equipment costs are determined by the state Machinery Management Committee, which assigns an hourly rate to each piece of equipment that includes depreciation from the purchase price, maintenance costs, and fuel costs. Rising fuel costs have contributed to increased equipment costs, as have some counties' purchase of larger, more expensive vehicles. These larger vehicles are often more useful for year-round maintenance tasks and are also more efficient in the winter, as they can accommodate larger plows and carry more salt.

- Salt costs are affected by salt prices per ton, which vary because of transportation costs. For example, salt entering the state at the Port of Milwaukee doesn't have to travel as far to reach counties in the Southeast region as it does to reach counties in the center of the state.

- Costs for materials other than salt, such as sand, are also affected by transportation costs. In addition, some counties use more expensive deicing agents that are more effective at lower temperatures (see Table 3.3 on page 42 for details on deicing agent costs).

- Administrative costs are calculated at 4.25 percent of each county's combined labor, equipment and materials costs, and cover the overhead costs for office activities.

However, the breakdown of expenditures by category varies among regions because of the factors described above. For example, the Southeast Region spends more on labor because hourly labor rates tend to be higher in those counties, while equipment expenditures make up a smaller percentage of that region's total expenditures. Figure 4.4 on page 79 shows the distribution of costs by category for each region.

County-by-county cost data is available in Table 4.10 on page 93.

A Note About Cost Data

The tables at the end of this section were generated with data from two sources — final costs as billed to WisDOT, and preliminary costs from the winter storm reports. The tables created from preliminary storm reports data (such as Table 4.11 on page 99, Cost per Lane Mile per Severity Index Ranking) are included in this report because they provide county-by-county breakdowns of cost data not available elsewhere. Many of the tables in the Appendix also include cost data from the storm reports. The source of each table's data is indicated below the table title.

Final cost data includes expenses for all winter activities, including putting up snow fence, transporting salt, filling salt sheds, thawing out frozen culverts, calibrating salt spreaders, producing and storing salt brine, and anti-icing applications, as well as plowing and salting. Cost data from storm reports, however, include only plowing, sanding, salting and anti-icing expenses.

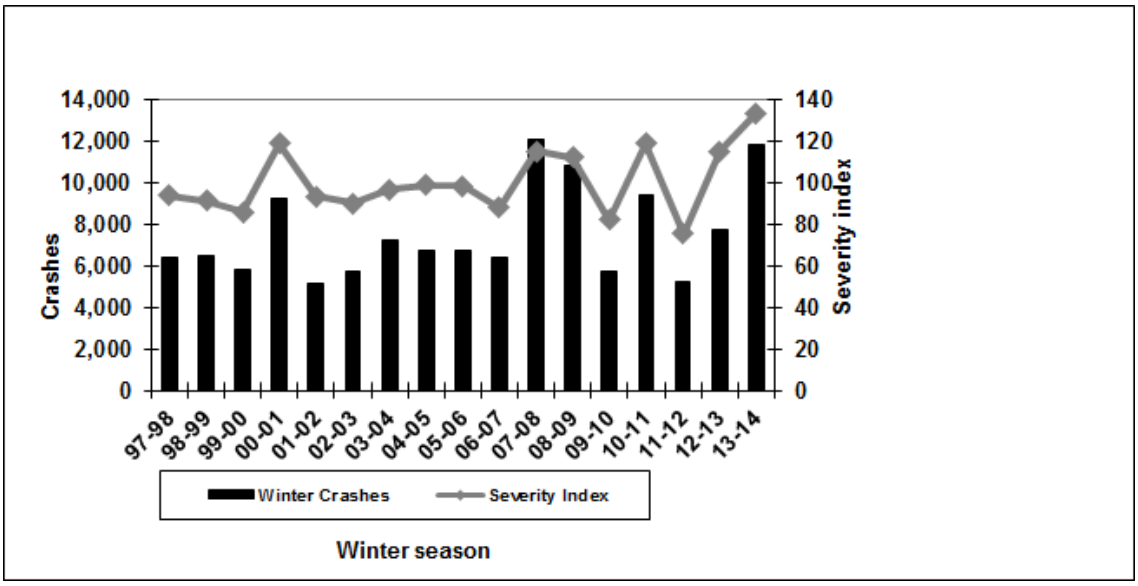
4E. Travel and Crashes

From black ice to freezing rain to white-out snowstorms, winter weather creates challenging conditions for even the most careful drivers. Many factors influence winter crash rates, most of which cannot be controlled by winter maintenance crews. However, 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 some winter crashes.

In the winter of 2013-14, there were 11,837 police-reported winter crashes (those that occurred with snowy, slushy or icy road conditions). In part, this data reflects the fact that the higher number of storm events increases the exposure rate. The crash rate (number of crashes per 100 million vehicle miles traveled) increased 52 percent this winter to a statewide average of 44, up from last winter's crash rate of 29.

Crashes tend to increase in more severe winters. Figure 4.6 on page 81 shows the trends in total crashes statewide over the last 17 years overlaid with the Winter Severity Index.

Figure 4.6 Snow/Slush/ice Road Condition Crashes and Winter Severity Index



Source: WisDOT Bureau of Transportation Safety

A Note About Crash Data

The tables and figures shown in this report somewhat understate the full picture of vehicle incidents in snow/slush/icy conditions in Wisconsin. These crash numbers include only legally "reportable" crashes, which are those in which someone is killed or injured or that result in private property damage over $1,000. Not included, for example, are so-called "slide offs" where a vehicle leaves the roadway but no one is hurt and damage to the vehicle is minimal. Also excluded from crash numbers used for analysis are driver-reported crashes – unless a police officer completed the report form and submitted it to the Department, data included on a self-reported form are not sufficiently reliable for analytical purposes. Unfortunately, during particularly heavy snow events when so-called "fender bender" crashes can skyrocket, some police agencies have insufficient staff to respond to every minor, non-injury crash and instead instruct drivers to complete a self-reporting form, which is helpful for notifying their insurance companies for use in sorting out damage claims later,

Winter Crashes and Vehicle Miles Traveled

Year-round, crashes in urban areas are more likely to occur at low speed, resulting in fewer deaths and injuries and less property damage, while crashes on rural highways are more likely to be high-speed collisions, with greater likelihood of death/injury and greater property damage. Regions with more urban area roadways, such as the Southeast Region, often have fewer winter weather (snow/slush/ice road condition) crashes per 100 million vehicle miles traveled (VMT) than do regions with more rural, high speed roadways. In part, this lower winter crash rate simply refllects the small impact a single crash in a county with very high VMT can have, and conversely, the large impact a single crash in a county with a very low VMT can have. In addition, the more urban regions have more highways with 24-hour coverage during winter, which means their roadways are more likely to be in passable condition.

In 2013-14, the statewide winter crash rate was 44 crashes per 100 million VMT, which was 52 percent higher than the rate of 29 per 100 million VMT in 2012-13. As shown in Table 4.7 on page 82, every Region of the state had an increase in their crash rate, with the Southeast Region experiencing the largest increase at 89 percent (from 19 to 36), and the Southwest Region seeing the lowest increase at 19 percent (from 37 to 44).. Table 4.12 on page 107 shows the estimated VMT traveled in each county during the past winter (November 2013 thru April 2014), as well as the number of police-reported winter (snow/slush/icy road condition) crashes that occurred in each county during that time period.

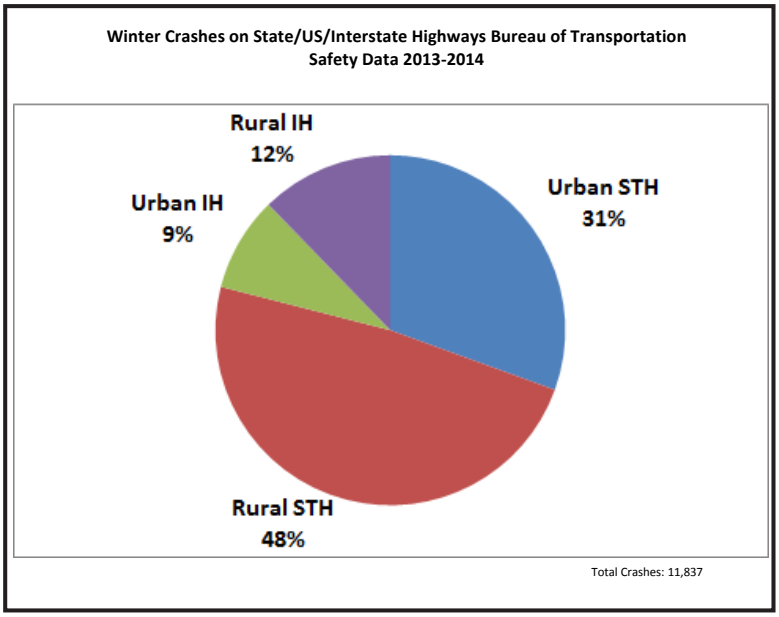
Table 4.7 Winter Crashes and Vehicle Miles of Travel by Region

	Winter Severity Index (2013-14)	Vehicle Miles of Travel (100 million) (Nov 2013 - April 2014)	Snow/Slush/Ice Crashes (Nov 2013 – April 2014	Crashes per 100M VMT (2012-13)	Crashes per 100M VMT (2013-14)
NC	148.9	33.82	1,808	34	53
NW	120.8	47.05	2,070	34	44
NE	139.7	39.20	2,155	37	55
SE	119.3	81.14	2,905	19	36
SW	124.0	66.54	2,899	37	44
Statewide	**133.6**	**267.75**	**11,837**	**29**	**44**

Source: WisDOT Bureau of Transportation Safety

WisDOT tracks crashes according to the type of road where they occurred (urban or rural, and Interstate or other state or U.S. highway), and whether the road was divided or nondivided. Figure 4.7 below shows that most winter crashes on the state trunk highway system occur on rural highways, largely because there are many more lane miles in this category than in the urban categoris. Table 4.13 on page 109 shows the breakdown of winter crashes in each county according to highway type.

Figure 4.7. Winter Crashes on State Trunk Highways by Road System



A Note About VMT Estimates

WisDOT's Traffic Forecasting Section uses a number of factors to estimate Vehicle Miles of Travel for the state's roads. Annual average daily traffic counts are taken in about one-third of Wisconsin's counties every year, and estimates are made for the counties not counted. In addition, forecasters factor in gallons of gas and diesel sold, motor fuel excise tax collected, and average vehicle miles per gallon. Total winter VMT for all counties is shown is Table 4.12 on page 105. This past winter, VMT estimates for November thru April ranged from a low of 14.3 million in Menominee County to a high of 2.9 billion in Milwaukee County. CAUTION: VMT estimates at the county level are less reliable than statewide estimates since recent traffic counts are not available for all counties and because more variability exists in the data at fine levels of resolution.

County-by-County Tables and Figure for Section 4: Performance

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Table 4.8. Winter Maintenance Sections

NC Region

County	Lane Miles	Winter Patrol Sections 2014 Survey	Lane Miles per Patrol Section	Winter Service Group
Adams	193.82	5	38.76	F
Florence	141.07	3	47.02	F
Forest	312.38	6	52.06	E
Green Lake	156.94	3	52.31	D
Iron	249.56	6	41.59	E
Langlade	299.21	6	49.87	E
Lincoln	415.19	10	41.52	C
Marathon	868.57	19	45.71	B
Marquette	245.09	5	49.02	D
Menominee	90.26	2	45.13	F
Oneida	396.79	10	39.68	D
Portage	581.81	15	38.79	B
Price	322.26	6	53.71	E
Shawano	519.55	14	37.11	C
Vilas	305.24	6	50.87	E
Waupaca	547.06	12	45.59	B
Waushara	345.01	7	49.29	D
Wood	429.88	14	30.71	C
Region Average			**44.93**	

NW Region

County	Lane Miles	Winter Patrol Sections 2014 Survey	Lane Miles per Patrol Section	Winter Service Group
Ashland	249.49	5	49.90	E
Barron	423.09	11	38.46	C
Bayfield	316.88	6	52.81	D
Buffalo	317.02	7	45.29	D
Burnett	234.95	5	46.99	E
Chippewa	654.65	16	40.92	B
Clark	402.56	10	40.26	C
Douglas	440.87	9	48.99	C
Dunn	516.58	11	46.96	C
Eau Claire	537.78	13	41.37	B
Jackson	515.00	9	57.22	C
Pepin	112.38	3	37.46	E
Pierce	365.50	7	52.21	C
Polk	385.05	7	55.01	D
Rusk	213.47	4	53.37	E
Saint Croix	630.22	10	63.02	B
Sawyer	367.44	6	61.24	E
Taylor	233.90	4	58.47	E
Trempeleau	441.05	11	40.10	D
Washburn	372.14	7	53.16	D
Region Average			**49.16**	

NE Region

County	Lane Miles	Winter Patrol Sections 2014 Survey	Lane Miles per Patrol Section	Winter Service Group
Brown	765.86	18	42.55	B
Calumet	201.71	6	33.62	E
Door	268.55	9	29.84	D
Fond du Lac	597.30	16	37.33	B
Kewaunee	110.41	3	36.80	F
Manitowoc	424.85	11	38.62	C
Marinette	421.42	9	46.82	D
Oconto	467.45	10	46.75	C
Outagamie	535.83	17	31.52	B
Sheboygan	522.38	13	40.18	C
Winnebago	622.41	17	36.61	B
Region Average			**38.24**	

SW Region

County	Lane Miles	Winter Patrol Sections 2014 Survey	Lane Miles per Patrol Section	Winter Service Group
Columbia	792.92	15	52.86	B
Crawford	394.99	8	49.37	C
Dane	1535.50	35	43.87	A
Dodge	630.41	14	45.03	B
Grant	622.06	11	56.55	B
Green	312.72	6	52.12	D
Iowa	457.98	10	45.80	E
Jefferson	549.15	10	54.92	B
Juneau	494.25	10	49.43	C
LaCrosse	488.80	13	37.60	C
Lafayette	293.88	5	58.78	D
Monroe	653.65	13	50.28	B
Richland	330.10	7	47.16	D
Rock	678.82	14	50.28	B
Sauk	578.72	13	44.52	B
Vernon	467.04	11	42.46	C
Region Average			**48.81**	

SE Region

County	Lane Miles	Winter Patrol Sections 2014 Survey	Lane Miles per Patrol Section	Winter Service Group
Kenosha	653.56	17	38.44	B
Milwaukee	1888.71	35	53.96	A
Ozaukee	308.71	6	51.45	D
Racine	698.11	17	41.07	B
Walworth	706.03	14	50.43	B
Washington	603.45	12	50.29	B
Waukesha	1112.03	19	58.53	A
Region Average			**49.17**	

	Lane Miles	Winter Patrol Sections 2014 Survey	Lane Miles per Patrol Section
Statewide Totals	34,339.47	753.5	45.57
Statewide Averages	476.94	10.5	45.57
Group A Averages	1512.08	29.7	52.12
Group B Averages	643.26	14.4	45.62
Group C Averages	455.50	10.7	43.62
Group D Averages	327.42	7.0	48.19
Group E Averages	273.84	5.6	48.84
Group F Averages	133.89	3.3	41.93

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Table 4.9. Storm Start vs. Crew Out by Precipitation Type, Group A

From Winter Storm Reports, 2013-2014

Note: 1) A negative number indicates that the crews were on the road when the storm started. 2) A discrepancy is inherent in these calculation because an individual storm may have several precipitations types but when calculating the average time difference for a particular precipitation type this is not taken into account.

County	Region	Precipitation Type					Severity Index	Cost per LM per Severity Index
		Dry Snow	Wet Snow	Freezing Rain	Sleet	All Precip. Types		
		(Average Time in Hours)						
DANE	SW	-0.24	0.44	0.20	0.25	-0.05	131.56	2.67
WAUKESHA	SE	1.06	0.61	0.79	2.50	0.94	107.92	2.45
MILWAUKEE	SE	0.00	0.00	0.00	0.00	0.00	122.76	1.92
Group A Averages		0.27	0.35	0.33	0.92	0.30	120.75	2.34

Table 4.9. Storm Start vs. Crew Out by Precipitation Type, Group B

From Winter Storm Reports, 2013-2014

Note: 1) A negative number indicates that the crews were on the road when the storm started. 2) A discrepancy is inherent in these calculation because an individual storm may have several precipitations types but when calculating the average time difference for a particular precipitation type this is not taken into account.

County	Region	Precipitation Type					Severity Index	Cost per LM per Severity Index
		Dry Snow	Wet Snow	Freezing Rain	Sleet	All Precip. Types		
		(Average Time in Hours)						
KEWAUNEE	NE	6.54	4.47	3.20	5.00	5.42	119.09	14.89
EAU CLAIRE	NW	-1.40	-1.86	-1.15	-0.60	-1.37	122.71	5.52
JEFFERSON	SW	0.50	0.50	0.50	0.56	0.49	122.01	4.93
WASHINGTON	SE	0.30	0.33	0.43	0.00	0.32	125.97	4.69
SAUK	SW	0.65	1.00	0.30	1.62	0.72	128.42	4.49
RACINE	SE	0.59	0.83	0.86	0.86	0.63	136.76	4.49
CHIPPEWA	NW	2.48	1.19	0.81	0.92	2.03	107.19	4.46
SAINT CROIX	NW	1.64	1.00	0.83	0.50	1.27	142.70	4.27
KENOSHA	SE	-0.10	0.50	-0.12	0.43	0.16	120.43	4.21
DODGE	SW	1.24	1.24	-0.70	0.00	1.22	116.82	4.21
COLUMBIA	SW	0.34	0.00	0.50	0.75	0.36	155.67	4.20
OUTAGAMIE	NE	1.66	2.02	0.25	0.17	1.69	108.23	4.05
WINNEBAGO	NE	0.99	1.28	0.83	0.75	1.02	105.96	4.00
PORTAGE	NC	2.07	2.09	1.35	1.75	1.98	156.85	3.98
FOND DU LAC	NE	2.05	2.33	3.06	4.25	2.39	123.33	3.94
WAUPACA	NC	2.96	2.25	2.25	2.60	2.68	120.84	3.90
GRANT	SW	1.93	3.67	1.00	1.00	2.19	105.96	3.28
MONROE	SW	2.27	1.71	2.00	1.25	1.96	129.96	3.02
MARATHON	NC	3.68	2.63	1.46	2.50	2.89	159.65	2.86
BROWN	NE	2.22	1.75	0.25	0.00	1.84	117.49	2.75
Group B Averages		1.63	1.45	0.90	1.22	1.49	126.30	4.61

Table 4.9. Storm Start vs. Crew Out by Precipitation Type, Group C

From Winter Storm Reports, 2013-2014

Note: 1) A negative number indicates that the crews were on the road when the storm started. 2) A discrepancy is inherent in these calculation because an individual storm may have several precipitations types but when calculating the average time difference for a particular precipitation type this is not taken into account.

County	Region	Precipitation Type (Average Time in Hours)					Severity Index	Cost per LM per Severity Index
		Dry Snow	Wet Snow	Freezing Rain	Sleet	All Precip. Types		
JACKSON	NW	1.12	0.95	1.09	1.17	1.05	134.38	6.83
BARRON	NW	1.22	0.73	0.65	-0.10	0.97	169.25	6.14
LINCOLN	NC	5.23	3.14	3.37	3.86	4.56	162.14	5.57
PIERCE	NW	3.91	3.62	2.09	2.75	3.94	128.79	5.50
MANITOWOC	NE	2.13	2.32	2.05	1.75	2.16	125.35	5.42
DUNN	NW	0.71	1.22	0.67	0.50	0.84	111.04	5.33
WOOD	NC	4.19	3.54	3.88	2.42	3.85	152.25	5.24
CLARK	NW	4.06	3.62	2.59	1.64	3.78	131.24	5.01
SHEBOYGAN	NE	3.07	2.70	2.75	0.75	2.80	128.42	4.83
LA CROSSE	SW	2.20	1.96	3.50	2.75	2.38	122.13	4.42
JUNEAU	SW	1.44	0.81	0.42	0.60	1.00	133.90	4.41
SHAWANO	NC	4.54	2.83	0.89	1.50	3.17	137.08	4.24
OCONTO	NE	3.77	2.10	2.19	1.94	2.77	120.11	4.22
CRAWFORD	SW	4.22	1.50	2.30	4.75	3.74	122.31	4.09
Group C Averages		2.99	2.22	2.03	1.88	2.64	134.17	5.09

Table 4.9. Storm Start vs. Crew Out by Precipitation Type, Group D

From Winter Storm Reports, 2013-2014

Note: 1) A negative number indicates that the crews were on the road when the storm started. 2) A discrepancy is inherent in these calculation because an individual storm may have several precipitations types but when calculating the average time difference for a particular precipitation type this is not taken into account.

County	Region	Precipitation Type					Severity Index	Cost per LM per Severity Index
		Dry Snow	Wet Snow	Freezing Rain	Sleet	All Precip. Types		
		(Average Time in Hours)						
DOOR	NE	2.89	2.75	2.50	1.88	2.78	122.48	9.07
BAYFIELD	NW	4.00	2.42	2.27	2.68	3.48	199.27	8.71
ONEIDA	NC	7.81	7.74	7.03	7.90	7.55	187.76	8.22
GREEN LAKE	NC	7.83	3.23	4.94	4.30	5.95	127.98	7.33
WASHBURN	NW	3.66	3.33	3.65	5.44	3.61	153.27	6.85
POLK	NW	4.46	3.53	4.11	4.70	3.89	181.61	6.72
GREEN	SW	2.44	2.10	1.25	2.50	2.18	111.91	4.83
MARINETTE	NE	3.84	2.46	3.11	3.11	3.52	139.54	4.73
RICHLAND	SW	3.34	2.12	0.50	2.00	2.50	98.60	4.65
TREMPEALEAU	NW	0.97	1.56	1.95	0.50	1.27	99.56	4.09
WAUSHARA	NC	3.63	2.36	2.67	3.30	3.24	108.92	4.03
Group D Averages		4.08	3.05	3.09	3.48	3.63	139.17	6.29

Table 4.9. Storm Start vs. Crew Out by Precipitation Type, Group E

From Winter Storm Reports, 2013-2014

Note: 1) A negative number indicates that the crews were on the road when the storm started. 2) A discrepancy is inherent in these calculation because an individual storm may have several precipitations types but when calculating the average time difference for a particular precipitation type this is not taken into account.

County	Region	Precipitation Type					Severity Index	Cost per LM per Severity Index
		Dry Snow	Wet Snow	Freezing Rain	Sleet	All Precip. Types		
		(Average Time in Hours)						
IRON	NC	6.54	4.86	2.31	2.33	5.64	225.36	13.81
PEPIN	NW	4.23	4.11	3.50	3.62	4.03	98.18	13.61
VILAS	NC	4.83	4.37	2.60	1.00	4.58	138.04	11.04
RUSK	NW	2.61	2.50	2.75	2.12	2.62	109.54	10.85
TAYLOR	NW	4.73	1.68	2.75	1.21	3.58	157.57	9.39
ASHLAND	NW	4.72	3.68	2.09	1.00	4.33	195.59	9.11
CALUMET	NE	3.50	3.00	2.12	0.50	3.14	118.63	8.89
BURNETT	NW	4.19	4.58	3.18	2.70	4.11	142.01	8.88
PRICE	NC	5.50	4.21	2.10	1.10	4.27	160.02	7.23
LANGLADE	NC	5.50	4.31	4.92	5.50	4.95	155.70	6.15
SAWYER	NW	3.57	3.02	1.00	2.00	2.90	140.76	5.56
Group E Averages		4.54	3.66	2.67	2.10	4.01	149.22	9.50

Table 4.9. Storm Start vs. Crew Out by Precipitation Type, Group F

From Winter Storm Reports, 2013-2014

Note: 1) A negative number indicates that the crews were on the road when the storm started. 2) A discrepancy is inherent in these calculation because an individual storm may have several precipitations types but when calculating the average time difference for a particular precipitation type this is not taken into account.

County	Region	Precipitation Type (Average Time in Hours)					Severity Index	Cost per LM per Severity Index
		Dry Snow	Wet Snow	Freezing Rain	Sleet	All Precip. Types		
FLORENCE	NC	6.24	5.69	4.13	4.00	5.71	166.58	19.42
ADAMS	NC	5.57	4.37	3.06	3.55	4.81	129.06	9.61
Group F Averages		5.91	5.03	3.59	3.78	5.26	147.82	14.51

Table 4.10. Winter Maintenance Costs per Lane Mile

Fiscal Year 2014
Winter Maintenance Costs Per Lane Mile

	Labor	Labor $'s per Lane Mile	Equipment	Equip $'s per Lane Mile	Materials	Materials $'s Lane Mile	Admin	Cost of Salt Used	Tons of Salt Used	Total FY 2014 Winter Costs	2014 LOS Lane Miles	Winter Costs Per Lane Mile
SOUTHWEST REGION												
Columbia	$569,907	$719	$815,948	$1,029	$104,887	$132	$99,862	$1,617,874	$22,997	$3,208,478	792.92	$4,046
Crawford	$205,173	$519	$321,704	$814	$29,860	$76	$45,440	$284,216	$4,564	$886,393	394.99	$2,244
Dane	$1,923,962	$1,253	$1,928,964	$1,256	$92,772	$60	$265,726	$3,381,043	$53,531	$7,592,467	1,535.50	$4,945
Dodge	$397,081	$630	$692,530	$1,099	$17,130	$27	$53,447	$935,186	$15,113	$2,095,374	630.41	$3,324
Grant	$349,160	$561	$564,365	$907	$21,713	$35	$43,409	$549,634	$9,074	$1,528,281	622.06	$2,457
Green	$200,952	$643	$257,658	$824	$7,176	$23	$24,334	$138,525	$2,120	$628,645	312.72	$2,010
Iowa	$376,425	$822	$503,162	$1,099	$9,272	$20	$46,878	$403,620	$6,586	$1,339,357	457.98	$2,924
Jefferson	$357,276	$651	$629,489	$1,146	$55,357	$101	$62,712	$717,265	$11,883	$1,822,099	549.15	$3,318
Juneau	$241,233	$488	$434,275	$879	$31,097	$63	$42,588	$589,870	$8,298	$1,339,063	494.25	$2,709
La Crosse	$339,280	$694	$577,275	$1,181	$45,349	$93	$44,668	$474,035	$8,325	$1,480,607	488.80	$3,029
Lafayette	$210,510	$716	$363,277	$1,236	$147,933	$503	$33,329	$122,189	$2,026	$877,238	293.88	$2,985
Monroe	$293,643	$449	$572,934	$877	$11,724	$18	$40,387	$669,700	$10,100	$1,588,388	653.65	$2,430
Richland	$159,825	$484	$233,904	$709	$21,501	$65	$25,026	$219,975	$3,273	$660,231	330.10	$2,000
Rock	$564,327	$831	$835,039	$1,230	$61,099	$90	$71,923	$754,218	$13,250	$2,286,606	678.82	$3,369
Sauk	$414,725	$717	$529,033	$914	$4,865	$8	$46,239	$805,476	$11,714	$1,800,338	578.72	$3,111
Vernon	$288,991	$619	$443,313	$949	$36,306	$78	$36,741	$446,912	$6,966	$1,252,263	467.04	$2,681
SW TOTAL	**$6,892,470**	**$743**	**$9,702,870**	**$1,045**	**$698,041**	**$75**	**$982,709**	**$12,109,738**	**189,820**	**$30,385,828**	**9,280.99**	**$3,274**

Table 4.10. Winter Maintenance Costs per Lane Mile

Fiscal Year 2014
Winter Maintenance Costs Per Lane Mile

	Labor	Labor $'s per Lane Mile	Equipment	Equip $'s per Lane Mile	Materials	Materials $'s Lane Mile	Admin	Cost of Salt Used	Tons of Salt Used	Total FY 2014 Winter Costs	2014 LOS Lane Miles	Winter Costs Per Lane Mile
SOUTHEAST REGION												
Kenosha	$594,705	$910	$845,161	$1,293	$23,519	$36	$66,587	$720,921	$13,267	$2,250,893	653.56	$3,444
Milwaukee	$4,093,816	$2,168	$2,189,523	$1,159	$70,368	$37	$0	$2,882,804	$54,921	$9,236,511	1,888.71	$4,890
Ozaukee	$321,324	$1,041	$342,750	$1,110	$18,186	$59	$31,981	$534,442	$9,910	$1,248,683	308.71	$4,045
Racine	$743,586	$1,065	$912,087	$1,307	$20,052	$29	$75,846	$1,027,402	$18,694	$2,778,973	698.11	$3,981
Walworth	$558,601	$791	$975,681	$1,382	$37,223	$53	$75,196	$854,707	$16,462	$2,501,408	706.03	$3,543
Washington	$469,141	$777	$705,274	$1,169	$62,424	$103	$56,277	$931,032	$16,167	$2,224,148	603.45	$3,686
Waukesha	$946,062	$851	$1,348,013	$1,212	$71,153	$64	$108,385	$1,363,018	$25,115	$3,836,631	1,112.03	$3,450
SE TOTAL	**$7,727,235**	**$1,294**	**$7,318,489**	**$1,226**	**$302,925**	**$51**	**$414,272**	**$8,314,325**	**154,536**	**$24,077,246**	**5,970.60**	**$4,033**
NORTHEAST REGION												
Brown	$547,907	$715	$1,008,577	$1,317	$43,695	$57	$96,362	$573,106	$11,193	$2,269,647	765.86	$2,964
Calumet	$133,682	$663	$232,253	$1,151	$3,931	$19	$16,672	$136,004	$2,592	$522,542	201.71	$2,591
Door	$251,498	$937	$358,172	$1,334	$36,222	$135	$31,577	$278,479	$4,990	$955,948	268.55	$3,560
Fond du Lac	$425,920	$713	$589,122	$986	$48,468	$81	$49,867	$639,216	$10,379	$1,752,593	597.30	$2,934
Kewanee	$82,225	$745	$135,353	$1,226	$8,803	$80	$10,246	$66,766	$1,251	$303,393	110.41	$2,748
Manitowoc	$351,808	$828	$469,527	$1,105	$52,723	$124	$43,463	$402,210	$7,560	$1,319,731	424.85	$3,106
Marinette	$300,681	$713	$408,214	$969	$39,580	$94	$36,762	$316,038	$5,367	$1,101,275	421.42	$2,613
Oconto	$357,701	$765	$473,184	$1,012	$3,983	$9	$37,831	$394,789	$6,820	$1,267,488	467.45	$2,711
Outagamie	$550,496	$1,027	$642,245	$1,199	$83,032	$155	$62,665	$520,218	$9,793	$1,858,656	535.83	$3,469
Sheboygan	$469,924	$900	$499,106	$955	$53,815	$103	$56,102	$641,035	$10,473	$1,719,982	522.38	$3,293
Winnebago	$487,299	$783	$747,042	$1,200	$19,023	$31	$59,711	$675,717	$11,861	$1,988,792	622.41	$3,195
NE TOTAL	**$3,959,141**	**$802**	**$5,562,795**	**$1,126**	**$393,275**	**$80**	**$501,258**	**$4,643,577**	**82,279**	**$15,060,046**	**4,938.17**	**$3,050**

Table 4.10. Winter Maintenance Costs per Lane Mile

Fiscal Year 2014
Winter Maintenance Costs Per Lane Mile

	Labor	Labor $'s per Lane Mile	Equipment	Equip $'s per Lane Mile	Materials	Materials $'s Lane Mile	Admin	Cost of Salt Used	Tons of Salt Used	Total FY 2014 Winter Costs	2014 LOS Lane Miles	Winter Costs Per Lane Mile
NORTH CENTRAL REGION												
Adams	$133,451	$689	$180,048	$929	$9,013	$47	$19,602	$198,207	$2,760	$540,321	193.82	$2,788
Florence	$87,942	$623	$190,574	$1,351	$2,754	$20	$14,998	$194,135	$3,254	$490,403	141.07	$3,476
Forest	$193,887	$621	$411,061	$1,316	$29,893	$96	$31,025	$440,499	$7,617	$1,106,365	312.38	$3,542
Green Lake	$98,460	$627	$89,752	$572	$8,143	$52	$9,822	$63,142	$1,034	$269,319	156.94	$1,716
Iron	$298,560	$1,196	$413,554	$1,657	$27,931	$112	$33,731	$431,684	$6,777	$1,205,460	249.56	$4,830
Langlade	$195,906	$655	$293,066	$979	$2,738	$9	$27,401	$204,386	$3,671	$723,497	299.21	$2,418
Lincoln	$314,681	$758	$495,548	$1,194	$54,033	$130	$45,076	$377,993	$6,080	$1,287,331	415.19	$3,101
Marathon	$644,378	$742	$1,078,151	$1,241	$50,695	$58	$86,465	$929,335	$13,873	$2,789,024	868.57	$3,211
Marquette	$108,969	$445	$138,404	$565	$12,566	$51	$12,465	$192,900	$3,106	$465,304	245.09	$1,899
Menominee	$27,899	$309	$66,419	$736	$17,317	$192	$5,038	$89,695	$1,675	$206,368	90.26	$2,286
Oneida	$318,116	$802	$512,981	$1,293	$53,216	$134	$58,548	$691,027	$10,363	$1,633,888	396.79	$4,118
Portage	$511,206	$879	$671,604	$1,154	$44,910	$77	$56,190	$417,856	$6,405	$1,701,766	581.81	$2,925
Price	$213,937	$664	$348,546	$1,082	$30,040	$93	$30,672	$341,837	$5,240	$965,032	322.26	$2,995
Shawano	$361,872	$697	$546,155	$1,051	$74,379	$143	$45,149	$480,025	$8,806	$1,507,580	519.55	$2,902
Vilas	$227,228	$744	$392,031	$1,284	$33,728	$110	$34,386	$615,302	$8,755	$1,302,675	305.24	$4,268
Waupaca	$348,844	$638	$599,696	$1,096	$40,784	$75	$46,718	$545,154	$10,012	$1,581,196	547.06	$2,890
Waushara	$210,333	$610	$216,192	$627	$11,529	$33	$36,252	$243,972	$4,120	$718,278	345.01	$2,082
Wood	$264,592	$616	$392,796	$914	$33,561	$78	$32,170	$470,980	$7,117	$1,194,099	429.88	$2,778
NC TOTAL	**$4,560,261**	**$710**	**$7,036,578**	**$1,096**	**$537,230**	**$84**	**$625,708**	**$6,928,130**	**110,665**	**$19,687,907**	**6,419.69**	**$3,067**

Table 4.10. Winter Maintenance Costs per Lane Mile

Fiscal Year 2014
Winter Maintenance Costs Per Lane Mile

	Labor	Labor $'s per Lane Mile	Equipment	Equip $'s per Lane Mile	Materials	Materials $'s Lane Mile	Admin	Cost of Salt Used	Tons of Salt Used	Total FY 2014 Winter Costs	2014 LOS Lane Miles	Winter Costs Per Lane Mile
NORTHWEST REGION												
Ashland	$198,147	$794	$355,176	$1,424	$47,291	$190	$27,210	$232,882	$3,710	$860,706	249.49	$3,450
Barron	$386,816	$914	$545,278	$1,289	$64,253	$152	$47,424	$289,346	$4,576	$1,333,117	423.09	$3,151
Bayfield	$209,537	$661	$423,825	$1,337	$45,841	$145	$38,093	$334,464	$5,688	$1,051,760	316.88	$3,319
Buffalo	$143,869	$454	$215,709	$680	$3,403	$11	$19,883	$132,067	$2,130	$514,931	317.02	$1,624
Burnett	$192,665	$820	$251,132	$1,069	$52,451	$223	$24,958	$213,550	$3,662	$734,756	234.95	$3,127
Chippewa	$652,909	$997	$719,044	$1,098	$73,567	$112	$67,454	$917,468	$13,937	$2,430,442	654.65	$3,713
Clark	$244,759	$608	$370,329	$920	$5,675	$14	$38,043	$375,315	$5,455	$1,034,121	402.56	$2,569
Douglas	$326,213	$740	$597,239	$1,355	$57,361	$130	$61,384	$540,390	$9,590	$1,582,587	440.87	$3,590
Dunn	$407,495	$789	$568,422	$1,100	$16,733	$32	$59,067	$746,182	$11,418	$1,797,899	516.58	$3,480
Eau Claire	$452,884	$842	$668,572	$1,243	$72,714	$135	$58,109	$671,814	$10,122	$1,924,093	537.78	$3,578
Jackson	$235,872	$458	$486,408	$944	$39,484	$77	$47,568	$630,310	$8,941	$1,439,642	515.00	$2,795
Pepin	$72,079	$641	$80,442	$716	$8,723	$78	$7,374	$65,040	$968	$233,658	112.38	$2,079
Pierce	$262,517	$718	$392,065	$1,073	$27,826	$76	$39,707	$316,760	$5,144	$1,038,875	365.50	$2,842
Polk	$268,050	$696	$462,506	$1,201	$52,809	$137	$39,881	$490,463	$7,590	$1,313,709	385.05	$3,412
Rusk	$133,143	$624	$242,501	$1,136	$15,715	$74	$25,165	$204,258	$3,077	$620,782	213.47	$2,908
Sawyer	$208,470	$567	$330,879	$900	$28,266	$77	$25,866	$367,459	$5,404	$960,940	367.44	$2,615
St. Croix	$556,624	$883	$709,245	$1,125	$107,961	$171	$79,119	$839,029	$13,811	$2,291,978	630.22	$3,637
Taylor	$167,030	$714	$245,760	$1,051	$25,706	$110	$21,709	$228,193	$3,056	$688,398	233.90	$2,943
Trempealeau	$256,821	$582	$365,643	$829	$50,447	$114	$43,226	$408,057	$6,496	$1,124,194	441.05	$2,549
Washburn	$251,913	$677	$504,538	$1,356	$33,788	$91	$36,273	$459,142	$7,732	$1,285,654	372.14	$3,455
NW TOTAL	**$5,627,813**	**$728**	**$8,534,713**	**$1,104**	**$830,014**	**$107**	**$807,513**	**$8,462,190**	**132,507**	**$24,262,243**	**7,730.02**	**$3,139**

Table 4.10. Winter Maintenance Costs per Lane Mile

Fiscal Year 2014
Winter Maintenance Costs Per Lane Mile

	Labor	Labor $'s per Lane Mile	Equipment	Equip $'s per Lane Mile	Materials	Materials $'s Lane Mile	Admin	Cost of Salt Used	Tons of Salt Used	Total FY 2014 Winter Costs	2014 LOS Lane Miles	Winter Costs Per Lane Mile
STATEWIDE SUMMARY												
SW Region	$6,892,470	$743	$9,702,870	$1,045	$698,041	$75	$982,709	$12,109,738	189,820	$30,385,828	9,280.99	$3,274
SE Region	$7,727,235	$1,294	$7,318,489	$1,226	$302,925	$51	$414,272	$8,314,325	154,536	$24,077,246	5,970.60	$4,033
NE Region	$3,959,141	$802	$5,562,795	$1,126	$393,275	$80	$501,258	$4,643,577	82,279	$15,060,046	4,938.17	$3,050
NC Region	$4,560,261	$710	$7,036,578	$1,096	$537,230	$84	$625,708	$6,928,130	110,665	$19,687,907	6,419.69	$3,067
NW Region	$5,627,813	$728	$8,534,713	$1,104	$830,014	$107	$807,513	$8,462,190	132,507	$24,262,243	7,730.02	$3,139
Statewide Tot	$28,766,920	$838	$38,155,445	$1,111	$2,761,485	$80	$3,331,460	$40,457,960	669,807	$113,473,270	34,339.47	$3,304

prepared by: Cathy Meinholz/Bureau of Highway Maintenance
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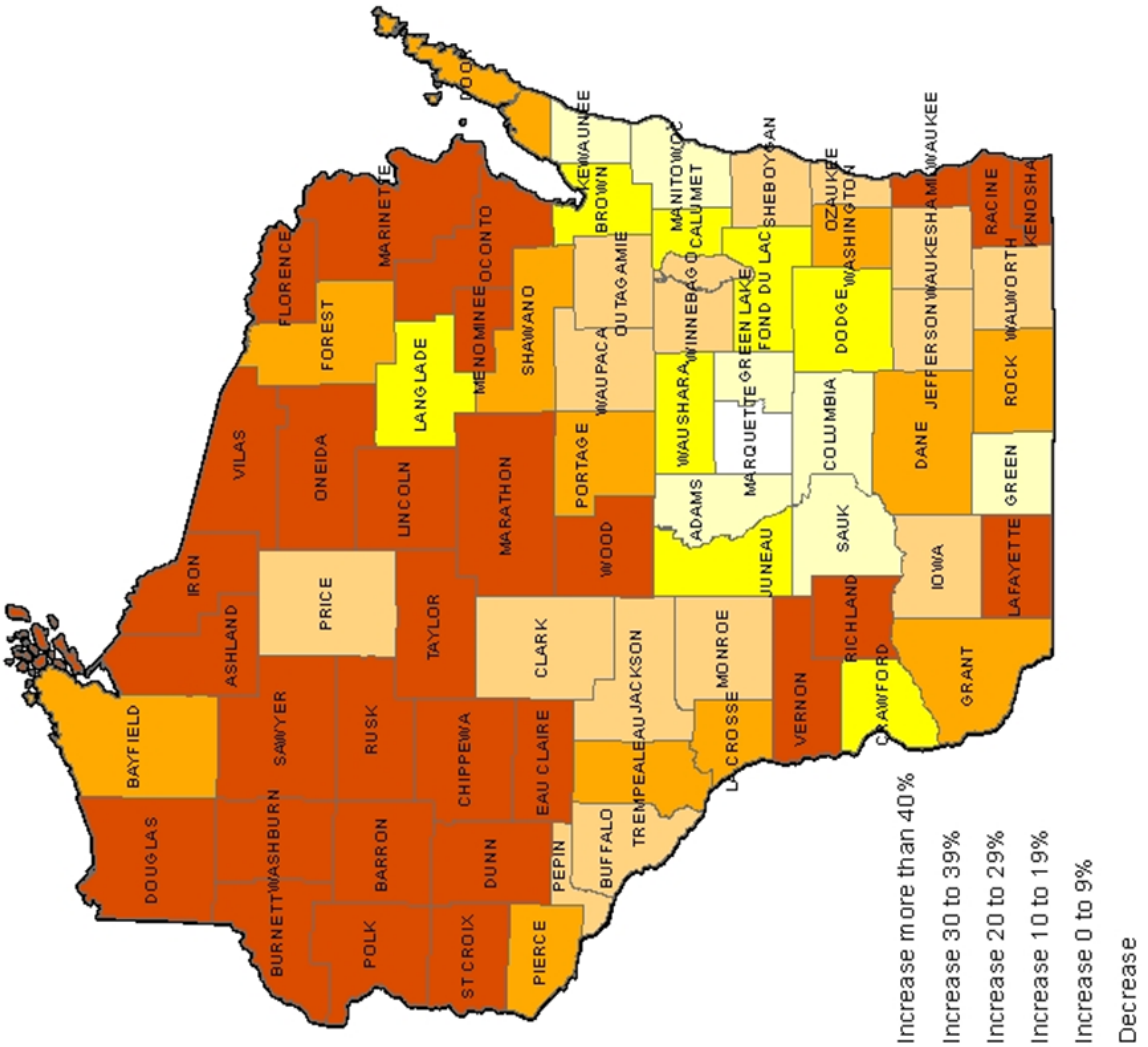
August 15, 2014

Figure 4.8. 2013-2014 Winter Costs vs. 5-Year Average



County	Departure
Washburn	75
Rusk	68
Menominee	66
Burnett	61
St. Croix	59
Chippewa	58
Douglas	54
Vernon	52
Sawyer	51
Polk	51
Marathon	50
Barron	50
Eau Claire	49
Kenosha	48
Lincoln	48
Wood	47
Racine	47
Oconto	46
Richland	46
Taylor	46
Oneida	45
Lafayette	45
Ashland	45
Marinette	44
Dunn	44
Iron	44
Florence	43
Milwaukee	42
Vilas	40
Door	40
Dane	36
Rock	36
Trempealeau	36
La Crosse	35
Pierce	35
Washington	34
Portage	34
Forest	32
Shawano	32
Bayfield	32
Grant	31
Walworth	30
Jefferson	30
Waupaca	29
Clark	28
Jackson	27
Ozaukee	26
Iowa	26
Monroe	25
Buffalo	25
Sheboygan	25
Waukesha	24
Outagamie	24
Winnebago	24
Pepin	23
Price	23
Brown	19
Crawford	19
Juneau	19
Fond du Lac	17
Waushara	16
Langlade	14
Calumet	12
Dodge	11
Kewanee	9
Columbia	9
Green	9
Manitowoc	7
Adams	4
Green Lake	3
Sauk	1
Marquette	-15

Table 4.11. Cost per Lane Mile per Severity Index Ranking (Group A)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Snow Depth (in)	Salt (ton)	Salt per LM	Salt per LM per Severity Index	Total Cost	Total $/LM	Cost per LM per Severity Index
DANE	SW	1,535.50	131.56	59.8	53531	34.86	0.26	$6,251,000	$4,095	2.67
WAUKESHA	SE	1,112.03	107.92	85.8	25115	22.58	0.21	$3,010,000	$2,721	2.45
MILWAUKEE	SE	1,888.71	122.76	58.6	54921	29.08	0.24	$6,804,000	$3,624	1.92
Group A Averages		1,512.08	120.75	68.1	44522	28.84	0.24	$5,355,000	$3,480	2.34

Table 4.11. Cost per Lane Mile per Severity Index Ranking (Group B)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Snow Depth (in)	Salt (ton)	Salt per LM	Salt per LM per Severity Index	Total Cost	Total $/LM	Cost per LM per Severity Index
KEWAUNEE	NE	110.41	119.09	92.7	1251	11.33	0.10	$182,000	$1,644	14.89
EAU CLAIRE	NW	537.78	122.71	96.5	10122	18.82	0.15	$1,595,000	$2,968	5.52
JEFFERSON	SW	549.15	122.01	95.0	11883	21.64	0.18	$1,455,000	$2,706	4.93
WASHINGTON	SE	603.45	125.97	63.0	16167	26.79	0.21	$1,656,000	$2,828	4.69
SAUK	SW	578.72	128.42	86.0	11714	20.24	0.16	$1,502,000	$2,598	4.49
RACINE	SE	698.11	136.76	91.4	18694	26.78	0.20	$2,182,000	$3,133	4.49
CHIPPEWA	NW	654.65	107.19	91.3	13937	21.29	0.20	$1,910,000	$2,918	4.46
SAINT CROIX	NW	630.22	142.70	91.3	13811	21.91	0.15	$1,696,000	$2,691	4.27
KENOSHA	SE	653.56	120.43	74.0	13267	20.30	0.17	$1,799,000	$2,753	4.21
DODGE	SW	630.41	116.82	77.6	15113	23.97	0.21	$1,670,000	$2,653	4.21
COLUMBIA	SW	792.92	155.67	98.9	22997	29.00	0.19	$2,643,000	$3,334	4.20
OUTAGAMIE	NE	535.83	108.23	94.8	9793	18.28	0.17	$1,148,000	$2,172	4.05
WINNEBAGO	NE	622.41	105.96	63.8	11861	19.06	0.18	$1,515,000	$2,488	4.00
PORTAGE	NC	581.81	156.85	88.7	6405	11.01	0.07	$1,347,000	$2,314	3.98
FOND DU LAC	NE	597.30	123.33	81.2	10379	17.38	0.14	$1,394,000	$2,354	3.94
WAUPACA	NC	547.06	120.84	88.9	10012	18.30	0.15	$1,163,000	$2,132	3.90
ROCK	SW	678.82	126.63	75.3	13250	19.52	0.15	$1,698,000	$2,517	3.71

Table 4.11. Cost per Lane Mile per Severity Index Ranking (Group B)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Snow Depth (in)	Salt (ton)	Salt per LM	Salt per LM per Severity Index	Total Cost	Total $/LM	Cost per LM per Severity Index
WALWORTH	SE	706.03	102.90	79.9	16462	23.32	0.23	$1,823,000	$2,587	3.66
GRANT	SW	622.06	105.96	81.4	9074	14.59	0.14	$1,270,000	$2,041	3.28
MONROE	SW	653.65	129.96	67.4	10100	15.45	0.12	$1,289,000	$1,973	3.02
MARATHON	NC	868.57	159.65	95.3	13873	15.97	0.10	$2,147,000	$2,488	2.86
BROWN	NE	765.86	117.49	82.7	11193	14.61	0.12	$1,612,000	$2,107	2.75
Group B Averages		619.04	125.25	84.4	12334	19.53	0.16	$1,577,091	$2,518	4.52

Table 4.11. Cost per Lane Mile per Severity Index Ranking (Group C)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Snow Depth (in)	Salt (ton)	Salt per LM	Salt per LM per Severity Index	Total Cost	Total $/LM	Cost per LM per Severity Index
JACKSON	NW	515.00	134.38	73.8	8941	17.36	0.13	$1,810,000	$3,515	6.83
BARRON	NW	423.09	169.25	144.4	4576	10.82	0.06	$1,068,000	$2,597	6.14
DOUGLAS	NW	440.87	168.42	218.3	9590	21.75	0.13	$1,188,000	$2,695	6.11
LINCOLN	NC	415.19	162.14	132.8	6080	14.64	0.09	$941,000	$2,313	5.57
PIERCE	NW	365.50	128.79	90.7	5144	14.07	0.11	$732,000	$2,009	5.50
MANITOWOC	NE	424.85	125.35	80.6	7560	17.79	0.14	$971,000	$2,305	5.42
DUNN	NW	516.58	111.04	98.5	11418	22.10	0.20	$1,422,000	$2,753	5.33
WOOD	NC	429.88	152.25	96.9	7117	16.56	0.11	$968,000	$2,251	5.24
CLARK	NW	402.56	131.24	106.4	5455	13.55	0.10	$811,000	$2,017	5.01
SHEBOYGAN	NE	522.38	128.42	63.4	10473	20.05	0.16	$1,281,000	$2,523	4.83
IOWA	SW	457.98	132.61	74.2	6586	14.38	0.11	$984,000	$2,148	4.69
LA CROSSE	SW	488.80	122.13	74.1	8325	17.03	0.14	$1,055,000	$2,159	4.42
JUNEAU	SW	494.25	133.90	91.3	8298	16.79	0.13	$1,075,000	$2,179	4.41
SHAWANO	NC	519.55	137.08	111.0	8806	16.95	0.12	$1,133,000	$2,202	4.24
OCONTO	NE	467.45	120.11	118.9	6820	14.59	0.12	$923,000	$1,975	4.22
VERNON	SW	467.04	134.35	87.2	6966	14.92	0.11	$909,000	$1,949	4.17
CRAWFORD	SW	394.99	122.31	59.9	4564	11.55	0.09	$638,000	$1,616	4.09

Table 4.11. Cost per Lane Mile per Severity Index Ranking (Group C)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Snow Depth (in)	Salt (ton)	Salt per LM	Salt per LM per Severity Index	Total Cost	Total $/LM	Cost per LM per Severity Index
Group C Averages		455.64	136.10	101.3	7454	16.17	0.12	$1,053,471	$2,306	5.07

Table 4.11. Cost per Lane Mile per Severity Index Ranking (Group D)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Snow Depth (in)	Salt (ton)	Salt per LM	Salt per LM per Severity Index	Total Cost	Total $/LM	Cost per LM per Severity Index
OZAUKEE	SE	308.71	118.36	62.3	9910	32.10	0.27	$911,000	$2,968	9.62
DOOR	NE	268.55	122.48	91.1	4990	18.58	0.15	$651,000	$2,436	9.07
BAYFIELD	NW	316.88	199.27	222.0	5688	17.95	0.09	$873,000	$2,759	8.71
ONEIDA	NC	396.79	187.76	144.5	10363	26.12	0.14	$1,294,000	$3,261	8.22
GREEN LAKE	NC	156.94	127.98	67.8	1034	6.59	0.05	$180,000	$1,151	7.33
WASHBURN	NW	372.14	153.27	202.2	7732	20.78	0.14	$945,000	$2,550	6.85
POLK	NW	385.05	181.61	134.7	7590	19.71	0.11	$991,000	$2,588	6.72
MARQUETTE	NC	245.09	106.49	69.3	3106	12.67	0.12	$366,000	$1,492	6.09
LAFAYETTE	SW	293.88	111.13	90.1	2026	6.89	0.06	$487,000	$1,658	5.64
GREEN	SW	312.72	111.91	68.9	2120	6.78	0.06	$472,000	$1,510	4.83
MARINETTE	NE	421.42	139.54	124.6	5367	12.74	0.09	$837,000	$1,992	4.73
RICHLAND	SW	330.10	98.60	55.7	3273	9.92	0.10	$507,000	$1,537	4.65
TREMPEALEAU	NW	441.05	99.56	65.3	6496	14.73	0.15	$796,000	$1,804	4.09
WAUSHARA	NC	345.01	108.92	84.5	4120	11.94	0.11	$480,000	$1,390	4.03
BUFFALO	NW	317.02	100.49	67.0	2130	6.72	0.07	$376,000	$1,187	3.74
Group D Averages		327.42	131.16	103.3	5063	14.95	0.11	$677,733	$2,019	6.29

Table 4.11. Cost per Lane Mile per Severity Index Ranking (Group E)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Snow Depth (in)	Salt (ton)	Salt per LM	Salt per LM per Severity Index	Total Cost	Total $/LM	Cost per LM per Severity Index
IRON	NC	249.56	225.36	233.4	6777	27.16	0.12	$857,000	$3,446	13.81
PEPIN	NW	112.38	98.18	68.0	968	8.61	0.09	$172,000	$1,530	13.61
VILAS	NC	305.24	138.04	176.0	8755	28.68	0.21	$1,026,000	$3,370	11.04
RUSK	NW	213.47	109.54	114.2	3077	14.41	0.13	$495,000	$2,317	10.85
TAYLOR	NW	233.90	157.57	107.8	3056	13.07	0.08	$508,000	$2,196	9.39
ASHLAND	NW	249.49	195.59	190.0	3710	14.87	0.08	$567,000	$2,273	9.11
CALUMET	NE	201.71	118.63	95.5	2592	12.85	0.11	$360,000	$1,792	8.89
BURNETT	NW	234.95	142.01	140.7	3662	15.59	0.11	$490,000	$2,087	8.88
FOREST	NC	312.38	187.34	154.7	7617	24.38	0.13	$866,000	$2,771	8.87
PRICE	NC	322.26	160.02	133.4	5240	16.26	0.10	$750,000	$2,328	7.23
LANGLADE	NC	299.21	155.70	107.2	3671	12.27	0.08	$547,000	$1,839	6.15
SAWYER	NW	367.44	140.76	149.2	5404	14.71	0.10	$751,000	$2,043	5.56
Group D Averages		258.50	152.40	139.2	4544	16.90	0.11	$615,750	$2,333	9.45

Table 4.11. Cost per Lane Mile per Severity Index Ranking (Group F)

From Winter Storm Reports, 2013-2014

County	Region	Lane Miles	Severity Index	Snow Depth (in)	Salt (ton)	Salt per LM	Salt per LM per Severity Index	Total Cost	Total $/LM	Cost per LM per Severity Index
FLORENCE	NC	141.07	166.58	154.2	3254	23.07	0.14	$384,000	$2,740	19.42
MENOMINEE	NC	90.26	98.47	83.1	1675	18.56	0.19	$130,000	$1,445	16.00
ADAMS	NC	193.82	129.06	64.0	2760	14.24	0.11	$361,000	$1,862	9.61
Group D Averages		141.72	131.37	100.4	2563	18.62	0.15	$291,667	$2,015	15.01

Table 4.12. Winter Crashes per 100 Million Vehicle Miles of Travel

Bureau of Transportation Safety data, November 2013 - April 2014

WisDOT REGION / COUNTY	2013-14 WINTER VEHICLE MILES OF TRAVEL	2013-14 WINTER CRASHES	CRASH RATE PER 100M VMT
NORTH CENTRAL			
ADAMS	108,700,000	35	32
FLORENCE	36,400,000	7	19
FOREST	56,300,000	27	48
GREEN LAKE	91,300,000	38	42
IRON	47,100,000	17	36
LANGLADE	98,900,000	42	42
LINCOLN	185,500,000	100	54
MARATHON	718,900,000	605	84
MARQUETTE	128,000,000	27	21
MENOMINEE	14,500,000	4	28
ONEIDA	230,100,000	116	50
PORTAGE	387,400,000	203	52
PRICE	78,500,000	35	45
SHAWANO	268,700,000	107	40
VILAS	146,700,000	59	40
WAUPACA	299,200,000	166	55
WAUSHARA	180,400,000	58	32
WOOD	306,100,000	162	53
Region Total	**3,382,700,000**	**1,808**	**53**
NORTHEAST			
BROWN	1,053,000,000	411	39
CALUMET	164,500,000	69	42
DOOR	161,000,000	59	37
FOND DU LAC	538,600,000	186	35
KEWAUNEE	84,700,000	26	31
MANITOWOC	370,500,000	156	42
MARINETTE	226,300,000	72	32
OCONTO	241,800,000	65	27
OUTAGAMIE	664,700,000	337	51
SHEBOYGAN	445,200,000	160	36
WINNEBAGO	754,400,000	529	70
Region Total	**4,704,700,000**	**2,070**	**44**
NORTHWEST			
ASHLAND	82,800,000	35	42
BARRON	260,300,000	137	53
BAYFIELD	133,700,000	40	30
BUFFALO	80,600,000	31	38
BURNETT	80,100,000	23	29
CHIPPEWA	385,500,000	223	58
CLARK	173,500,000	115	66
DOUGLAS	215,600,000	179	83
DUNN	289,800,000	150	52
EAU CLAIRE	461,900,000	432	94
JACKSON	244,900,000	106	43
PEPIN	35,000,000	24	69
PIERCE	147,100,000	75	51
POLK	216,300,000	80	37
RUSK	80,500,000	30	37
ST.CROIX	539,900,000	259	48
SAWYER	113,500,000	28	25
TAYLOR	78,800,000	19	24
TREMPEALEAU	172,600,000	97	56
WASHBURN	127,300,000	72	57
Region Total	**3,919,700,000**	**2,155**	**55**

Table 4.12. Winter Crashes per 100 Million Vehicle Miles of Travel

Bureau of Transportation Safety data, November 2013 - April 2014

WisDOT REGION / COUNTY	2013-14 WINTER VEHICLE MILES OF TRAVEL	2013-14 WINTER CRASHES	CRASH RATE PER 100M VMT
SOUTHEAST			
KENOSHA	686,800,000	305	44
MILWAUKEE	2,885,800,000	1039	36
OZAUKEE	489,700,000	150	31
RACINE	743,500,000	369	50
WALWORTH	551,100,000	213	39
WASHINGTON	668,900,000	282	42
WAUKESHA	2,088,100,000	547	26
Region Total	**8,113,900,000**	**2,905**	**36**
SOUTHWEST			
COLUMBIA	443,200,000	162	37
CRAWFORD	85,700,000	54	63
DANE	2,180,500,000	872	40
DODGE	437,400,000	131	30
GRANT	242,400,000	145	60
GREEN	142,400,000	74	52
IOWA	187,300,000	73	39
JEFFERSON	467,200,000	130	28
JUNEAU	290,200,000	106	37
LA CROSSE	433,500,000	317	73
LAFAYETTE	95,000,000	42	44
MONROE	339,500,000	148	44
RICHLAND	90,700,000	41	45
ROCK	719,400,000	433	60
SAUK	383,700,000	151	39
VERNON	115,600,000	20	17
Region Total	**6,653,700,000**	**2,899**	**44**
STATEWIDE TOTAL	**26,774,700,000**	**11,837**	**44**

Table 4.13. Motor Vehicle Crashes on State, US and Interstate Highways with Snow/Ice/Slush

Bureau of Transportation Safety data, November 2013 - April 2014

NORTH CENTRAL REGION

COUNTY	TOTAL	Urban STH	Rural STH	Urban IH	Rural IH	Urban State Highway			Rural State Highway		
						Non-div	Divided	Unkn	Non-div	Divided	Unkn
ADAMS	35	0	35	0	0	0	0	0	35	0	0
FLORENCE	7	0	7	0	0	0	0	0	7	0	0
FOREST	27	0	27	0	0	0	0	0	27	0	0
GREEN LAKE	38	6	32	0	0	6	0	0	32	0	0
IRON	17	0	17	0	0	0	0	0	15	2	0
LANGLADE	42	8	34	0	0	6	2	0	32	2	0
LINCOLN	100	27	73	0	0	27	0	0	24	49	0
MARATHON	605	177	351	25	52	63	114	0	91	260	0
MARQUETTE	27	0	12	0	15	0	0	0	12	0	0
MENOMINEE	4	0	4	0	0	0	0	0	4	0	0
ONEIDA	116	5	111	0	0	2	3	0	103	8	0
PORTAGE	203	48	85	22	48	23	25	0	36	49	0
PRICE	35	0	35	0	0	0	0	0	33	2	0
SHAWANO	107	10	97	0	0	9	1	0	37	60	0
VILAS	59	0	59	0	0	0	0	0	56	3	0
WAUPACA	166	4	162	0	0	2	2	0	54	108	0
WAUSHARA	58	0	45	0	13	0	0	0	43	2	0
WOOD	162	94	68	0	0	30	64	0	36	32	0
TOTAL	**1,808**	**379**	**1,254**	**47**	**128**	**168**	**211**	**0**	**677**	**577**	**0**

NORTHEAST REGION

COUNTY	TOTAL	Urban STH	Rural STH	Urban IH	Rural IH	Urban State Highway			Rural State Highway		
						Non-div	Divided	Unkn	Non-div	Divided	Unkn
BROWN	411	278	56	36	41	85	193	0	20	36	0
CALUMET	69	7	62	0	0	2	5	0	55	7	0
DOOR	59	7	52	0	0	1	6	0	33	19	0
FOND DU LAC	186	45	141	0	0	30	15	0	62	79	0
KEWAUNEE	26	0	26	0	0	0	0	0	24	2	0
MANITOWOC	156	59	38	1	58	28	31	0	34	4	0
MARINETTE	72	14	58	0	0	11	3	0	35	23	0
OCONTO	65	0	65	0	0	0	0	0	18	47	0
OUTAGAMIE	337	128	209	0	0	49	79	0	90	119	0
SHEBOYGAN	160	54	64	0	42	35	19	0	27	37	0
WINNEBAGO	529	149	380	0	0	75	74	0	72	308	0
TOTAL	**2,070**	**741**	**1,151**	**37**	**141**	**316**	**425**	**0**	**470**	**681**	**0**

NORTHWEST REGION

COUNTY	TOTAL	Urban STH	Rural STH	Urban IH	Rural IH	Urban State Highway			Rural State Highway		
						Non-div	Divided	Unkn	Non-div	Divided	Unkn
ASHLAND	35	15	20	0	0	12	3	0	20	0	0
BARRON	137	15	122	0	0	7	8	0	62	60	0
BAYFIELD	40	0	40	0	0	0	0	0	38	2	0
BUFFALO	31	0	31	0	0	0	0	0	30	1	0
BURNETT	23	0	23	0	0	0	0	0	19	4	0
CHIPPEWA	223	23	200	0	0	8	15	0	54	146	0
CLARK	115	0	115	0	0	0	0	0	46	69	0
DOUGLAS	179	101	47	31	0	50	51	0	25	22	0
DUNN	150	23	55	10	62	14	9	0	49	6	0
EAU CLAIRE	432	143	59	147	83	26	117	0	37	22	0
JACKSON	106	0	45	0	61	0	0	0	40	5	0
PEPIN	24	0	24	0	0	0	0	0	22	1	1
PIERCE	75	8	67	0	0	8	0	0	66	1	0
POLK	80	0	80	0	0	0	0	0	79	1	0
RUSK	30	0	30	0	0	0	0	0	30	0	0
ST. CROIX	259	11	138	22	88	5	6	0	97	41	0
SAWYER	28	0	28	0	0	0	0	0	24	4	0
TAYLOR	19	0	19	0	0	0	0	0	18	1	0
TREMPEALEAU	97	0	93	0	4	0	0	0	91	2	0
WASHBURN	72	0	72	0	0	0	0	0	26	46	0
TOTAL	**2,155**	**339**	**1,308**	**210**	**298**	**130**	**209**	**0**	**873**	**434**	**1**

SOUTHEAST REGION

COUNTY	TOTAL	Urban STH	Rural STH	Urban IH	Rural IH	Urban State Highway			Rural State Highway		
						Non-div	Divided	Unkn	Non-div	Divided	Unkn
KENOSHA	305	60	159	9	77	27	33	0	36	123	0
MILWAUKEE	1,039	688	0	351	0	190	498	0	0	0	0
OZAUKEE	150	23	22	37	68	12	11	0	6	16	0
RACINE	369	200	55	12	102	90	110	0	40	14	1
WALWORTH	213	34	149	3	27	20	14	0	95	54	0
WASHINGTON	282	151	131	0	0	58	93	0	53	78	0
WAUKESHA	547	209	119	153	66	33	176	0	56	63	0
TOTAL	**2,905**	**1,365**	**635**	**565**	**340**	**430**	**935**	**0**	**286**	**348**	**1**

SOUTHWEST REGION

COUNTY	TOTAL	Urban STH	Rural STH	Urban IH	Rural IH	Urban State Highway			Rural State Highway		
						Non-div	Divided	Unkn	Non-div	Divided	Unkn
COLUMBIA	162	14	73	10	65	10	4	0	65	8	0
CRAWFORD	54	8	46	0	0	8	0	0	44	2	0
DANE	872	400	268	51	153	83	317	0	139	129	0
DODGE	131	17	114	0	0	6	11	0	61	53	0
GRANT	145	9	136	0	0	7	2	0	83	53	0
GREEN	74	10	64	0	0	1	9	0	59	5	0
IOWA	73	0	73	0	0	0	0	0	29	44	0
JEFFERSON	130	18	74	0	38	16	2	0	50	24	0
JUNEAU	106	0	42	0	64	0	0	0	41	1	0
LA CROSSE	317	142	85	50	40	84	58	0	57	28	0
LAFAYETTE	42	0	42	0	0	0	0	0	28	14	0
MONROE	148	23	61	2	62	8	15	0	53	8	0
RICHLAND	41	0	41	0	0	0	0	0	35	6	0
ROCK	433	132	169	63	69	71	61	0	138	31	0
SAUK	151	17	81	0	53	10	7	0	65	16	0
VERNON	20	0	20	0	0	0	0	0	19	1	0
TOTAL	**2,899**	**790**	**1,389**	**176**	**544**	**304**	**486**	**0**	**966**	**423**	**0**

STATE TOTAL	**11,837**	**3,614**	**5,737**	**1,035**	**1,451**	**1,348**	**2,266**	**0**	**3,272**	**2,463**	**2**

STH = State highways or non-interstate US highways
IH = Interstate highways Non-div = Non-divided
Rural = An unincorporated area or an incorporated area with a population under 5,000
Urban = An incorporated area with a population of 5,000 or more.

**2014 figures are preliminary at this time.*
***Does not include deer or other animal crashes*

SW Region

COUNTY	TOTAL	Urban STH	Rural STH	Urban IH	Rural IH	Urban State Highway			Rural State Highway		
						Non-div	Divided	Unkn	Non-div	Divided	Unkn
COLUMBIA	151	7	78	1	65	6	1	0	68	9	1
CRAWFORD	28	5	23	0	0	5	0	0	22	1	0
DANE	541	234	195	10	102	41	193	0	107	88	0
DODGE	149	8	141	0	0	7	1	0	80	60	1
GRANT	77	1	76	0	0	1	0	0	59	17	0
GREEN	55	4	51	0	0	1	3	0	47	4	0
IOWA	68	0	68	0	0	0	0	0	28	40	0
JEFFERSON	108	22	62	0	24	20	2	0	38	24	0
JUNEAU	92	0	33	0	59	0	0	0	32	1	0
LA CROSSE	210	109	60	23	18	53	56	0	31	29	0
LAFAYETTE	31	0	31	0	0	0	0	0	23	8	0
MONROE	153	30	50	4	69	15	15	0	50	0	0
RICHLAND	41	0	41	0	0	0	0	0	37	4	0
ROCK	241	63	101	23	54	15	48	0	82	19	1
SAUK	93	14	64	0	15	10	3	1	51	13	0
VERNON	47	0	47	0	0	0	0	0	42	5	0
TOTAL	2,085	497	1,121	61	406	174	322	1	797	322	2

STH = State highways or non-interstate US highways
IH = Interstate highways Non-div = Non-divided
Rural = An unincorporated area or an incorporated area with a population under 5,000
Urban = An incorporated area with a population of 5,000 or more.

*2013 figures are preliminary at this time.
**Does not include deer or other animal crashes

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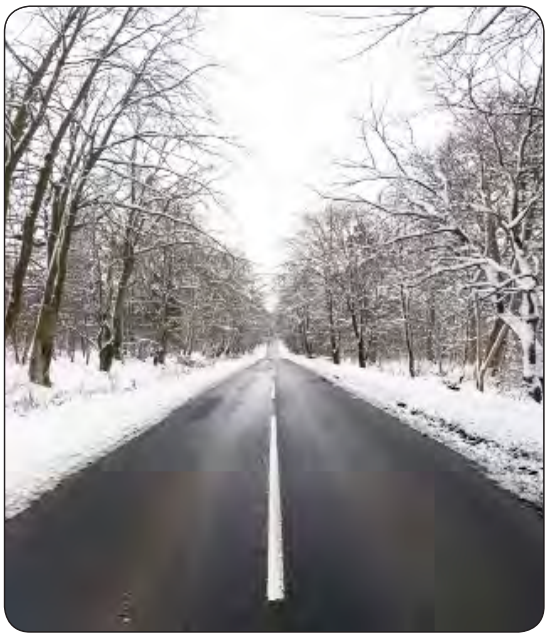
5 Looking Ahead

The 2013-14 winter season was the most severe in recent history for most of Wisconsin. Heavier than average snowfall combined with extremely cold temperatures to create a winter maintenance nightmare. Numerous fairly light snow events impacted the state almost non-stop from December into early April. The record for salt used in a single season was also increased by 25,000 tons over the previous record and required emergency salt purchases from as far away as Texas to keep up with the demand.



In 2014-15, WisDOT will continue to work on implementing and expanding the best practices. However, focus over the next year will move towards identifying service providers who are efficient and cost effective as the department will explore full implementation of the best management practices.

Winter focus areas for 2014-15 include:

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 higher emphasis on service providers with Interstates and Expressways and with counties that are actively using the MDSS forecasting-treatment recommendation program. The goal is to expand to 60 counties.

2. WisDOT is going to partner with Dane County Highway Department to conduct a route optimizing study on Dane County's highways. Software called 'Route Smart' is being jointly purchased for the study.

3. WisDOT will focus 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 the use of 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. We will work with counties to begin investigating and testing these techniques.

5. Snowplow operator training modules for operators and supervisors will continue to be developed by Clear Roads in 2014-15 and will be implemented in 2016.

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Appendix

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Wisconsin Department of Transportation Regions
September 2014

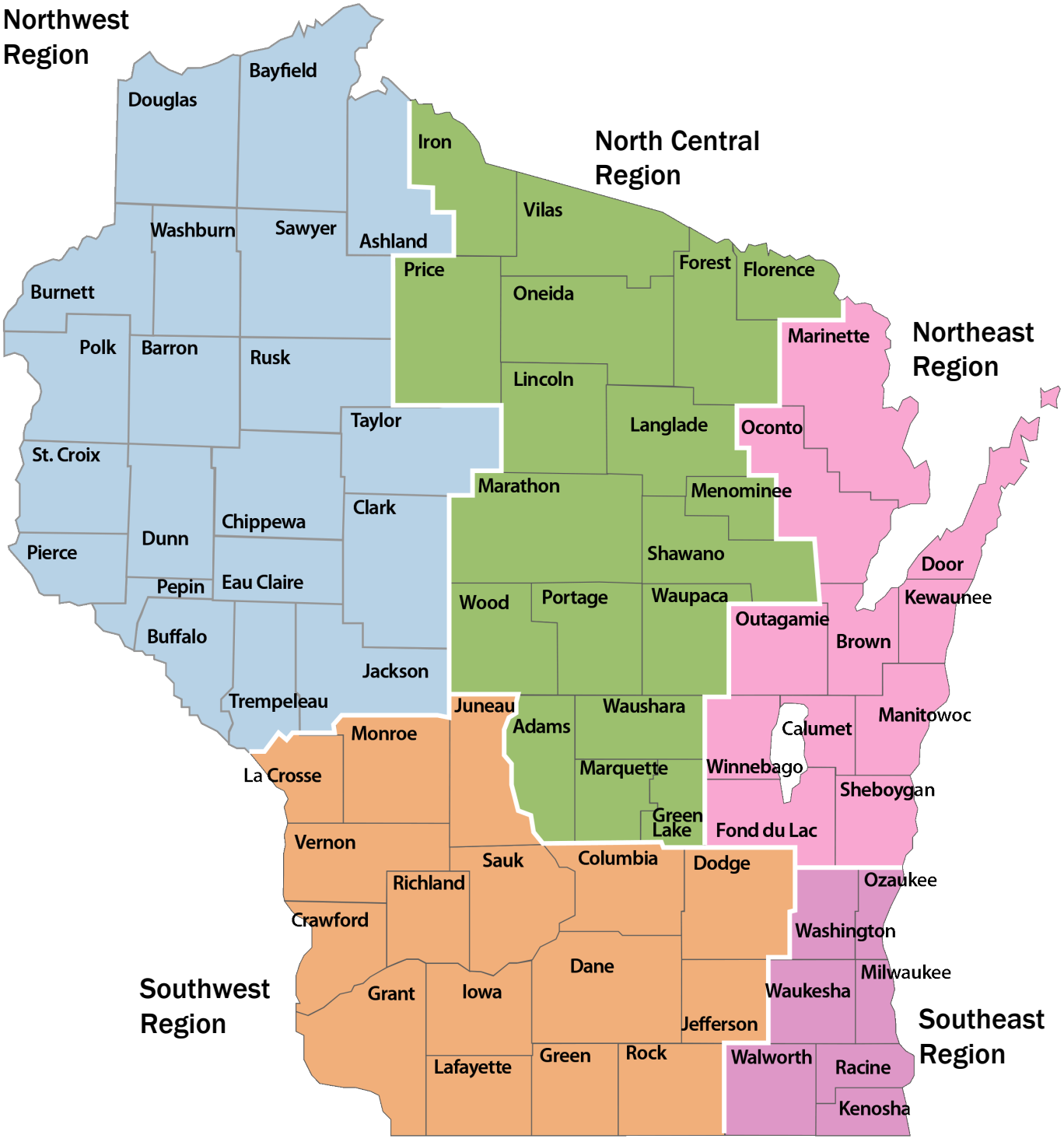


Figure A-1

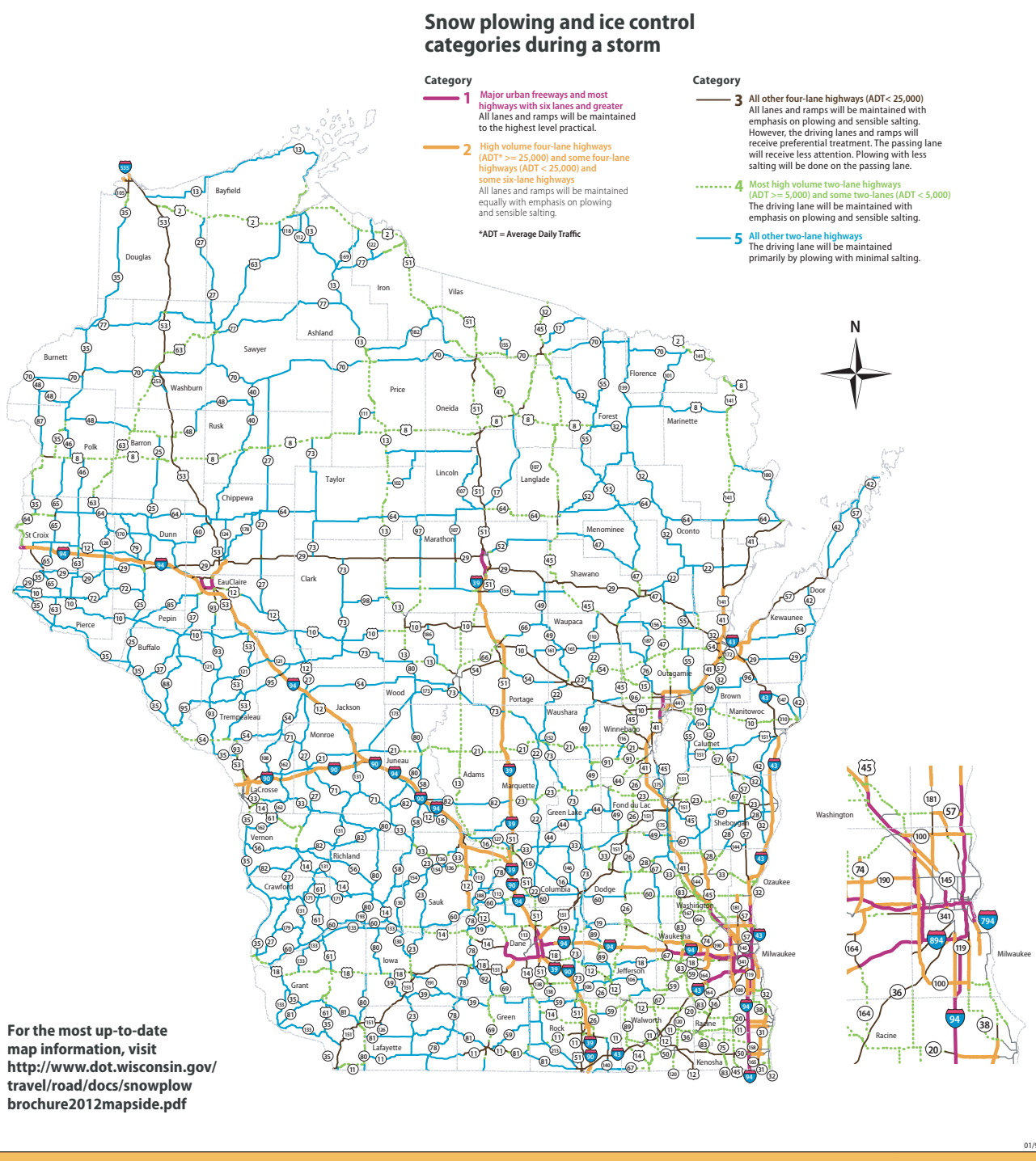

Snow plowing and ice control categories during a storm
Category
1 Major urban freeways and most highways with six lanes and greater
All lanes and ramps will be maintained to the highest level practical.
2 High volume four-lane highways (ADT* >= 25,000) and some four-lane highways (ADT < 25,000) and some six-lane highways
All lanes and ramps will be maintained equally with emphasis on plowing and sensible salting.
*ADT = Average Daily Traffic
Category
3 All other four-lane highways (ADT< 25,000)
All lanes and ramps will be maintained with emphasis on plowing and sensible salting. However, the driving lanes and ramps will receive preferential treatment. The passing lane will receive less attention. Plowing with less salting will be done on the passing lane.
4 Most high volume two-lane highways (ADT >= 5,000) and some two-lanes (ADT < 5,000)
The driving lane will be maintained with emphasis on plowing and sensible salting.
5 All other two-lane highways
The driving lane will be maintained primarily by plowing with minimal salting.
N
Bayfield
Douglas
Iron
Vilas
Ashland
Sawyer
Burnett
Washburn
Price
Oneida
Florence
Forest
Marinette
Rusk
Polk
Barron
Taylor
Lincoln
Langlade
Chippewa
St Croix
Dunn
Marathon
Menominee
Oconto
EauClaire
Clark
Shawano
Door
Pepin
Pierce
Buffalo
Waupaca
Kewaunee
Outagamie
Brown
Trempealeau
Jackson
Wood
Portage
Waushara
Manitowoc
Monroe
Winnebago
Calumet
Juneau
Adams
Marquette
LaCrosse
Fond du Lac
Green Lake
Sheboygan
Vernon
Richland
Ozaukee
Crawford
Sauk
Columbia
Dodge
Washington
Waukesha
Dane
Milwaukee
Iowa
Jefferson
Grant
Green
Rock
Walworth
Racine
Lafayette
Kenosha
Washington
Milwaukee
Racine
For the most up-to-date map information, visit http://www.dot.wisconsin.gov/travel/road/docs/snowplowbrochure2012mapside.pdf
01/9/2013

Figure A-2

Table A.1. Storm Report Summary

From Winter Storm Reports, 2013-2014

Notes: 1) Costs shown in table are estimated and do not include the 4.44% Administrative Costs; 2) Material Costs includes Salt, Sand, and other Deicing and Anti-icing Agents; 3) Equipment Costs are based on $60 per hour per unit; 4) Labor Costs are based on each County's average labor rate; 5) Total Salt Available = salt in sheds as of May '12 (modified as required) plus early seasonal fill plus seasonal fill plus vendor reserve available.

Region / NC County	Lane Miles	Severity Index	Snow Amount (inches)	Events this Season: Anti-Icing	Events this Season: Storms	Events this Season: Incident	Freez. Rain Events	Total Salt Avail. (tons)	Total Salt Used (tons)	Total Salt Remain. (tons)	Salt Used per LM (tons)	Total Thaw-Rox (tons)	Total Clear-Lane (tons)	Total Sand Used (CY)	Total Reg. Hours	Total OT Hours	Estimated Cost Per Lane Mile: Mat'l	Equip	Labor	Total	Estimated Total Cost to Date	Salt per LM per Severity Index
ADAMS	193.82	129.06	64.0	12	39	17	19	4,512	2,760	1,752	14.2	0	0	33	1204.0	351.0	$1,023	$450	$389	$1,862	$360,876	0.11
FLORENCE	141.07	166.58	154.2	14	62	27	12	3,599	3,254	345	23.1	0	0	152	1355.0	339.0	$1,463	$703	$573	$2,740	$384,054	0.14
FOREST	312.38	187.34	154.7	3	59	43	18	9,370	7,617	1,753	24.4	0	0	0	3026.0	1457.0	$1,410	$748	$613	$2,771	$865,721	0.13
GREEN LAKE	156.94	127.98	67.8	4	37	43	8	2,153	1,034	1,119	6.6	0	0	0	862.0	289.0	$416	$392	$343	$1,151	$179,958	0.05
IRON	249.56	225.36	233.4	0	69	40	13	7,304	6,777	527	27.2	0	0	976	2593.0	1317.0	$1,755	$867	$824	$3,446	$856,763	0.12
LANGLADE	299.21	155.70	107.2	14	43	32	24	6,414	3,671	2,743	12.3	0	0	102	2292.0	1079.0	$713	$619	$507	$1,839	$546,737	0.08
LINCOLN	415.19	162.14	132.8	16	47	38	27	6,121	6,080	41	14.6	0	0	3874	3852.0	1406.0	$1,064	$690	$559	$2,313	$941,474	0.09
MARATHON	868.57	159.65	95.3	10	53	55	12	14,733	13,873	860	16.0	0	23	485	7636.0	4102.0	$1,106	$730	$652	$2,488	$2,147,180	0.10
MARQUETTE	245.09	106.49	69.3	5	35	27	11	5,448	3,106	2,342	12.7	0	0	0	897.0	693.0	$806	$388	$297	$1,492	$365,619	0.12
MENOMINEE	90.26	98.47	83.1	1	40	26	5	2,302	1,675	627	18.6	0	0	245	368.0	72.0	$994	$288	$162	$1,445	$130,385	0.19
ONEIDA	396.79	187.76	144.5	15	51	25	29	9,303	10,363	-1,060	26.1	0	0	2547	5767.0	648.0	$1,741	$832	$688	$3,261	$1,293,930	0.14
PORTAGE	581.81	156.85	88.7	2	55	27	24	10,017	6,405	3,612	11.0	0	0	3643	6073.0	2876.0	$718	$920	$676	$2,314	$1,346,582	0.07
PRICE	322.26	160.02	133.4	6	51	33	15	6,844	5,240	1,604	16.3	0	0	669	2500.0	1439.0	$1,061	$686	$582	$2,328	$750,357	0.10
SHAWANO	519.55	137.08	111.0	8	44	40	9	9,854	8,806	1,048	16.9	0	0	1380	4695.0	2038.0	$972	$699	$530	$2,202	$1,133,036	0.12
VILAS	305.24	138.04	176.0	1	53	29	5	8,826	8,755	71	28.7	0	0	2172	2474.0	1369.0	$2,031	$702	$636	$3,370	$1,026,239	0.21
WAUPACA	547.06	120.84	88.9	3	37	30	8	11,128	10,012	1,116	18.3	0	0	184	3836.0	1965.0	$1,010	$638	$484	$2,132	$1,162,693	0.15
WAUSHARA	345.01	108.92	84.5	7	42	13	9	4,728	4,120	608	11.9	0	0	50	2282.0	180.0	$715	$390	$285	$1,390	$479,593	0.11
WOOD	429.88	152.25	96.9	9	46	30	23	7,284	7,117	167	16.6	0	3	814	2572.0	2202.0	$1,096	$645	$511	$2,251	$967,871	0.11
Region Total		--	--	--	--	--	--	129,940	110,665	19,275	--	0	26	17326	--	--	--	--	--	--	14,939,069	
Region Average		148.92	115.9	7.2	47.9	31.9	15.1	7,219	6,148	1,071	17.5	0	1	963	3015.8	1323.4	$1,116	$633	$517	$2,266	$829,948	0.12

Table A.1. Storm Report Summary

From Winter Storm Reports, 2013-2014

Notes: 1) Costs shown in table are estimated and do not include the 4.44% Administrative Costs; 2) Material Costs includes Salt, Sand, and other Deicing and Anti-icing Agents; 3) Equipment Costs are based on $60 per hour per unit; 4) Labor Costs are based on each County's average labor rate; 5) Total Salt Available = salt in sheds as of May '12 (modified as required) plus early seasonal fill plus seasonal fill plus vendor reserve available.

Region / NE / County	Lane Miles	Severity Index	Snow Amount (inches)	Events this Season: Anti-Icing	Events this Season: Storms	Events this Season: Incident	Freez. Rain Events	Total Salt Avail. (tons)	Total Salt Used (tons)	Total Salt Remain. (tons)	Salt Used per LM (tons)	Total Thaw-Rox (tons)	Total Clear-Lane (tons)	Total Sand Used (CY)	Total Reg. Hours	Total OT Hours	Estimated Cost Per Lane Mile: Mat'l	Equip	Labor	Total	Estimated Total Cost to Date	Salt per LM per Severity Index
BROWN	765.86	117.49	82.7	20	45	18	4	16,871	11,193	5,678	14.6	0	11	297	5440.0	4327.0	$751	$710	$645	$2,107	$1,612,431	0.12
CALUMET	201.71	118.63	95.5	3	37	35	5	2,720	2,592	128	12.9	0	0	0	1784.0	601.0	$692	$649	$451	$1,792	$359,905	0.11
DOOR	268.55	122.48	91.1	8	32	40	5	4,585	4,990	-405	18.6	0	0	180	1124.0	1946.0	$1,075	$681	$681	$2,436	$651,154	0.15
FOND DU LAC	597.3	123.33	81.2	13	38	29	8	12,714	10,379	2,335	17.4	0	0	288	3254.0	3550.0	$1,126	$626	$602	$2,354	$1,393,639	0.14
KEWAUNEE	110.41	119.09	92.7	8	30	38	5	1,766	1,251	515	11.3	0	0	326	759.0	271.0	$605	$560	$479	$1,644	$181,505	0.10
MANITOWOC	424.85	125.35	80.6	9	40	28	13	9,860	7,560	2,300	17.8	0	0	0	3456.0	1504.0	$1,002	$695	$608	$2,305	$970,806	0.14
MARINETTE	421.42	139.54	124.6	20	46	40	9	7,248	5,367	1,881	12.7	0	0	1639	4067.0	862.0	$775	$609	$608	$1,992	$836,846	0.09
OCONTO	467.45	120.11	118.9	26	43	23	9	7,448	6,820	628	14.6	0	0	0	2943.0	2016.0	$846	$601	$527	$1,975	$922,739	0.12
OUTAGAMIE	535.83	108.23	94.8	1	40	17	4	11,297	9,793	1,504	18.3	0	0	210	4214.0	2111.0	$1,029	$595	$548	$2,172	$1,148,440	0.17
SHEBOYGAN	522.38	128.42	63.4	13	40	29	13	12,026	10,473	1,553	20.0	0	0	0	3386.0	2018.0	$1,377	$591	$554	$2,523	$1,280,800	0.16
WINNEBAGO	622.41	105.96	63.8	2	44	33	6	13,319	11,861	1,458	19.1	0	0	21	4014.0	3661.0	$1,200	$679	$609	$2,488	$1,514,753	0.18
Region Total		--	--	--	--	--	--	99,854	82,279	17,575	--	0	11	2961	--	--	--	--	--	--	10,873,016	
Region Average		120.78	89.9	11.2	39.5	30.0	7.4	9,078	7,480	1,598	16.1	0	1	269	3131.0	2078.8	$953	$636	$574	$2,163	$988,456	0.13

Table A.1. Storm Report Summary

From Winter Storm Reports, 2013-2014

Notes: 1) Costs shown in table are estimated and do not include the 4.44% Administrative Costs; 2) Material Costs includes Salt, Sand, and other Deicing and Anti-icing Agents; 3) Equipment Costs are based on $60 per hour per unit; 4) Labor Costs are based on each County's average labor rate; 5) Total Salt Available = salt in sheds as of May '12 (modified as required) plus early seasonal fill plus seasonal fill plus vendor reserve available.

Region NW County	Lane Miles	Severity Index	Snow Amount (inches)	Events this Season: Anti-Icing	Storms	Incident	Freez. Rain Events	Total Salt Avail. (tons)	Total Salt Used (tons)	Total Salt Remain. (tons)	Salt Used per LM (tons)	Total Thaw-Rox (tons)	Total Clear-Lane (tons)	Total Sand Used (CY)	Total Reg. Hours	Total OT Hours	Estimated Cost Per Lane Mile: Mat'l	Equip	Labor	Total	Estimated Total Cost to Date	Salt per LM per Severity Index
ASHLAND	249.49	195.59	190.0	2	56	48	16	3,975	3,710	265	14.9	0	47	308	2291.0	1024.0	$965	$754	$553	$2,273	$566,737	0.08
BARRON	423.09	169.25	144.4	3	45	65	17	5,398	4,576	822	10.8	0	0	1879	5459.0	2153.0	$831	$1,019	$748	$2,597	$1,067,977	0.06
BAYFIELD	316.88	199.27	222.0	5	55	42	11	6,879	5,688	1,191	18.0	0	0	457	3399.0	1732.0	$1,062	$971	$726	$2,759	$873,482	0.09
BUFFALO	317.02	100.49	67.0	7	40	23	8	2,907	2,130	777	6.7	0	0	191	1825.0	787.0	$417	$411	$359	$1,187	$376,199	0.07
BURNETT	234.95	142.01	140.7	8	40	30	12	3,489	3,662	-173	15.6	0	0	334	1451.0	1098.0	$936	$621	$531	$2,087	$489,836	0.11
CHIPPEWA	654.65	107.19	91.3	0	37	28	8	13,935	13,937	-2	21.3	0	0	3186	4709.0	4310.0	$1,401	$820	$696	$2,918	$1,909,985	0.20
CLARK	402.56	131.24	106.4	3	41	26	11	6,825	5,455	1,370	13.6	0	0	16	2394.0	1708.0	$936	$580	$501	$2,017	$811,254	0.10
DOUGLAS	440.87	168.42	218.3	12	44	62	11	9,172	9,590	-418	21.8	0	0	387	4292.0	1991.0	$1,250	$751	$694	$2,695	$1,188,026	0.13
DUNN	516.58	111.04	98.5	2	38	18	7	11,305	11,418	-113	22.1	60	0	628	3358.0	2747.0	$1,471	$639	$644	$2,753	$1,422,375	0.20
EAU CLAIRE	537.78	122.71	96.5	3	42	44	10	11,109	10,122	987	18.8	0	0	1024	7586.0	2399.0	$1,256	$961	$751	$2,968	$1,594,940	0.15
JACKSON	515	134.38	73.8	7	43	27	15	11,815	8,941	2,874	17.4	0	0	305	2952.0	2111.0	$1,224	$1,898	$392	$3,515	$1,810,262	0.13
PEPIN	112.38	98.18	68.0	2	34	14	9	1,257	968	289	8.6	0	0	283	692.0	398.0	$607	$509	$413	$1,530	$171,896	0.09
PIERCE	365.5	128.79	90.7	3	41	26	12	6,089	5,144	945	14.1	0	0	1327	2649.0	1320.0	$879	$559	$570	$2,009	$732,046	0.11
POLK	385.05	181.61	134.7	1	49	44	19	8,125	7,590	535	19.7	0	21	1273	2949.5	1828.5	$1,311	$689	$589	$2,588	$990,901	0.11
RUSK	213.47	109.54	114.2	0	34	50	10	2,948	3,077	-129	14.4	0	0	804	2218.0	721.0	$959	$751	$607	$2,317	$494,612	0.13
SAINT CROIX	630.22	142.70	91.3	0	45	30	15	13,535	13,811	-276	21.9	0	0	1421	3642.0	4169.0	$1,331	$730	$629	$2,691	$1,695,950	0.15
SAWYER	367.44	140.76	149.2	0	49	29	7	5,304	5,404	-100	14.7	0	0	794	2307.0	1258.0	$1,010	$550	$482	$2,043	$750,577	0.10
TAYLOR	233.9	157.57	107.8	9	46	42	18	4,293	3,056	1,237	13.1	0	0	994	1847.0	848.0	$1,022	$643	$531	$2,196	$508,410	0.08
TREMPEALEAU	441.05	99.56	65.3	7	32	30	10	7,716	6,496	1,220	14.7	0	0	1837	2247.0	1641.0	$925	$476	$403	$1,804	$795,841	0.15
WASHBURN	372.14	153.27	202.2	6	48	26	20	7,709	7,732	-23	20.8	0	0	565	2403.0	1967.0	$1,259	$703	$589	$2,550	$945,011	0.14
Region Total		--	--	--	--	--	--	143,785	132,507	11,278	--	60	68	18013	--	--	--	--	--	--	19,196,315	
Region Average		139.68	123.6	4.0	43.0	35.2	12.3	7,189	6,625	564	16.1	3	3	901	3033.5	1810.5	$1,053	$752	$570	$2,375	$959,816	0.12

Final totals as of Monday, June 30, 2014

Table A.1. Storm Report Summary

From Winter Storm Reports, 2013-2014

Notes: 1) Costs shown in table are estimated and do not include the 4.44% Administrative Costs; 2) Material Costs includes Salt, Sand, and other Deicing and Anti-icing Agents; 3) Equipment Costs are based on $60 per hour per unit; 4) Labor Costs are based on each County's average labor rate; 5) Total Salt Available = salt in sheds as of May '12 (modified as required) plus early seasonal fill plus seasonal fill plus vendor reserve available.

Region / SE / County	Lane Miles	Severity Index	Snow Amount (inches)	Events this Season: Anti-Icing	Events this Season: Storms	Events this Season: Incident	Freez. Rain Events	Total Salt Avail. (tons)	Total Salt Used (tons)	Total Salt Remain. (tons)	Salt Used per LM (tons)	Total Thaw-Rox (tons)	Total Clear-Lane (tons)	Total Sand Used (CY)	Total Reg. Hours	Total OT Hours	Estimated Cost Per Lane Mile: Mat'l	Equip	Labor	Total	Estimated Total Cost to Date	Salt per LM per Severity Index
KENOSHA	653.56	120.43	74.0	5	41	25	4	12,108	13,267	-1,159	20.3	0	5	48	6506.0	3373.0	$1,114	$824	$815	$2,753	$1,798,976	0.17
MILWAUKEE	1888.71	122.76	58.6	6	38	7	7	55,179	54,921	258	29.1	0	0	107	13514.0	18400.0	$1,582	$860	$1,182	$3,624	$6,803,878	0.24
OZAUKEE	308.71	118.36	62.3	1	47	32	6	9,986	9,910	76	32.1	0	0	0	2161.0	1062.0	$1,802	$624	$542	$2,968	$910,760	0.27
RACINE	698.11	136.76	91.4	1	41	37	7	16,283	18,694	-2,411	26.8	0	0	154	4584.0	5407.0	$1,503	$778	$852	$3,133	$2,181,896	0.20
WALWORTH	706.03	102.90	79.9	5	33	32	2	20,452	16,462	3,990	23.3	0	0	1449	6744.0	2436.0	$1,224	$737	$626	$2,587	$1,823,044	0.23
WASHINGTON	603.45	125.97	63.0	3	49	15	7	15,876	16,167	-291	26.8	0	30	0	2667.0	4118.0	$1,650	$604	$575	$2,828	$1,655,831	0.21
WAUKESHA	1112.03	107.92	85.8	3	44	4	8	41,673	25,115	16,558	22.6	0	0	582	8606.0	6049.0	$1,263	$781	$676	$2,721	$3,009,615	0.21
Region Total		--	--	--	--	--	--	171,557	154,536	17,021	--	0	35	2340	--	--	--	--	--	--	18,184,001	
Region Average		119.30	73.6	3.4	41.9	21.7	5.9	24,508	22,077	2,432	25.8	0	5	334	6397.4	5835.0	$1,448	$744	$752	$2,945	$2,597,714	0.22

Table A.1. Storm Report Summary

From Winter Storm Reports, 2013-2014

Notes: 1) Costs shown in table are estimated and do not include the 4.44% Administrative Costs; 2) Material Costs includes Salt, Sand, and other Deicing and Anti-icing Agents; 3) Equipment Costs are based on $60 per hour per unit; 4) Labor Costs are based on each County's average labor rate; 5) Total Salt Available = salt in sheds as of May '12 (modified as required) plus early seasonal fill plus seasonal fill plus vendor reserve available.

Region / SW / County	Lane Miles	Severity Index	Snow Amount (inches)	Events this Season: Anti-Icing	Storms	Incident	Freez. Rain Events	Total Salt Avail. (tons)	Total Salt Used (tons)	Total Salt Remain. (tons)	Salt Used per LM (tons)	Total Thaw-Rox (tons)	Total Clear-Lane (tons)	Total Sand Used (CY)	Total Reg. Hours	Total OT Hours	Estimated Cost Per Lane Mile: Mat'l	Equip	Labor	Total	Estimated Total Cost to Date	Salt per LM per Severity Index
COLUMBIA	792.92	155.67	98.9	20	49	29	4	27,767	22,997	4,770	29.0	0	0	1710	3946.0	5142.0	$2,042	$686	$607	$3,334	$2,643,475	0.19
CRAWFORD	394.99	122.31	59.9	3	37	38	5	5,832	4,564	1,268	11.6	0	33	1859	2066.0	1517.0	$722	$496	$398	$1,616	$637,877	0.09
DANE	1535.5	131.56	59.8	1	43	16	6	60,730	53,531	7,199	34.9	0	0	1186	7334.0	16320.0	$2,250	$854	$992	$4,095	$6,251,417	0.26
DODGE	630.41	116.82	77.6	1	39	20	10	21,259	15,113	6,146	24.0	0	0	0	3553.0	3118.0	$1,502	$635	$528	$2,665	$1,677,789	0.21
GRANT	622.06	105.96	81.4	2	36	42	1	11,171	9,074	2,097	14.6	0	0	2892	4229.0	3330.0	$884	$652	$506	$2,041	$1,269,924	0.14
GREEN	312.72	111.91	68.9	17	33	49	6	3,826	2,120	1,706	6.8	0	0	514	2099.0	1540.0	$445	$601	$464	$1,510	$471,892	0.06
IOWA	457.98	132.61	74.2	7	47	38	5	8,520	6,586	1,934	14.4	10	0	84	2708.0	3135.0	$881	$694	$572	$2,148	$983,596	0.11
JEFFERSON	549.15	122.01	95.0	2	43	36	11	15,411	11,883	3,528	21.6	163	0	5	2941.0	3281.0	$1,445	$676	$586	$2,706	$1,454,625	0.18
JUNEAU	494.25	133.90	91.3	6	48	26	12	11,340	8,298	3,042	16.8	0	0	397	2326.0	2255.0	$1,226	$503	$451	$2,179	$1,074,990	0.13
LA CROSSE	488.8	122.13	74.1	10	37	33	13	10,344	8,325	2,019	17.0	63	0	1097	3014.0	2508.0	$980	$624	$556	$2,159	$1,055,480	0.14
LAFAYETTE	293.88	111.13	90.1	5	36	24	4	3,574	2,026	1,548	6.9	0	0	3411	1381.0	2256.0	$423	$669	$567	$1,658	$487,382	0.06
MONROE	653.65	129.96	67.4	5	45	23	11	11,994	10,100	1,894	15.5	66	0	350	3235.0	2921.0	$1,047	$516	$410	$1,973	$1,288,698	0.12
RICHLAND	330.1	98.60	55.7	9	36	34	7	3,943	3,273	670	9.9	0	44	541	1782.0	1171.0	$667	$477	$392	$1,537	$507,122	0.10
ROCK	678.82	126.63	75.3	1	39	40	9	10,497	13,250	-2,753	19.5	0	0	1536	3642.0	4859.0	$1,145	$694	$678	$2,517	$1,697,504	0.15
SAUK	578.72	128.42	86.0	23	52	29	11	18,044	11,714	6,330	20.2	62	0	140	3622.0	3383.0	$1,410	$667	$521	$2,598	$1,502,080	0.16
VERNON	467.04	134.35	87.2	10	39	39	10	7,005	6,966	39	14.9	0	0	2508	2544.0	1829.0	$968	$553	$428	$1,949	$909,325	0.11
Region Total		--	--	--	--	--	--	231,257	189,820	41,437	--	364	77	18230	--	--	--	--	--	--	23,913,174	
Region Average		124.00	77.7	7.6	41.2	32.3	7.8	14,454	11,864	2,590	17.3	23	5	1139	3151.4	3660.3	$1,127	$625	$541	$2,293	$1,494,573	0.14

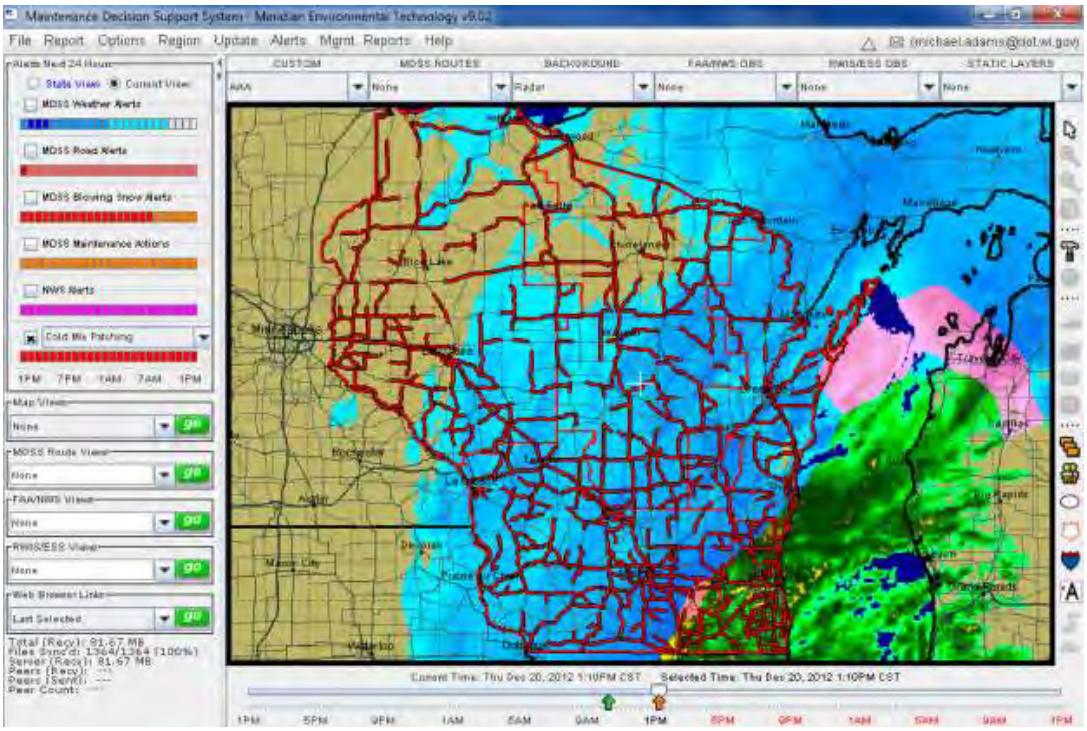
Table A.1. Storm Report Summary

From Winter Storm Reports, 2013-2014

Notes: 1) Costs shown in table are estimated and do not include the 4.44% Administrative Costs; 2) Material Costs includes Salt, Sand, and other Deicing and Anti-icing Agents; 3) Equipment Costs are based on $60 per hour per unit; 4) Labor Costs are based on each County's average labor rate; 5) Total Salt Available = salt in sheds as of May '12 (modified as required) plus early seasonal fill plus seasonal fill plus vendor reserve available.

Statewide Total	--	--	--	--	--	--	776,393	669,807	106,586	--	424	217	58870.0	--	--	--	--	--	--	$87,105,575	--
Statewide Average	133.64	101.5	6.7	43.2	31.6	10.6	10,783	9,303	1,480	17.7	5.9	3.0	817.6	3397.2	2532.1	$1,108	$675	$569	$2,353	$1,209,800	0.14

6/17/2013



WMS

Weather Forecast Services Evaluation 2013

Michael J. Adams

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Executive Summary

Introduction

In 2012-13, the Wisconsin Department of Transportation (WisDOT) continued using weather and pavement forecast information provided by Iteris (formerly Meridian). The information is received through the Maintenance Decision Support System (MDSS).

In order to assess the quality of these weather and pavement temperature forecasts provided to WisDOT and the county highway departments who provide winter maintenance on the state trunk highway system, the WisDOT Road Weather Information System (RWIS) Program Manager performed a verification study on these forecasts. The primary aim of this study is to uncover any potential problems in forecast accuracy. The ultimate goal of this project is to use the findings of this study to improve the quality of weather and pavement temperature forecast information provided by Iteris or any other provider of forecast information.

For all information presented in this report, results for the winter seasons of 1998-99 through 2004-05 are for forecasts provided by Surface Systems, Inc., while results after that are for forecasts provided by Iteris, first via a web site and, after 2009-10, MDSS.

Verification Procedures

Forecasts for eight locations were examined: Madison, Milwaukee, Green Bay, Wausau, La Crosse, Eau Claire, and Rhinelander, and Rice Lake. The time period covered by the verification study was December 1, 2012 through March 31, 2013. This is the standard verification time span, though this year it does omit several snow events that occurred in April. Four specific criteria were examined: snow, freezing precipitation, wind speed, and pavement temperature.

For the first two criteria, the verification methodology is based on a paper presented by John Thornes at the 1998 Standing International Road Weather Commission (SIRWEC) conference. It is based on common meteorological forecast verification techniques. The basis of the method is to choose two time periods (in our case 0 to 6 hours and 6 to 24 hours after forecast issuance) during the forecasts and see if the particular criterion was forecast to occur and whether it actually occurred during the periods being examined. In other words, was snow forecast to occur and did it occur? Two-by-two contingency tables are then constructed. A number of statistics were calculated, each of which provides a different piece of intelligence. Goal scores for each statistic have also been established. For pavement temperature and wind speed, the forecast values 3 and 9 hours after forecast issuance times were compared to the actual values and error statistics were computed. In addition, the timing error for the start and stop of precipitation and the lead time provided by the winter storm alert service were also examined.

Results of this and previous studies are made available to Iteris or whoever the current forecast provider is. It is expected that Iteris will use the results of these studies to continue to improve upon their weather support to WisDOT and the county highway departments.

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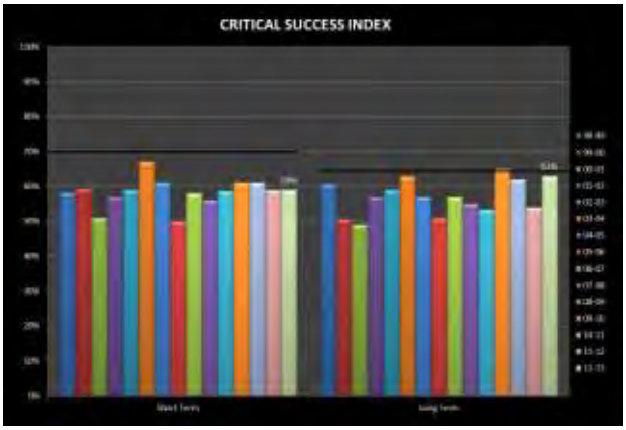
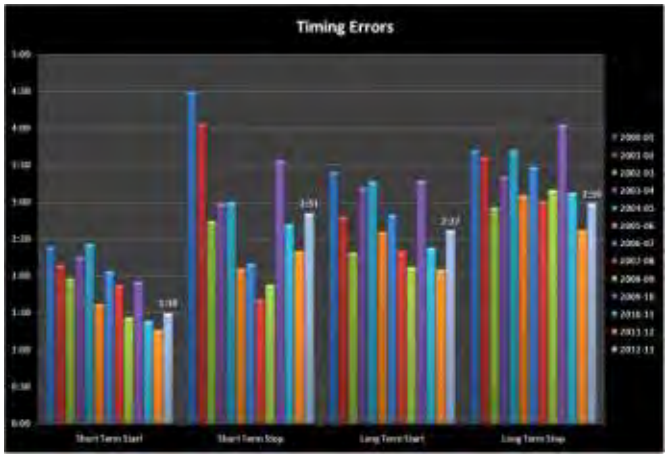
Verification Results

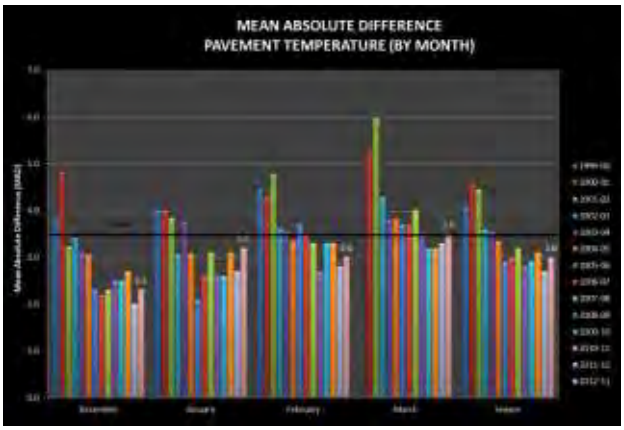
- **Precipitation forecasts.** Accuracy in the short term forecasts remained relatively steady and rose somewhat in the longer term forecasts.

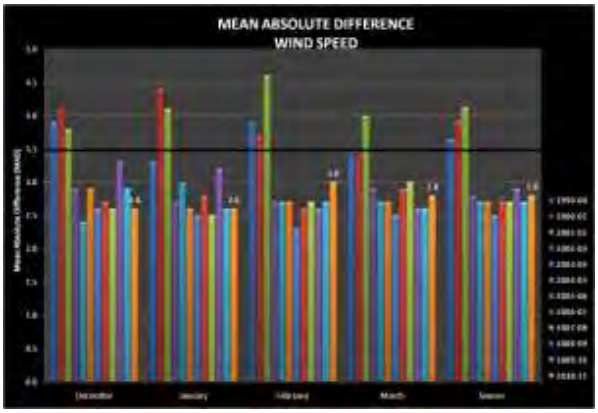




- **Timing error.** On the other hand, timing errors for both the start and end times of snow continue to be superb. For the second consecutive year, the short term timing errors for the start time were the best we've recorded.

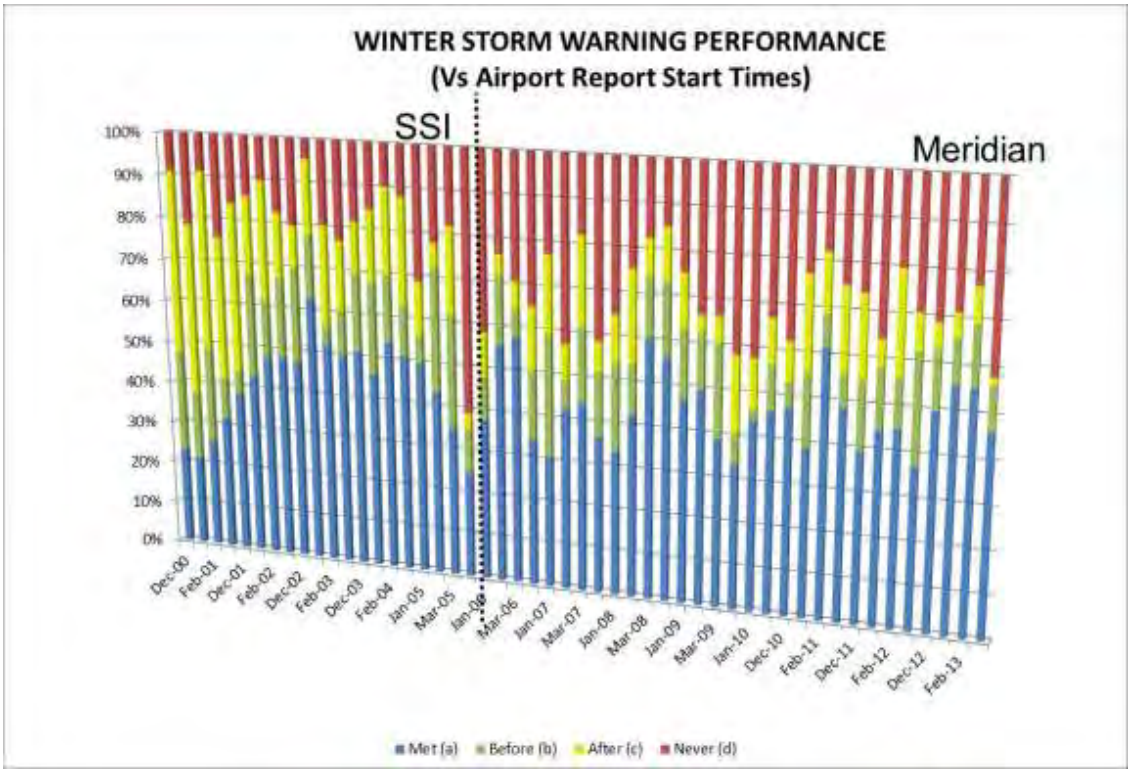
- **Pavement temperature.** Performance continued to be excellent. However, forecasts were slightly worse than the previous winter.





- **Winds.** Wind forecast accuracy remained relatively constant at an excellent level.

- **Winter storm warnings.** Performance was slightly worse than the previous winter, and again failed to meet expectations. For the winter, 53 percent of events were preceded by a warning issued more than two hours in advance, as required by WisDOT's contract with Iteris. About 30 percent of events were preceded by no warning at all, though many of these were likely inconsequential.



Legend:
Met: warning issued more than 2 hours before event onset
Before: warning issued before event onset
After: warning issued after event onset
Never: no warning ever issued for event

Table A-2. Weather Forecasting Service Usage

From Winter Storm Reports, 2013-2014

Region	County	Good	Fair	Poor	Times Used	Times Not Used	% of Events Used	Salt Used (tons)	Snow Amount (inches)	Severity Index	Salt per LM per Severity Index	No. of Storms Events	No. of Incidents Reported	No.of Freezing Rains	No. of Anti-Ice Appl.
SW	JEFFERSON	1	21	21	43	2	96%	11,883	95.0	122.0	0.18	43	36	0	2
	VERNON	23	23	0	46	3	94%	6,966	87.2	134.4	0.11	39	39	9	10
	CRAWFORD	0	24	12	36	4	90%	4,564	59.9	122.3	0.09	37	38	5	3
	DANE	18	12	14	44	0	100%	53,531	59.8	131.6	0.26	43	16	6	1
	DODGE	0	5	0	5	35	13%	15,113	77.6	116.8	0.21	39	20	2	1
	GRANT	21	12	3	36	2	95%	9,074	81.4	106.0	0.14	36	42	1	2
	IOWA	8	27	12	47	7	87%	6,586	74.2	132.6	0.11	47	38	3	7
	COLUMBIA	3	42	0	45	24	65%	22,997	98.9	155.7	0.19	49	29	3	20
	JUNEAU	19	20	9	48	6	89%	8,298	91.3	133.9	0.13	48	26	4	6
	LA CROSSE	3	24	16	43	4	91%	8,325	74.1	122.1	0.14	37	33	4	10
	LAFAYETTE	15	19	2	36	5	88%	2,026	90.1	111.1	0.06	36	24	3	5
	MONROE	2	24	24	50	0	100%	10,100	67.4	130.0	0.12	45	23	4	5
	RICHLAND	1	26	3	30	15	67%	3,273	55.7	98.6	0.10	36	34	6	9
	ROCK	0	8	29	37	3	93%	13,250	75.3	126.6	0.15	39	40	5	1
	SAUK	6	41	18	65	10	87%	11,714	86.0	128.4	0.16	52	29	7	23
	GREEN	28	2	4	34	16	68%	2,120	68.9	111.9	0.06	33	49	6	17
Region Average		9.3	20.6	10.4	40.3	8.5	82.6%	11,863.8	77.7	124.0	0.14	41.2	32.3	4.3	7.6

Table A-2. Weather Forecasting Service Usage

From Winter Storm Reports, 2013-2014

Region	County	Good	Fair	Poor	Times Used	Times Not Used	% of Events Used	Salt Used (tons)	Snow Amount (inches)	Severity Index	Salt per LM per Severity Index	No. of Storms Events	No. of Incidents Reported	No.of Freezing Rains	No. of Anti-Ice Appl.
SE	OZAUKEE	4	31	12	47	1	98%	9,910	62.3	118.4	0.27	47	32	4	1
	KENOSHA	0	1	0	1	45	2%	13,267	74.0	120.4	0.17	41	25	3	5
	MILWAUKEE	0	0	0	0	44	0%	54,921	58.6	122.8	0.24	38	7	7	6
	RACINE	0	41	0	41	1	98%	18,694	91.4	136.8	0.20	41	37	4	1
	WALWORTH	21	12	1	34	4	89%	16,462	79.9	102.9	0.23	33	32	1	5
	WAUKESHA	23	14	6	43	4	91%	25,115	85.8	107.9	0.21	44	4	6	3
	WASHINGTON	8	40	1	49	3	94%	16,167	63.0	126.0	0.21	49	15	6	3
Region Average		8.0	19.9	2.9	30.7	14.6	67.6%	22,076.6	73.6	119.3	0.22	41.9	21.7	4.4	3.4

Table A-2. Weather Forecasting Service Usage

From Winter Storm Reports, 2013-2014

Region	County	Good	Fair	Poor	Times Used	Times Not Used	% of Events Used	Salt Used (tons)	Snow Amount (inches)	Severity Index	Salt per LM per Severity Index	No. of Storms Events	No. of Incidents Reported	No.of Freezing Rains	No. of Anti-Ice Appl.
NW	EAU CLAIRE	0	38	4	42	3	93%	10,122	96.5	122.7	0.15	42	44	5	3
	ASHLAND	26	6	2	34	24	59%	3,710	190.0	195.6	0.08	56	48	4	2
	BARRON	1	44	0	45	3	94%	4,576	144.4	169.2	0.06	45	65	4	3
	BAYFIELD	0	0	0	0	60	0%	5,688	222.0	199.3	0.09	55	42	0	5
	BUFFALO	19	9	6	34	13	72%	2,130	67.0	100.5	0.07	40	23	5	7
	BURNETT	27	18	0	45	3	94%	3,662	140.7	142.0	0.11	40	30	4	8
	CLARK	0	3	13	16	28	36%	5,455	106.4	131.2	0.10	41	26	3	3
	DOUGLAS	0	0	0	0	56	0%	9,590	218.3	168.4	0.13	44	62	8	12
	DUNN	2	21	9	32	8	80%	11,418	98.5	111.0	0.20	38	18	3	2
	SAWYER	0	0	0	0	49	0%	5,404	149.2	140.8	0.10	49	29	3	0
	JACKSON	0	0	0	0	50	0%	8,941	73.8	134.4	0.13	43	27	10	7
	WASHBURN	3	26	5	34	20	63%	7,732	202.2	153.3	0.14	48	26	3	6
	TAYLOR	44	6	1	51	4	93%	3,056	107.8	157.6	0.08	46	42	8	9
	SAINT CROIX	14	21	10	45	0	100%	13,811	91.3	142.7	0.15	45	30	8	0
	CHIPPEWA	15	13	0	28	9	76%	13,937	91.3	107.2	0.20	37	28	1	0
	RUSK	0	0	0	0	34	0%	3,077	114.2	109.5	0.13	34	50	2	0
	POLK	30	20	0	50	0	100%	7,590	134.7	181.6	0.11	49	44	8	1
	PIERCE	29	11	0	40	4	91%	5,144	90.7	128.8	0.11	41	26	5	3
	PEPIN	21	7	0	28	8	78%	968	68.0	98.2	0.09	34	14	4	2
	TREMPEALEA	1	0	0	1	38	3%	6,496	65.3	99.6	0.15	32	30	5	7
Region Average		11.6	12.2	2.5	26.3	20.7	56.5%	6,625.4	123.6	139.7	0.12	43.0	35.2	4.7	4.0

Table A-2. Weather Forecasting Service Usage

From Winter Storm Reports, 2013-2014

Region	County	Good	Fair	Poor	Times Used	Times Not Used	% of Events Used	Salt Used (tons)	Snow Amount (inches)	Severity Index	Salt per LM per Severity Index	No. of Storms Events	No. of Incidents Reported	No.of Freezing Rains	No. of Anti-Ice Appl.
NE	DOOR	25	11	1	37	3	93%	4,990	91.1	122.5	0.15	32	40	1	8
	MANITOWOC	3	17	13	33	16	67%	7,560	80.6	125.3	0.14	40	28	10	9
	CALUMET	37	3	0	40	0	100%	2,592	95.5	118.6	0.11	37	35	2	3
	FOND DU LAC	0	36	2	38	13	75%	10,379	81.2	123.3	0.14	38	29	5	13
	KEWAUNEE	0	25	5	30	8	79%	1,251	92.7	119.1	0.10	30	38	1	8
	OCONTO	39	3	1	43	26	62%	6,820	118.9	120.1	0.12	43	23	7	26
	OUTAGAMIE	3	27	8	38	3	93%	9,793	94.8	108.2	0.17	40	17	0	1
	SHEBOYGAN	29	15	7	51	2	96%	10,473	63.4	128.4	0.16	40	29	11	13
	WINNEBAGO	7	27	8	42	4	91%	11,861	63.8	106.0	0.18	44	33	4	2
	MARINETTE	18	17	2	37	29	56%	5,367	124.6	139.5	0.09	46	40	2	20
	BROWN	4	19	13	36	29	55%	11,193	82.7	117.5	0.12	45	18	4	20
Region Average		15.0	18.2	5.5	38.6	12.1	78.8%	7,479.9	89.9	120.8	0.13	39.5	30.0	4.3	11.2

Table A-2. Weather Forecasting Service Usage

From Winter Storm Reports, 2013-2014

Region	County	Good	Fair	Poor	Times Used	Times Not Used	% of Events Used	Salt Used (tons)	Snow Amount (inches)	Severity Index	Salt per LM per Severity Index	No. of Storms Events	No. of Incidents Reported	No.of Freezing Rains	No. of Anti-Ice Appl.
NC	PRICE	3	17	3	23	34	40%	5,240	133.4	160.0	0.10	51	33	3	6
	FLORENCE	6	58	12	76	0	100%	3,254	154.2	166.6	0.14	62	27	9	14
	FOREST	18	29	11	58	4	94%	7,617	154.7	187.3	0.13	59	43	4	3
	GREEN LAKE	0	3	35	38	3	93%	1,034	67.8	128.0	0.05	37	43	5	4
	IRON	0	41	22	63	6	91%	6,777	233.4	225.4	0.12	69	40	4	0
	LANGLADE	13	34	10	57	0	100%	3,671	107.2	155.7	0.08	43	32	16	14
	LINCOLN	1	41	11	53	10	84%	6,080	132.8	162.1	0.09	47	38	10	16
	MARATHON	24	9	4	37	26	59%	13,873	95.3	159.6	0.10	53	55	4	10
	MARQUETTE	1	29	9	39	1	98%	3,106	69.3	106.5	0.12	35	27	9	5
	MENOMINEE	5	14	1	20	21	49%	1,675	83.1	98.5	0.19	40	26	3	1
	PORTAGE	0	0	14	14	43	25%	6,405	88.7	156.8	0.07	55	27	10	2
	SHAWANO	12	23	5	40	12	77%	8,806	111.0	137.1	0.12	44	40	4	8
	VILAS	50	4	0	54	0	100%	8,755	176.0	138.0	0.21	53	29	0	1
	WAUPACA	12	20	5	37	3	93%	10,012	88.9	120.8	0.15	37	30	3	3
	WAUSHARA	0	0	0	0	49	0%	4,120	84.5	108.9	0.11	42	13	4	7
	WOOD	0	43	12	55	0	100%	7,117	96.9	152.2	0.11	46	30	8	9
	ADAMS	5	24	15	44	7	86%	2,760	64.0	129.1	0.11	39	17	15	12
	ONEIDA	5	55	6	66	0	100%	10,363	144.5	187.8	0.14	51	25	14	15
Region Average		8.6	24.7	9.7	43.0	12.2	77.1%	6,148.1	115.9	148.9	0.12	47.9	31.9	6.9	7.2

Table A-2. Weather Forecasting Service Usage

From Winter Storm Reports, 2013-2014

Region	County	Good	Fair	Poor	Times Used	Times Not Used	% of Events Used	Salt Used (tons)	Snow Amount (inches)	Severity Index	Salt per LM per Severity Index	No. of Storms Events	No. of Incidents Reported	No.of Freezing Rains	No. of Anti-Ice Appl.
Statewide Average		10.5	18.8	6.6	35.9	13.9	71.9%	9,302.9	101.5	133.6	0.14	43.2	31.6	5.1	6.7

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
NC	ADAMS	12	8	1	11	5	0	0	0	3,300	2,614	5,914
	FLORENCE	14	8	1	8	8	1	0	7,380	4,560	3,516	15,456
	FOREST	3	2	0	3	0	0	0	0	840	1,029	1,869
	GREEN LAKE	4	1	0	0	1	0	3	820	960	873	2,653
	LANGLADE	14	10	0	11	6	0	0	1,745	5,220	3,842	10,807
	LINCOLN	16	9	0	8	4	5	4	25,738	6,060	4,731	36,529
	MARATHON	10	0	0	0	0	6	4	3,662	6,180	5,049	14,891
	MARQUETTE	5	0	2	3	1	3	1	0	3,900	2,447	6,347
	MENOMINEE	1	0	0	1	0	0	0	0	60	123	183
	ONEIDA	15	5	1	9	7	4	0	0	10,560	7,126	17,686
	PORTAGE	2	0	0	0	0	2	0	0	1,680	1,515	3,195
	PRICE	6	0	0	0	0	0	6	0	1,680	1,167	2,847
	SHAWANO	8	0	0	0	0	0	8	3,485	1,980	1,421	6,886
	VILAS	1	1	0	0	0	0	0	21	180	129	330
	WAUPACA	3	0	0	0	0	0	3	195	1,080	742	2,017
	WAUSHARA	7	0	0	0	0	1	6	0	2,820	1,964	4,784
	WOOD	9	5	2	3	0	7	0	0	2,820	2,261	5,081

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
Region Total		130	49	7	57	32	29	35	43,045	53,880	40,550	137,476
Region Average		8	--	--	--	--	--	--	2,532	3,169	2,385	8,087

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
NE	BROWN	20	10	1	2	0	3	4	539	9,900	7,183	17,622
	CALUMET	3	2	0	1	1	1	0	364	840	475	1,679
	DOOR	8	2	3	0	0	2	1	3,876	3,180	2,398	9,454
	FOND DU LAC	13	0	0	0	0	0	13	1,708	8,580	6,201	16,489
	KEWAUNEE	8	0	0	0	0	0	8	0	1,980	1,498	3,478
	MANITOWOC	9	1	2	3	1	5	4	6,680	2,400	1,809	10,889
	MARINETTE	20	0	0	0	0	6	14	5,115	5,280	4,257	14,652
	OCONTO	26	0	0	1	1	0	25	280	16,800	12,803	29,883
	OUTAGAMIE	1	1	0	0	0	1	0	198	360	278	836
	SHEBOYGAN	13	1	3	5	5	6	0	4,335	8,580	6,700	19,615
	WINNEBAGO	2	0	0	0	0	1	1	3,200	1,200	1,955	6,355
Region Total		123	17	9	12	8	25	70	26,295	59,100	45,557	130,952
Region Average		11	--	--	--	--	--	--	2,390	5,373	4,142	11,905

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
NW	ASHLAND	2	0	0	0	0	1	1	546	900	577	2,023
	BARRON	3	0	0	0	0	0	3	488	2,280	819	3,587
	BAYFIELD	5	0	0	0	0	0	5	320	1,740	1,113	3,173
	BUFFALO	7	0	0	0	0	1	7	76	2,460	2,043	4,579
	BURNETT	8	0	0	1	0	4	3	751	2,520	1,892	5,163
	CLARK	3	0	0	0	0	2	1	183	1,320	936	2,439
	DOUGLAS	12	2	0	2	0	1	7	5,060	4,020	3,487	12,567
	DUNN	2	0	2	1	0	0	0	0	780	1,245	2,025
	EAU CLAIRE	3	0	0	0	0	0	3	554	3,360	650	4,563
	JACKSON	7	1	0	4	0	0	2	260	5,700	2,311	8,271
	PEPIN	2	0	0	0	0	0	2	0	720	648	1,368
	PIERCE	3	1	0	1	1	0	2	280	840	945	2,065
	POLK	1	0	1	0	0	0	0	70	120	159	349
	TAYLOR	9	3	1	2	1	1	4	273	3,480	4,379	8,132
	TREMPEALEAU	7	0	0	0	0	1	6	47	2,040	1,359	3,446
	WASHBURN	2	0	0	0	0	1	1	105	720	491	1,316
	WASHBURN	1	0	0	1	0	0	0	611	900	614	2,124

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
NW	WASHBURN	1	1	0	1	0	0	0	315	420	286	1,021
	WASHBURN	1	0	0	0	0	1	0	46	240	164	450
	WASHBURN	1	0	0	1	0	0	0	252	360	246	858
Region Total		80	8	4	14	2	13	47	10,236	34,920	24,364	69,520
Region Average		4	--	--	--	--	--	--	512	1,746	1,218	3,476

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
SE	KENOSHA	5	0	0	0	0	0	5	279	1,500	1,312	3,091
	MILWAUKEE	6	0	0	1	0	4	1	5,716	7,860	7,111	20,687
	OZAUKEE	1	0	1	0	0	0	0	105	960	713	1,778
	RACINE	1	0	0	0	0	0	1	40	360	281	681
	WALWORTH	5	0	0	0	0	1	4	2,546	2,520	2,062	7,128
	WASHINGTON	3	0	0	0	0	0	3	86	660	470	1,217
	WAUKESHA	3	0	0	1	0	2	0	414	1,800	1,276	3,490
Region Total		24	0	1	2	0	7	14	9,186	15,660	13,226	38,072
Region Average		3	--	--	--	--	--	--	1,312	2,237	1,889	5,439

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
SW	COLUMBIA	20	0	0	0	0	0	20	491	7,380	5,074	12,945
	CRAWFORD	3	0	1	0	0	0	2	49	1,080	725	1,854
	DANE	1	0	0	1	0	0	0	275	420	191	886
	DODGE	1	0	0	0	0	0	1	0	480	324	804
	GRANT	2	0	0	0	0	0	2	0	2,520	1,433	3,953
	GREEN	17	1	0	2	0	0	15	31	3,420	3,161	6,612
	IOWA	7	0	0	0	0	0	7	0	2,040	1,273	3,313
	JEFFERSON	2	0	0	0	0	0	2	600	720	491	1,811
	JUNEAU	6	0	0	0	0	0	6	559	2,040	1,876	4,475
	LA CROSSE	10	3	0	4	2	5	1	0	5,040	3,368	8,408
	LAFAYETTE	5	0	0	0	0	0	5	0	3,900	769	4,669
	MONROE	5	0	0	0	0	5	0	3,780	4,680	3,133	11,593
	RICHLAND	9	0	0	1	0	1	8	52	6,660	4,721	11,434
	ROCK	1	0	0	0	0	0	1	850	1,140	1,390	3,380
	SAUK	23	0	3	1	0	9	10	2,354	7,860	4,611	14,825
	VERNON	10	0	0	5	0	2	3	3,080	4,920	3,328	11,328

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
Region Total		122	4	4	14	2	22	83	12,121	54,300	35,868	102,290
Region Average		8	--	--	--	--	--	--	758	3,394	2,242	6,393

Table A.3. Anti-icing Details

From Winter Storm Reports, 2013-2014

Region	County	Anti-Icing applic.	What weather prediction caused you to anti-ice? Or did you do anti-icing on a routine schedule?						Estimated Costs			
			Wet Snow	Dry Snow	Frz Rain	Sleet	Frost	Routine	$ Mat'l	$ Equip	$ Labor	$ Total
Statewide Total		479	78	25	99	44	96	249	100,884	217,860	159,565	478,309

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Table A.4. Annual Anti-icing Agent Usage

From Winter Storm Reports, 2013-2014

Region	County	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB_M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M1000 (gal)	Caliber M2000 (gal)	BioMelt 64 (gal)	Geo-Melt (gal)	Ice Bite 55 (gal)
NC	ADAMS	0	21,350	0	0	0	0	0	0	0	0	0	0	0
	FLORENCE	0	49,200	0	0	0	0	0	0	0	0	0	0	0
	FOREST	600	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN LAKE	0	8,200	0	0	0	0	0	0	0	0	0	0	0
	IRON	0	0	0	0	0	0	0	0	0	0	0	0	0
	LANGLADE	0	17,450	0	0	0	0	0	0	0	0	0	0	0
	LINCOLN	0	128,689	0	0	0	0	0	0	0	0	0	0	0
	MARATHON	0	12,205	0	0	0	0	0	0	0	0	0	0	0
	MARQUETTE	0	23,350	0	0	0	0	0	0	0	0	0	0	0
	MENOMINEE	0	120	0	0	0	0	0	0	0	0	0	0	0
	ONEIDA	0	46,203	0	0	0	0	0	0	0	0	0	0	0
	PORTAGE	0	1,480	0	0	0	0	0	0	0	0	0	0	0
	PRICE	0	2,215	0	0	0	0	0	0	0	0	0	0	0
	SHAWANO	0	17,425	0	0	0	0	0	0	0	0	0	0	0
	VILAS	0	150	0	0	0	0	0	0	0	0	0	0	0
	WAUPACA	0	1,951	0	0	0	0	0	0	0	0	0	0	0
	WAUSHARA	0	6,075	0	0	0	0	0	0	0	0	0	0	0
	WOOD	0	16,250	0	0	0	0	0	0	0	0	0	0	0
Region Total		600	352,313	0	0	0	0	0	0	0	0	0	0	0

Table A.4. Annual Anti-icing Agent Usage

From Winter Storm Reports, 2013-2014

Region	County	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB_M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M1000 (gal)	Caliber M2000 (gal)	BioMelt 64 (gal)	Geo-Melt (gal)	Ice Bite 55 (gal)
NE	BROWN	0	53,890	0	0	0	0	0	0	0	0	0	0	0
	CALUMET	0	1,300	0	0	0	0	0	0	0	0	0	0	0
	DOOR	0	22,800	0	0	0	0	0	0	0	0	0	0	0
	FOND DU LAC	0	8,540	0	0	0	0	0	0	0	0	0	0	0
	KEWAUNEE	0	11,100	0	0	0	0	0	0	0	0	0	0	0
	MANITOWOC	0	33,400	0	0	0	0	0	0	0	0	0	0	0
	MARINETTE	0	51,150	0	0	0	0	0	0	0	0	0	0	0
	OCONTO	0	27,975	0	0	0	0	0	0	0	0	0	0	0
	OUTAGAMIE	0	1,100	0	0	0	0	0	0	0	0	0	0	0
	SHEBOYGAN	0	17,340	0	0	0	0	0	0	0	0	0	0	0
	WINNEBAGO	0	16,000	0	0	0	0	0	0	0	0	0	0	0
Region Total		0	244,595	0	0	0	0	0	0	0	0	0	0	0

Table A.4. Annual Anti-icing Agent Usage

From Winter Storm Reports, 2013-2014

Region	County	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB_M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M1000 (gal)	Caliber M2000 (gal)	BioMelt 64 (gal)	Geo-Melt (gal)	Ice Bite 55 (gal)
NW	ASHLAND	0	1,725	0	0	0	0	0	285	0	0	0	90	0
	BARRON	0	975	0	0	0	0	0	0	0	0	0	0	0
	BAYFIELD	0	2,465	0	0	0	0	0	0	0	0	0	0	0
	BUFFALO	0	7,600	0	0	0	0	0	0	0	0	0	0	0
	BURNETT	0	365	0	0	2,320	0	0	525	0	0	0	0	0
	CHIPPEWA	0	0	0	0	0	0	0	0	0	0	0	0	0
	CLARK	0	730	0	0	0	0	0	0	0	0	0	0	0
	DOUGLAS	0	0	0	0	5,750	0	0	0	0	0	0	0	0
	DUNN	0	300	0	0	0	0	0	0	0	0	0	0	0
	EAU CLAIRE	135	1,080	0	0	0	0	0	0	0	0	0	135	0
	JACKSON	0	5,200	1,325	0	0	0	0	0	0	0	0	0	0
	PEPIN	0	720	0	0	0	0	0	0	0	0	0	0	0
	PIERCE	0	1,400	0	0	0	0	0	0	0	0	0	0	0
	POLK	0	350	0	0	0	0	0	0	0	0	0	0	0
	RUSK	0	0	0	0	0	0	0	0	0	0	0	0	0
	SAINT CROIX	0	0	0	0	0	0	0	0	0	0	0	0	0
	SAWYER	0	0	0	0	0	0	0	0	0	0	0	0	0
	TAYLOR	0	3,035	0	0	0	0	0	0	0	0	0	0	0
	TREMPEALEAU	0	4,710	0	0	0	0	0	0	0	0	0	0	0
	WASHBURN	0	9,491	0	0	0	0	0	0	0	0	0	0	1,069
Region Total		135	40,146	1,325	0	8,070	0	0	810	0	0	0	225	1,069

Table A.4. Annual Anti-icing Agent Usage

From Winter Storm Reports, 2013-2014

Region	County	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB_M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M1000 (gal)	Caliber M2000 (gal)	BioMelt 64 (gal)	Geo-Melt (gal)	Ice Bite 55 (gal)
SE	KENOSHA	0	0	0	0	0	0	0	245	0	0	0	0	0
	MILWAUKEE	0	28,580	0	0	0	0	0	0	0	0	0	0	0
	OZAUKEE	0	700	0	0	0	0	0	0	0	0	0	0	0
	RACINE	0	400	0	0	0	0	0	0	0	0	0	0	0
	WALWORTH	0	12,125	0	0	0	0	0	0	0	0	0	0	0
	WASHINGTON	20	575	0	0	0	0	0	0	0	0	0	0	0
	WAUKESHA	0	8,270	0	0	0	0	0	0	0	0	0	280	0
Region Total		20	50,650	0	0	0	0	0	245	0	0	0	280	0

Table A.4. Annual Anti-icing Agent Usage

From Winter Storm Reports, 2013-2014

Region	County	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB_M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M1000 (gal)	Caliber M2000 (gal)	BioMelt 64 (gal)	Geo-Melt (gal)	Ice Bite 55 (gal)
SW	COLUMBIA	0	49,100	0	0	6,000	0	0	0	0	0	0	0	0
	CRAWFORD	0	4,900	0	0	0	0	0	0	0	0	0	0	0
	DANE	0	1,100	0	0	0	0	0	0	0	0	0	0	0
	DODGE	0	0	0	0	0	0	0	200	0	0	0	0	0
	GRANT	0	950	0	0	0	0	0	0	0	0	0	0	0
	GREEN	0	3,115	0	0	0	0	0	0	0	0	0	0	0
	IOWA	0	785	0	0	0	0	0	0	0	0	0	0	0
	JEFFERSON	0	2,400	0	0	0	0	0	0	0	0	0	0	0
	JUNEAU	0	5,200	0	0	0	0	0	0	0	0	0	25	0
	LA CROSSE	0	32,082	0	0	0	0	0	0	0	0	0	0	0
	LAFAYETTE	0	300	0	0	0	0	0	0	0	0	0	0	0
	MONROE	0	26,000	0	0	0	0	0	0	0	0	0	1,550	0
	RICHLAND	0	5,245	0	0	0	0	0	0	0	0	0	0	0
	ROCK	0	3,400	0	0	0	0	0	0	0	0	0	0	0
	SAUK	0	11,770	0	0	0	0	0	0	0	0	0	0	0
	VERNON	0	30,800	0	0	2,000	0	0	0	0	0	0	0	0
Region Total		0	177,147	0	0	8,000	0	0	200	0	0	0	1,575	0

Table A.4. Annual Anti-icing Agent Usage

From Winter Storm Reports, 2013-2014

Region	County	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB_M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M1000 (gal)	Caliber M2000 (gal)	BioMelt 64 (gal)	Geo-Melt (gal)	Ice Bite 55 (gal)
Grand Total		755	864,851	1,325	0	16,070	0	0	1,255	0	0	0	2,080	1,069

Table A-5. Actual Anti-icing Costs

FinaL billed costs from the WisDOT accounting system, October 2013 - April 2014
County charges to Activity Code #73 (Applying Liquid Anti-icing Agents)

		Cost to Apply Liquid Anti-Icing Chemicals	Total Billed Winter Maintenance Costs	Anti-Icing as a % of Winter Costs
SOUTHWEST REGION	Columbia	$19,024	$3,208,478	0.59%
	Crawford	$2,935	$886,394	0.33%
	Dane	$13,293	$7,592,466	0.18%
	Dodge	$5,095	$2,095,374	0.24%
	Grant	$4,913	$1,528,282	0.32%
	Green	$7,678	$628,646	1.22%
	Iowa	$2,742	$1,339,357	0.20%
	Jefferson	$4,714	$1,822,099	0.26%
	Juneau	$8,756	$1,339,062	0.65%
	La Crosse	$25,891	$1,480,608	1.75%
	Lafayette	$2,440	$877,237	0.28%
	Monroe	$16,407	$1,588,388	1.03%
	Richland	$6,894	$660,231	1.04%
	Rock	$3,033	$2,286,606	0.13%
	Sauk	$13,256	$1,800,337	0.74%
	Vernon	$10,509	$1,252,263	0.84%
	SW TOTAL	**$147,580**	**$30,385,828**	**0.49%**
SOUTHEAST REGION	Kenosha	$2,529	$2,250,893	0.11%
	Milwaukee	$32,726	$9,236,510	0.35%
	Ozaukee	$1,284	$1,248,684	0.10%
	Racine	$618	$2,778,974	0.02%
	Walworth	$4,401	$2,501,409	0.18%
	Washington	$1,943	$2,224,147	0.09%
	Waukesha	$16,979	$3,836,630	0.44%
	SE TOTAL	**$60,480**	**$24,077,246**	**0.25%**
NORTHEAST REGION	Brown	$32,086	$2,269,647	1.41%
	Calumet	$1,386	$522,542	0.27%
	Door	$4,782	$955,950	0.50%
	Fond du Lac	$12,384	$1,752,592	0.71%
	Kewanee	$3,390	$303,393	1.12%
	Manitowoc	$5,680	$1,319,731	0.43%
	Marinette	$10,256	$1,101,275	0.93%
	Oconto	$23,950	$1,267,488	1.89%
	Outagamie	$0	$1,858,656	0.00%
	Sheboygan	$10,149	$1,719,981	0.59%
	Winnebago	$5,707	$1,988,792	0.29%
	NE TOTAL	**$109,770**	**$15,060,046**	**0.73%**

Table A-5. Actual Anti-icing Costs

Final billed costs from the WisDOT accounting system, October 2013 - April 2014
County charges to Activity Code #73 (Applying Liquid Anti-icing Agents)

		Cost to Apply Liquid Anti-Icing Chemicals	Total Billed Winter Maintenance Costs	Anti-Icing as a % of Winter Costs
NORTH CENTRAL REGION	Adams	$4,964	$540,320	0.92%
	Florence	$9,869	$490,403	2.01%
	Forest	$1,380	$1,106,364	0.12%
	Green Lake	$1,649	$269,319	0.61%
	Iron	$0	$1,205,459	0.00%
	Langlade	$6,062	$723,497	0.84%
	Lincoln	$26,310	$1,287,331	2.04%
	Marathon	$9,670	$2,789,025	0.35%
	Marquette	$4,546	$465,304	0.98%
	Menominee	$53	$206,368	0.03%
	Oneida	$39,863	$1,633,888	2.44%
	Portage	$7,753	$1,701,765	0.46%
	Price	$3,261	$965,032	0.34%
	Shawano	$5,428	$1,507,581	0.36%
	Vilas	$1,117	$1,302,676	0.09%
	Waupaca	$14,573	$1,581,197	0.92%
	Waushara	$7,229	$718,278	1.01%
	Wood	$6,357	$1,194,099	0.53%
	NC TOTAL	**$150,084**	**$19,687,907**	**0.76%**
NORTHWEST REGION	Ashland	$5,127	$860,707	0.60%
	Barron	$700	$1,333,117	0.05%
	Bayfield	$2,581	$1,051,760	0.25%
	Buffalo	$5,333	$514,931	1.04%
	Burnett	$2,149	$734,755	0.29%
	Chippewa	$0	$2,430,442	0.00%
	Clark	$1,343	$1,034,121	0.13%
	Douglas	$23,660	$1,582,586	1.50%
	Dunn	$1,514	$1,797,898	0.08%
	Eau Claire	$29,822	$1,924,093	1.55%
	Jackson	$8,418	$1,439,642	0.58%
	Pepin	$926	$233,658	0.40%
	Pierce	$1,734	$1,038,874	0.17%
	Polk	$172	$1,313,708	0.01%
	Rusk	$0	$620,783	0.00%
	Sawyer	$165	$960,939	0.02%
	St. Croix	$146	$2,291,982	0.01%
	Taylor	$0	$688,399	0.00%
	Trempealeau	$13,889	$1,124,193	1.24%
	Washburn	$9,875	$1,285,654	0.77%
	NW TOTAL	**$107,554**	**$24,262,243**	**0.44%**
	STATEWIDE TOTAL	**$575,468**	**$113,473,270**	**0.51%**
	67 Out of 72 Counties (90%)			August 15, 2014

Table A-6. Salt Brine Use

From Winter Storm Reports, 2013-2014

REGION	GROUP	COUNTY	PREWETTING (GALLONS)	ANTI-ICING (GALLONS)	TOTAL (GALLONS)
SOUTHWEST	B	COLUMBIA	25,848	55,100	80,948
	C	CRAWFORD	40,166	4,900	45,066
	A	DANE	146,516	1,100	147,616
	B	DODGE	15,040	200	15,240
	C	GRANT	30,335	950	31,285
	D	GREEN	24,472	3,115	27,587
	C	IOWA	0	785	785
	B	JEFFERSON	133,292	2,400	135,692
	C	JUNEAU	21,836	5,225	27,061
	A	LA CROSSE	42,384	32,082	74,466
	C	LAFAYETTE	0	300	300
	C	MONROE	18,384	27,550	45,934
	D	RICHLAND	8,164	5,245	13,409
	B	ROCK	44,384	3,400	47,784
	B	SAUK	7,585	11,770	19,355
	C	VERNON	14,009	32,800	46,809
		TOTAL	**572,415**	**186,922**	**759,337**
SOUTHEAST	A	KENOSHA	7,936	245	8,181
	A	MILWAUKEE	124,664	28,580	153,244
	A	OZAUKEE	57,345	700	58,045
	A	RACINE	73,102	400	73,502
	B	WALWORTH	16,800	12,125	28,925
	B	WASHINGTON	90,414	595	91,009
	A	WAUKESHA	480,113	8,550	488,663
		TOTAL	**850,374**	**51,195**	**901,569**
NORTHEAST	A	BROWN	92,765	53,890	146,655
	C	CALUMET	5,767	1,300	7,067
	C	DOOR	18,355	22,800	41,155
	C	FOND DU LAC	59,051	8,540	67,591
	C	KEWAUNEE	9,040	11,100	20,140
	B	MANITOWOC	41,638	33,400	75,038
	D	MARINETTE	28,240	51,150	79,390
	C	OCONTO	29,230	27,975	57,205
	B	OUTAGAMIE	86,163	1,100	87,263
	B	SHEBOYGAN	148,074	17,340	165,414
	A	WINNEBAGO	169,611	1,600	171,211
		TOTAL	**687,934**	**230,195**	**918,129**

Table A-6. Salt Brine Use

From Winter Storm Reports, 2013-2014

REGION	GROUP	COUNTY	PREWETTING (GALLONS)	ANTI-ICING (GALLONS)	TOTAL (GALLONS)
NORTH CENTRAL	D	ADAMS	7,785	21,350	29,135
	D	FLORENCE	16,050	49,200	65,250
	D	FOREST	14,217	600	14,817
	D	GREEN LAKE	7,196	8,200	15,396
	D	IRON	31,855	0	31,855
	D	LANGLADE	36,837	17,450	54,287
	C	LINCOLN	95,275	128,689	223,964
	A	MARATHON	50,299	12,205	62,504
	B	MARQUETTE	11,492	23,350	34,842
	D	MENOMINEE	0	120	120
	B	ONEIDA	92,287	46,203	138,490
	A	PORTAGE	61,405	1,480	62,885
	D	PRICE	28,398	2,215	30,613
	B	SHAWANO	53,789	17,425	71,214
	C	VILAS	16,633	150	16,783
	C	WAUPACA	34,991	1,951	36,942
	B	WAUSHARA	12,891	6,075	18,966
	C	WOOD	16,955	16,250	33,205
		TOTAL	**588,355**	**352,913**	**941,268**
NORTHWEST	D	ASHLAND	28,059	2,010	30,069
	D	BARRON	61,936	975	62,911
	D	BAYFIELD	7,092	2,465	9,557
	D	BUFFALO	8,004	7,600	15,604
	D	BURNETT	18,330	3,210	21,540
	B	CHIPPEWA	300	0	300
	C	CLARK	2,865	730	3,595
	C	DOUGLAS	6,443	5,750	12,193
	B	DUNN	5,230	300	5,530
	A	EAU CLAIRE	25,088	1,215	26,303
	C	JACKSON	7,550	6,525	14,075
	D	PEPIN	2,828	720	3,548
	D	PIERCE	13,665	1,400	15,065
	D	POLK	39,537	350	39,887
	D	RUSK	385	0	385
	D	SAWYER	2,783	0	2,783
	B	ST. CROIX	37,962	0	37,962
	D	TAYLOR	54,885	3,035	57,920
	C	TREMPEALEAU	4,975	4,710	9,685
	C	WASHBURN	33,121	10,560	43,681
		TOTAL	**361,038**	**51,555**	**412,593**
		STATE TOTAL	**3,060,116**	**872,780**	**3,932,896**
		# OF COUNTIES	69	67	

PREVIOUS USE			
2013-2014	3,060,116	872,780	3,932,896
2012-2013	1,082,163	1,164,394	2,246,557
2010-2011	1,674,472	714,760	2,389,232
2009-2010	933,690	649,909	1,583,599
2008-2009	1,028,457	467,943	1,496,400
2007-2008	965,797	305,409	1,271,206
2006-2007	530,733	456,875	987,608
2005-2006	570,203	394,991	965,194
2004-2005	398,661	246,813	695,474
2003-2004	285,710	241,780	527,490
2002-2003	174,413	228,524	402,937
2001-2002	144,505	194,349	338,854
2000-2001	111,816	48,149	159,965

Table A.7. Annual Prewetting Agent Usage for Salt

From Winter Storm Reports, 2013-2014

Region	County	Salt (ton)	CaCl2 (ton)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite55 (gal)
NC	ADAMS	2,760	0	0	1,090	0	0	0	6,695	0	0	0	0	0	0
	FLORENCE	3,254	0	0	16,050	0	0	0	0	0	0	0	0	0	0
	FOREST	7,617	0	14,217	0	0	0	0	0	0	0	0	0	0	0
	GREEN LAKE	1,034	0	0	6,444	602	0	0	0	0	0	0	0	150	0
	IRON	6,777	0	0	31,855	0	0	0	0	0	0	0	0	0	0
	LANGLADE	3,671	0	0	36,585	0	0	252	0	0	0	0	0	0	0
	LINCOLN	6,080	0	0	57,270	0	0	630	0	0	0	0	0	0	0
	MARATHON	13,873	0	0	46,359	2,979	0	0	0	50	0	0	0	325	586
	MARQUETTE	3,106	0	0	7,226	0	0	0	0	0	4,266	0	0	0	0
	MENOMINEE	1,675	0	0	0	0	0	0	0	0	0	0	0	0	0
	ONEIDA	10,363	70	0	77,208	0	0	0	0	0	0	0	0	0	0
	PORTAGE	6,405	0	0	39,050	0	0	0	0	0	0	0	0	0	0
	PRICE	5,240	0	0	25,721	1,615	0	0	0	0	0	0	0	55	777
	SHAWANO	8,806	0	0	53,014	0	0	0	0	0	0	0	0	0	0
	VILAS	8,755	0	0	16,633	0	0	0	0	0	0	0	0	0	0
	WAUPACA	10,012	0	0	34,141	0	0	0	0	0	0	0	0	0	0
	WAUSHARA	4,120	0	2,385	10,351	0	0	0	155	0	0	0	0	0	0
	WOOD	7,117	0	0	16,910	0	0	0	0	0	0	0	0	0	0
Region Total		110,665	70	16,602	475,907	5,196	0	882	6,850	50	4,266	0	0	530	1,363

Table A.7. Annual Prewetting Agent Usage for Salt

From Winter Storm Reports, 2013-2014

Region	County	Salt (ton)	CaCl2 (ton)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite55 (gal)
NE	BROWN	11,193	0	0	92,765	0	0	0	0	0	0	0	0	0	0
	CALUMET	2,592	0	0	5,737	0	0	0	0	0	0	0	0	0	0
	DOOR	4,990	0	0	18,355	0	0	0	0	0	0	0	0	0	0
	FOND DU LAC	10,379	4	0	50,771	0	0	0	0	0	8,280	0	0	0	0
	KEWAUNEE	1,251	0	0	9,040	0	0	0	0	0	0	0	0	0	0
	MANITOWOC	7,560	0	0	41,638	0	0	0	0	0	0	0	0	0	0
	MARINETTE	5,367	0	0	27,885	0	0	385	0	0	0	0	0	0	0
	OCONTO	6,820	0	0	29,230	0	0	0	0	0	0	0	0	0	0
	OUTAGAMIE	9,793	0	0	86,163	0	0	0	0	0	0	0	0	0	0
	SHEBOYGAN	10,473	0	0	147,970	104	0	0	0	0	0	0	0	0	0
	WINNEBAGO	11,861	0	0	166,901	0	0	0	0	0	0	0	0	0	0
Region Total		82,279	5	0	676,455	104	0	385	0	0	8,280	0	0	0	0

Table A.7. Annual Prewetting Agent Usage for Salt

From Winter Storm Reports, 2013-2014

Region	County	Salt (ton)	CaCl2 (ton)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite55 (gal)
NW	ASHLAND	3,710	0	0	23,023	0	0	0	0	0	3,040	0	0	1,649	0
	BARRON	4,576	0	0	55,095	0	0	0	0	0	0	0	0	0	0
	BAYFIELD	5,688	0	0	7,092	0	0	0	0	0	0	0	0	0	0
	BUFFALO	2,130	0	0	8,004	0	0	0	0	0	0	0	0	0	0
	BURNETT	3,662	0	0	3,820	0	0	8,210	0	0	3,280	0	0	0	0
	CHIPPEWA	13,937	0	300	0	0	0	0	0	0	0	0	0	0	0
	CLARK	5,455	0	230	2,635	0	0	0	0	0	0	0	0	0	0
	DOUGLAS	9,590	0	0	0	0	0	6,443	0	0	0	0	0	0	0
	DUNN	11,418	0	0	0	0	0	0	0	0	0	0	0	5,230	0
	EAU CLAIRE	10,122	0	20,668	3,904	0	0	0	0	0	0	0	0	516	0
	JACKSON	8,941	0	0	0	7,550	0	0	0	0	0	0	0	0	0
	PEPIN	968	0	0	0	2,828	0	0	0	0	0	0	0	0	0
	PIERCE	5,144	0	2,760	10,905	0	0	0	0	0	0	0	0	0	0
	POLK	7,590	0	0	28,973	0	0	8,756	0	0	1,808	0	0	0	0
	RUSK	3,077	0	0	0	0	0	0	0	0	385	0	0	0	0
	SAINT CROIX	13,811	0	36,147	0	0	0	0	0	0	0	0	0	1,815	0
	SAWYER	5,404	0	0	0	0	0	0	0	0	2,783	0	0	0	0
	TAYLOR	3,056	0	0	58,820	0	0	2,065	0	0	0	0	0	0	0
	TREMPEALEA	6,496	0	0	2,070	2,205	0	650	0	0	50	0	0	0	0
	WASHBURN	7,732	0	0	27,294	0	0	0	0	0	0	0	0	0	3,826
Region Total		132,507	0	60,105	231,635	12,583	0	26,124	0	0	11,346	0	0	9,210	3,826

Table A.7. Annual Prewetting Agent Usage for Salt

From Winter Storm Reports, 2013-2014

Region	County	Salt (ton)	CaCl2 (ton)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite55 (gal)
SE	KENOSHA	13,267	0	0	0	0	0	0	0	0	5,811	0	0	0	2,125
	MILWAUKEE	54,921	63	92,264	32,400	0	0	0	0	0	0	0	0	0	0
	OZAUKEE	9,910	2	20,200	37,145	0	0	0	0	0	0	0	0	0	0
	RACINE	18,694	0	19,644	53,458	0	0	0	0	0	0	0	0	0	0
	WALWORTH	16,462	0	0	16,800	0	0	0	0	0	0	0	0	0	0
	WASHINGTON	16,167	70	0	90,414	0	0	0	0	0	0	0	0	0	0
	WAUKESHA	25,115	0	16,914	314,875	0	0	0	0	0	0	0	0	148,324	0
Region Total		154,536	135	149,022	545,092	0	0	0	0	0	5,811	0	0	148,324	2,125

Table A.7. Annual Prewetting Agent Usage for Salt

From Winter Storm Reports, 2013-2014

Region	County	Salt (ton)	CaCl2 (ton)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite55 (gal)
SW	COLUMBIA	22,997	0	0	22,610	0	0	3,210	0	0	28	0	0	0	0
	CRAWFORD	4,564	0	0	31,080	0	0	0	0	0	0	0	0	0	0
	DANE	53,531	0	0	146,516	0	0	0	0	0	0	0	0	0	0
	DODGE	15,113	0	0	12,080	0	0	0	0	0	0	0	2,960	0	0
	GRANT	9,074	0	0	30,335	0	0	0	0	0	0	0	0	0	0
	GREEN	2,120	0	0	20,484	0	0	0	0	0	0	0	0	0	0
	IOWA	6,586	0	0	0	0	0	0	0	0	0	0	0	0	0
	JEFFERSON	11,883	0	0	126,295	0	0	0	6,994	0	0	0	0	0	0
	JUNEAU	8,298	0	0	21,851	0	0	180	0	0	160	0	0	6,872	0
	LA CROSSE	8,325	0	0	42,384	0	0	0	0	0	0	0	0	0	0
	LAFAYETTE	2,026	0	0	0	0	0	0	0	0	0	0	0	0	0
	MONROE	10,100	0	0	16,040	0	0	0	0	0	0	0	0	2,344	0
	RICHLAND	3,273	0	0	8,164	0	0	180	0	0	0	0	0	0	0
	ROCK	13,250	0	0	43,874	0	0	0	0	0	0	0	0	0	0
	SAUK	11,714	0	0	7,585	0	0	0	0	0	0	0	0	0	0
	VERNON	6,966	0	0	10,135	305	0	1,602	0	0	740	0	0	0	325
Region Total		189,820	0	0	539,433	305	0	5,172	6,994	0	928	0	2,960	9,216	325

Table A.7. Annual Prewetting Agent Usage for Salt

From Winter Storm Reports, 2013-2014

Region	County	Salt (ton)	CaCl2 (ton)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	Freeze Guard (gal)	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite55 (gal)
Statewide Total		669,807	210	225,729	2,468,522	18,188	0	32,563	13,844	50	30,631	0	2,960	######	7,639

Table A.8. Annual Abrasives and Prewetting Agent Usage for Abrasives

From Winter Storm Reports, 2013-2014

Region	County	Sand (CY)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	FreezeGard Guard	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite (gal)
NC	ADAMS	33	0	0	0	0	0	0	0	0	0	0	0	0
	FLORENCE	152	0	0	0	0	0	0	0	0	0	0	0	0
	FOREST	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN LAKE	0	0	0	0	0	0	0	0	0	0	0	0	0
	IRON	976	0	0	0	0	0	0	0	0	0	0	0	0
	LANGLADE	102	0	0	0	0	0	0	0	0	0	0	0	0
	LINCOLN	3,874	0	37,735	0	0	0	0	0	0	0	0	0	0
	MARATHON	485	0	0	0	0	0	0	0	0	0	0	0	0
	MARQUETTE	0	0	0	0	0	0	0	0	0	0	0	0	0
	MENOMINEE	245	0	0	0	0	0	0	0	0	0	0	0	0
	ONEIDA	2,547	0	15,079	0	0	0	0	0	0	0	0	0	0
	PORTAGE	3,643	0	22,355	0	0	0	0	0	0	0	0	0	0
	PRICE	669	0	230	0	0	0	0	0	0	0	0	0	0
	SHAWANO	1,380	0	775	0	0	0	0	0	0	0	0	0	0
	VILAS	2,172	0	0	0	0	0	0	0	0	0	0	0	0
	WAUPACA	184	0	850	0	0	0	0	0	0	0	0	0	0
	WAUSHARA	50	0	0	0	0	0	0	0	0	0	0	0	0
	WOOD	814	0	45	0	0	0	0	0	0	0	0	0	0
Region Total		17,326	0	77,069	0	0	0	0	0	0	0	0	0	0

Table A.8. Annual Abrasives and Prewetting Agent Usage for Abrasives

From Winter Storm Reports, 2013-2014

Region	County	Sand (CY)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	FreezeGard Guard	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite (gal)
NE	BROWN	297	0	0	0	0	0	0	0	0	0	0	0	0
	CALUMET	0	0	30	0	0	0	0	0	0	0	0	0	0
	DOOR	180	0	0	0	0	0	0	0	0	0	0	0	0
	FOND DU LAC	288	0	0	0	0	0	0	0	0	0	0	0	0
	KEWAUNEE	326	0	0	0	0	0	0	0	0	0	0	0	0
	MANITOWOC	0	0	0	0	0	0	0	0	0	0	0	0	0
	MARINETTE	1,639	0	0	0	0	0	0	0	0	0	0	0	0
	OCONTO	0	0	0	0	0	0	0	0	0	0	0	0	0
	OUTAGAMIE	210	0	0	0	0	0	0	0	0	0	0	0	0
	SHEBOYGAN	0	0	0	0	0	0	0	0	0	0	0	0	0
	WINNEBAGO	21	0	2,710	0	0	0	0	0	0	0	0	0	0
Region Total		2,961	0	2,740	0	0	0	0	0	0	0	0	0	0

Table A.8. Annual Abrasives and Prewetting Agent Usage for Abrasives

From Winter Storm Reports, 2013-2014

Region	County	Sand (CY)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	FreezeGard Guard	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite (gal)
NW	ASHLAND	308	0	286	0	0	0	0	0	39	0	0	22	0
	BARRON	1,879	0	6,841	0	0	0	0	0	0	0	0	0	0
	BAYFIELD	457	0	0	0	0	0	0	0	0	0	0	0	0
	BUFFALO	191	0	0	0	0	0	0	0	0	0	0	0	0
	BURNETT	334	0	500	0	0	2,520	0	0	0	0	0	0	0
	CHIPPEWA	3,186	0	0	0	0	0	0	0	0	0	0	0	0
	CLARK	16	0	0	0	0	0	0	0	0	0	0	0	0
	DOUGLAS	387	0	0	0	0	0	0	0	0	0	0	0	0
	DUNN	628	0	0	0	0	0	0	0	0	0	0	0	0
	EAU CLAIRE	1,024	0	0	0	0	0	0	0	0	0	0	0	0
	JACKSON	305	0	0	0	0	0	0	0	0	0	0	0	0
	PEPIN	283	0	0	0	0	0	0	0	0	0	0	0	0
	PIERCE	1,327	0	0	0	0	0	0	0	0	0	0	0	0
	POLK	1,273	0	0	0	0	0	0	0	0	0	0	0	0
	RUSK	804	0	0	0	0	0	0	0	0	0	0	0	0
	SAINT CROIX	1,421	0	0	0	0	0	0	0	0	0	0	0	0
	SAWYER	794	0	0	0	0	0	0	0	0	0	0	0	0
	TAYLOR	994	0	0	0	0	0	0	0	0	0	0	0	0
	TREMPEALEAU	1,837	0	0	0	0	0	0	0	0	0	0	0	0
	WASHBURN	565	0	926	0	0	0	0	0	0	0	0	0	1,075
Region Total		18,013	0	8,553	0	0	2,520	0	0	39	0	0	22	1,075

Table A.8. Annual Abrasives and Prewetting Agent Usage for Abrasives

From Winter Storm Reports, 2013-2014

Region	County	Sand (CY)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	FreezeGard Guard	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite (gal)
SE	KENOSHA	48	0	0	0	0	0	0	0	0	0	0	0	0
	MILWAUKEE	107	0	0	0	0	0	0	0	0	0	0	0	0
	OZAUKEE	0	0	0	0	0	0	0	0	0	0	0	0	0
	RACINE	154	0	0	0	0	0	0	0	0	0	0	0	0
	WALWORTH	1,449	0	0	0	0	0	0	0	0	0	0	0	0
	WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0
	WAUKESHA	582	0	0	0	0	0	0	0	0	0	0	0	0
Region Total		2,340	0	0	0	0	0	0	0	0	0	0	0	0

Table A.8. Annual Abrasives and Prewetting Agent Usage for Abrasives

From Winter Storm Reports, 2013-2014

Region	County	Sand (CY)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	FreezeGard Guard	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite (gal)
SW	COLUMBIA	1,710	0	0	0	0	0	0	0	0	0	0	0	0
	CRAWFORD	1,859	0	8,961	0	0	125	0	0	0	0	0	0	0
	DANE	1,186	0	0	0	0	0	0	0	0	0	0	0	0
	DODGE	0	0	0	0	0	0	0	0	0	0	0	0	0
	GRANT	2,892	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN	514	0	3,988	0	0	0	0	0	0	0	0	0	0
	IOWA	84	0	0	0	0	0	0	0	0	0	0	0	0
	JEFFERSON	5	0	3	0	0	0	0	0	0	0	0	0	0
	JUNEAU	397	0	344	0	0	0	0	0	0	0	0	108	0
	LA CROSSE	1,097	0	0	0	0	0	0	0	0	0	0	0	0
	LAFAYETTE	3,411	0	0	0	0	0	0	0	0	0	0	0	0
	MONROE	350	0	0	0	0	0	0	0	0	0	0	0	0
	RICHLAND	541	0	0	0	0	0	0	0	0	0	0	0	0
	ROCK	1,536	0	510	0	0	0	0	0	0	0	0	0	0
	SAUK	140	0	0	0	0	0	0	0	0	0	0	0	0
	VERNON	2,508	0	795	0	0	35	0	0	72	0	0	0	0
Region Total		18,230	0	14,601	0	0	160	0	0	72	0	0	108	0

Table A.8. Annual Abrasives and Prewetting Agent Usage for Abrasives

From Winter Storm Reports, 2013-2014

Region	County	Sand (CY)	CaCl2 (gal)	NaCl Brine (gal)	MgCl2 (gal)	IB-M80 (gal)	FreezeGard Guard	CaCl2 DOW (gal)	Arctic Clear Gold	MC95 (gal)	Caliber M2000 (gal)	BioMelt64 (gal)	Geo Melt (gal)	Ice Bite (gal)
Statewide Total		58,870	0	102,963	0	0	2,680	0	0	111	0	0	130	1,075

Table A-9. History of Salt Use on State Trunk Highways

From Salt Inventory Reporting System

Winter	Tons of Salt	Lane Miles	Tons/Lane Mile	Million Vehicle Miles Traveled STH System (Winter)
1959/60	93,673	19,521	4.8	8,828
1960/61	54,805	19,948	2.7	9,254
1961/62	109,412	19,966	5.5	9,558
1962/63	77,719	19,756	3.9	9,782
1963/64	82,033	19,717	4.2	10,064
1964/65	149,329	19,911	7.5	10,566
1965/66	111,634	19,505	5.7	11,122
1966/67	181,230	20,137	8.0	11,933
1967/68	137,729	22,395	6.2	12,140
1968/69	193,004	22,675	8.5	12,870
1969/70	199,353	22,831	8.7	13,853
1970/71	273,010	23,120	11.8	15,133
1971/72	223,249	25,543	8.7	14,325
1972/73	256,571	25,673	10.0	15,301
1973/74	218,189	N/A	N/A	16,198
1974/75	237,916	N/A	N/A	15,807
1975/76	257,154	N/A	N/A	16,198
1976/77	188,011	N/A	N/A	18,556
1977/78	210,054	N/A	N/A	19,621
1978/79	235,193	N/A	N/A	21,053
1979/80	220,180	N/A	N/A	20,403
1980/81	151,021	N/A	N/A	19,360
1981/82	192,740	N/A	N/A	20,210
1982/83	234,529	27,407	8.6	20,056
1983/84	224,368	27,416	8.2	20,873
1984/85	217,136	27,598	7.9	21,214
1985/86	304,296	27,632	11.0	22,110
1986/87	196,035	27,613	7.1	23,176
1987/88	224,573	27,743	8.1	24,346
1988/89	230,403	27,872	8.3	24,550
1989/90	297,004	28,024	10.6	25,370
1990/91	364,174	28,006	13.0	26,247
1991/92	337,079*	28,104	12.0*	27,391
1992/93	416,594*	28,182	14.8*	28,252
1993/94	314,489*	28,221	11.1*	28,859
1994/95	295,479*	28,312	10.4*	29,210
1995/96	440,488*	28,374	15.5	30,077
1996/97	509,147*	28,545	17.8*	31,122
1997/98	413,824*	29,619	14.0*	32,083
1998/99	371,602	30,119	12.4	33,236
1999/00	346,963*	30,340	11.4*	33,825
2000/01	521,056	30,553	17.1	34,657
2001/02	308,954	30,909	10.0	34,076
2002/03	328,922	30,975	10.6	35,088
2003/04	390,664	31,429	12.4	35,662
2004/05	407,924	31,810	12.8	36,013
2005/06	410,570	33,022	12.4	35,642
2006/07	405,793	33,221	12.2	27,911
2007/08	644,484	33,297	19.4	27,931
2008/09	569,985	33,531	17.0	26,888
2009/10	408,523	33,532	12.2	26,109
2010/11	573,253	33,776	17.0	26,998
2011/12	355,519	33,944	10.5	25,669
2012/13	621,207	34,192	18.2	26,512
2013/14	669,807	34,339	19.5	26,774

* Quantities adjusted

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