ANNUAL WINTER MAINTENANCE REPORT

2007-2008

A Record-Setting Winter

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

November 2008

Acknowledgments

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

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1 Introduction

To our partners

The 2007-2008 winter was a harsh one in Wisconsin, with the northern counties contending with typically high snowfall and many cities in the traditionally milder south experiencing record snowfall that rivaled their northern neighbors. As county highway departments battled back-to-back storms, they faced challenges on several fronts: salt shortages that led to record sand use and supplemental salt purchases at higher prices, below-normal temperatures that made salt work less efficiently, and rising fuel prices that increased the cost of plowing, salting and transporting salt.

County maintenance crews put in long hours this winter to keep state roadways clear, and we commend them for their efforts. In addition to plowing and salting, counties responded with proactive anti-icing applications, prewetting salt, and use of state-of-the-art products and equipment. 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 8) highlights statewide facts and figures, while **Winter in Wisconsin** (page 15) 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 new maps that compare key data for this winter with the previous five years. These maps visually put each county's experience with **winter severity** (page 29), **salt use** (page 53) and **total costs** (page 87) in the context of what's normal for that county.

- **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, prewetting, and use of Road Weather Information 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.state.wi.us.

Sincerely,

David Vieth, Director
Bureau of Highway Operations

Table 1.1. Statewide Summary: This Winter by the Numbers

From multiple sources, 2007-2008

Infrastructure	Lane miles	33,297 miles
	Patrol sections	768
	Average patrol section length	43.36 lane miles
Materials[1]	Salt used	644,485 tons 19.4 tons per lane mile
	Average cost of salt	$41.69 per ton
	Prewetting liquid used	1,293,655 gal.
	Anti-icing agents used	331,179 gal.
	Sand used	80,133 cubic yd.
Costs, Equipment and Performance	Total winter costs[2]	$86,287,363
	Total winter costs per lane mile	$2,591
	Average crew reaction time from start of storm	2.66 hours
	Time to bare/wet pavement (measured from end of storm)	3.27 hours
	Road Weather Information System (RWIS) stations	59
	Counties with salt spreaders equipped with on-board prewetting unit	52 of 72 (72%)
	Counties with salt spreaders equipped with ground-speed controller unit	67 of 72 (93%)
	Underbody plows	565
	Counties with underbody plows	55 of 72 (76%)
	Counties equipped to use anti-icing agents	65 of 72 (90%)
	Counties that used anti-icing agents during 2007-08 winter season	52 of 72 (72%)
Labor and Services	Regular county winter labor hours[3]	178,682 hrs.
	Overtime county winter labor hours	199,835 hrs.
	Public service announcements aired	6,786 total 6,109 radio; 677 TV
	Cost of public service announcements	$35,000 ($301,463 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 reflect 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 Operations 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.

Report Structure and Data Sources

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

Section 2: Weather
Section 3: Snow and Ice Control
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 Service Group (Groups A, B, C and D), which reflect 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 11 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 counties 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 Operations, in partnership with the five WisDOT regional offices, is responsible for the maintenance of the state trunk highway system. The state trunk highway system includes 33,297 lane miles of highway and 5,017 bridges.

WisDOT contracts with the state's 72 county highway departments to plow and provide ice control on all state- and U.S.-owned highways in Wisconsin, including the Interstate system. This partnership was set up more than 90 years ago, and to our knowledge, it is unique in 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 purchases and having crews or equipment sitting idle.

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

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	2,863	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.	3,199	10%
3	All other four-lane highways (ADT < 25,000)	8,202	25%
4	Most high volume two-lane highways (ADT ≥ 5,000) and some 2-lanes (ADT <5000)	4,933	15%
5	All other two-lane highways	14,100	42%
Total		**33,297**	

Note: Percentage totals exceed 100% due to rounding.

lower-volume roads receive 18-hour coverage. On lower-volume four-lane highways, the passing lanes may receive less attention than the driving lanes and ramps.

Table 1.2 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 2008 map on page 105 in the Appendix.

To facilitate comparisons between counties that provide similar levels of service, WisDOT divides the 72 counties into four Winter Service Groups—A, B, C and D, with A being the most urban and D being the most rural. Table 1.3 explains the divisions between the groups. In many tables throughout this report, the counties are arranged according to these groups. Group A contains the fewest counties, while Group D has the most.

Table 1.3. County Winter Service Groups

Winter Service Group	Definition	Number of Counties	% of Counties
A	Counties where all or most of the highways receive 24-hour coverage	12	17%
B	Counties with 18-hour and 24-hour coverage. More than 50% of highways receive 24-hour coverage.	17	24%
C	Counties with 18-hour and 24-hour coverage. Less than 50% of highways receive 24-hour coverage.	21	29%
D	Counties where no highways receive 24-hour coverage.	22	31%

Note: Percentage totals exceed 100% due to rounding.

Table 1.4 shows which service group each county is assigned to.

Table 1.4. Winter Service Group Assignments

Winter Service Group	County Name
A	Brown, Dane, Eau Claire, Kenosha, La Crosse, Marathon, Milwaukee, Ozaukee, Portage, Racine, Waukesha, Winnebago
B	Chippewa, Columbia, Dodge, Dunn, Jefferson, Manitowoc, Marquette, Oneida, Outagamie, Rock, Sauk, Shawano, Sheboygan, St. Croix, Walworth, Washington, Waushara
C	Calumet, Clark, Crawford, Door, Douglas, Fond du Lac, Grant, Iowa, Jackson, Juneau, Kewaunee, Lafayette, Lincoln, Monroe, Oconto, Trempealeau, Vernon, Vilas, Washburn, Waupaca, Wood
D	Adams, Ashland, Barron, Bayfield, Buffalo, Burnett, Florence, Forest, Green, Green Lake, Iron, Langlade, Marinette, Menominee, Pepin, Pierce, Polk, Price, Richland, Rusk, Sawyer, Taylor

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 768 patrol sections on state-maintained highways, with an average of 43 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.

This Winter in Wisconsin

Table 1.5 on pages 15-19 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 106 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, 2007-2008													
	County	Winter service group	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used 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	D	192.09	42.11	109.1	3,684	19.18	0.46	$186,521	$971	$527,004	$2,744	$65.15
	Florence	D	141.07	43.00	128.6	2,805	19.88	0.46	$129,956	$921	$333,503	$2,364	$54.98
	Forest	D	312.38	41.90	122.8	6,706	21.47	0.51	$310,604	$994	$828,012	$2,651	$63.26
	Green Lake	D	151.30	32.74	129.0	1,819	12.02	0.37	$74,252	$491	$287,581	$1,901	$58.06
	Iron	D	250.91	58.90	217.2	5,233	20.86	0.35	$245,218	$977	$826,687	$3,295	$55.94
	Langlade	D	292.69	43.82	111.3	5,236	17.89	0.41	$219,879	$751	$785,294	$2,683	$61.23
	Lincoln	C	418.33	42.54	103.3	4,764	11.39	0.27	$210,855	$504	$889,822	$2,127	$50.00
	Marathon	A	869.61	45.31	85.8	13,143	15.11	0.33	$560,680	$645	$1,918,643	$2,206	$48.69
	Marquette	B	243.77	34.44	116.4	4,800	19.69	0.57	$211,200	$866	$601,653	$2,468	$71.66
	Menominee	D	90.26	33.63	102.5	1,752	19.41	0.58	$62,757	$695	$153,928	$1,705	$50.71
	Oneida	B	389.73	55.48	110.7	7,449	19.11	0.34	$342,887	$880	$1,145,128	$2,938	$52.96
	Portage	A	504.28	37.05	100.1	7,836	15.54	0.42	$331,306	$657	$1,211,277	$2,402	$64.83
	Price	D	320.57	50.42	94.2	5,168	16.12	0.32	$256,168	$799	$710,639	$2,217	$43.97
	Shawano	B	509.14	40.33	105.9	6,662	13.08	0.32	$238,494	$468	$1,038,108	$2,039	$50.56
	Vilas	C	305.24	39.28	121.6	6,867	22.50	0.57	$332,169	$1,088	$895,785	$2,935	$74.71
	Waupaca	C	541.92	31.86	102.6	7,810	14.41	0.45	$300,060	$554	$1,196,865	$2,209	$69.32
	Waushara	B	345.71	31.78	107.3	4,126	11.93	0.38	$178,697	$517	$684,476	$1,980	$62.30
	Wood	C	362.92	37.69	99.8	4,976	13.71	0.36	$234,421	$646	$778,199	$2,144	$56.89
Region total			**6,241.92**			**100,836**			**$4,426,124**		**$14,812,604**		
Region average			**346.77**	**41.24**	**114.9**	**5602**	**16.15**	**0.39**	**$245,896**	**$709**	**$822,922**	**$2,373**	**$57.55**
Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data are taken from WisDOT's Salt Inventory Reporting System.													

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Northeast Region													
	Brown	A	712.86	37.74	102.9	14,294	20.05	0.53	$427,519	$600	$2,000,319	$2,806	$74.35
	Calumet	C	200.86	41.71	95.6	2,564	12.77	0.31	$87,202	$434	$515,467	$2,566	$61.53
	Door	C	251.87	38.54	84.5	3,449	13.69	0.36	$124,474	$494	$652,911	$2,592	$67.26
	Fond du Lac	C	579.80	40.43	90.0	10,169	17.54	0.43	$399,542	$689	$1,534,730	$2,647	$65.47
	Kewaunee	C	110.41	33.35	83.6	1,369	12.40	0.37	$50,776	$460	$274,871	$2,490	$74.65
	Manitowoc	B	415.29	34.00	98.1	7,864	18.94	0.56	$274,619	$661	$1,168,256	$2,813	$82.74
	Marinette	D	372.18	38.48	108.5	5,641	15.16	0.39	$216,332	$581	$727,933	$1,956	$50.83
	Oconto	C	425.43	39.77	105.5	5,826	13.69	0.34	$206,182	$485	$816,203	$1,919	$48.24
	Outagamie	B	506.23	33.57	91.2	11,051	21.83	0.65	$376,831	$744	$1,555,356	$3,072	$91.52
	Sheboygan	B	518.90	35.07	117.8	10,125	19.51	0.56	$393,268	$758	$1,323,115	$2,550	$72.71
	Winnebago	A	549.02	40.16	98.6	10,094	18.39	0.46	$372,964	$679	$1,587,049	$2,891	$71.98
Region total			**4,642.85**			**82,446**			**$2,929,710**		**$12,156,211**		
Region average			**422.08**	**37.53**	**97.8**	**7495**	**17.76**	**0.47**	**$266,337**	**$631**	**$1,105,110**	**$2,618**	**$69.77**
Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data are taken from WisDOT's Salt Inventory Reporting System.													

Table 1.5. Winter in Wisconsin, 2007-2008													
	County	Winter service group	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used 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	D	247.57	54.54	187.7	2,558	10.33	0.19	$107,922	$436	$503,317	$2,033	$37.28
	Barron	D	422.39	35.58	80.7	2,207	5.23	0.15	$97,969	$232	$747,921	$1,771	$49.77
	Bayfield	D	316.90	55.32	158.4	4,105	12.95	0.23	$157,635	$497	$620,455	$1,958	$35.39
	Buffalo	D	315.77	34.08	62.9	2,098	6.64	0.19	$87,612	$277	$379,965	$1,203	$35.31
	Burnett	D	233.64	33.75	71.8	2,864	12.26	0.36	$114,997	$492	$370,556	$1,586	$46.99
	Chippewa	B	667.85	26.36	86.0	6,726	10.07	0.38	$403,275	$604	$1,344,070	$2,013	$76.35
	Clark	C	402.28	29.40	86.8	5,018	12.47	0.42	$281,200	$699	$768,206	$1,910	$64.95
	Douglas	C	439.23	42.14	158.1	5,782	13.16	0.31	$218,906	$498	$853,352	$1,943	$46.10
	Dunn	B	516.55	25.70	66.9	8,416	16.29	0.63	$424,572	$822	$1,206,997	$2,337	$90.92
	Eau Claire	A	555.74	26.71	76.4	8,841	15.91	0.60	$460,541	$829	$1,327,956	$2,390	$89.46
	Jackson	C	504.10	33.37	114.0	8,603	17.07	0.51	$400,794	$795	$1,044,017	$2,071	$62.06
	Pepin	D	110.91	26.23	56.3	1,014	9.14	0.35	$44,221	$399	$182,990	$1,650	$62.90
	Pierce	D	364.82	35.60	70.4	4,385	12.02	0.34	$212,250	$582	$713,058	$1,955	$54.90
	Polk	D	385.05	43.94	90.5	5,099	13.24	0.30	$247,927	$644	$744,674	$1,934	$44.01
	Rusk	D	213.47	36.50	110.8	1,850	8.67	0.24	$89,855	$421	$315,988	$1,480	$40.55
	St. Croix	B	616.98	36.43	70.9	9,482	15.37	0.42	$470,686	$763	$1,281,683	$2,077	$57.02
	Sawyer	D	367.44	34.72	94.0	3,242	8.82	0.25	$143,642	$391	$464,856	$1,265	$36.44
	Taylor	D	234.37	33.93	80.4	2,706	11.55	0.34	$143,247	$611	$377,113	$1,609	$47.42
	Trempealeau	C	431.24	32.41	70.4	6,175	14.32	0.44	$266,841	$619	$817,705	$1,896	$58.51
	Washburn	C	372.14	36.37	95.3	7,709	20.72	0.57	$309,577	$832	$706,962	$1,900	$52.23
Region total			**7,718.44**			**98,880**			**$4,683,671**		**$14,771,843**		
Region average			**385.92**	**35.65**	**94.4**	**4944**	**12.31**	**0.35**	**$234,184**	**$607**	**$738,592**	**$1,914**	**$53.68**
Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data are taken from WisDOT's Salt Inventory Reporting System.													

Table 1.5. Winter in Wisconsin, 2007-2008													
	County	Winter service group	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used 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	A	553.35	34.92	134.0	12,108	21.88	0.63	$410,352	$742	$1,679,112	$3,034	$86.90
	Milwaukee	A	1789.02	35.42	97.0	55,279	30.90	0.87	$1,887,237	$1,055	$5,975,109	$3,340	$94.29
	Ozaukee	A	304.03	35.81	112.2	8,183	26.92	0.75	$274,290	$902	$978,942	$3,220	$89.92
	Racine	A	587.21	35.07	124.9	16,283	27.73	0.79	$589,768	$1,004	$2,001,856	$3,409	$97.21
	Walworth	B	689.25	32.53	109.2	19,024	27.60	0.85	$663,188	$962	$2,123,276	$3,081	$94.70
	Washington	B	580.03	42.20	124.4	13,628	23.50	0.56	$547,709	$944	$1,784,485	$3,077	$72.90
	Waukesha	A	1055.27	33.06	111.7	41,673	39.49	1.19	$1,516,074	$1,437	$3,426,048	$3,247	$98.20
Region total			**5,558.16**			**166,178**			**$5,888,619**		**$17,968,829**		
Region average			**794.02**	**35.57**	**116.2**	**23740**	**29.90**	**0.84**	**$841,231**	**$1,059**	**$2,566,976**	**$3,233**	**$90.88**
Sources: Cost data are final billed costs as billed to WisDOT by the counties. Salt data are taken from WisDOT's Salt Inventory Reporting System.													

Table 1.5. Winter in Wisconsin, 2007-2008

	County	Winter service group	Lane miles	Severity Index	Snowfall (inches)	Total salt used (tons)	Salt used (tons) per lane mile	Salt used 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	B	745.80	36.86	145.3	21,965	29.45	0.80	$1,059,369	$1,420	$3,114,320	$4,176	$113.29
	Crawford	C	385.21	35.93	95.9	4,559	11.84	0.33	$205,383	$533	$792,576	$2,058	$57.26
	Dane	A	1674.08	32.89	99.9	43,773	26.15	0.79	$1,826,196	$1,091	$5,925,699	$3,540	$107.62
	Dodge	B	606.62	31.75	116.7	16,214	26.73	0.84	$619,876	$1,022	$1,867,116	$3,078	$96.94
	Grant	C	624.14	43.67	100.8	10,132	16.23	0.37	$456,548	$731	$1,434,127	$2,298	$52.62
	Green	D	311.45	32.01	87.0	3,826	12.28	0.38	$178,972	$575	$780,124	$2,505	$78.25
	Iowa	C	451.03	35.64	100.3	8,520	18.89	0.53	$417,569	$926	$1,422,221	$3,153	$88.48
	Jefferson	B	458.21	28.84	110.0	14,871	32.45	1.13	$542,196	$1,183	$1,584,980	$3,459	$119.94
	Juneau	C	498.13	34.98	120.6	9,563	19.20	0.55	$482,932	$969	$1,121,574	$2,252	$64.37
	La Crosse	A	480.28	40.63	116.9	10,377	21.61	0.53	$441,023	$918	$1,325,778	$2,760	$67.94
	Lafayette	C	293.88	35.21	107.6	3,574	12.16	0.35	$168,429	$573	$753,339	$2,563	$72.80
	Monroe	C	643.69	37.05	87.0	9,239	14.35	0.39	$410,212	$637	$1,197,119	$1,860	$50.20
	Richland	D	328.72	29.72	99.3	2,884	8.77	0.30	$141,229	$430	$503,019	$1,530	$51.49
	Rock	B	592.56	29.31	105.1	15,290	25.80	0.88	$632,858	$1,068	$1,928,068	$3,254	$111.01
	Sauk	B	591.55	39.50	124.7	16,204	27.39	0.69	$870,304	$1,471	$2,010,439	$3,399	$86.04
	Vernon	C	450.00	37.11	91.3	5,153	11.45	0.31	$230,545	$512	$817,377	$1,816	$48.95
Region total			**9,135.35**			**196,144**			**$8,683,641**		**$26,577,876**		
Region average			**570.96**	**35.07**	**106.8**	**12259**	**21.47**	**0.61**	**$542,728**	**$951**	**$1,661,117**	**$2,909**	**$82.96**
Statewide total			**33,296.72**			**644,484**			**$26,611,765**		**$86,287,363**		
Statewide average			**462.45**	**37.2**	**104.9**	**8,951**	**19.36**	**0.52**	**$369,608**	**$799**	**$1,198,436**	**$2,591**	**$69.66**

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

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2 Winter Weather

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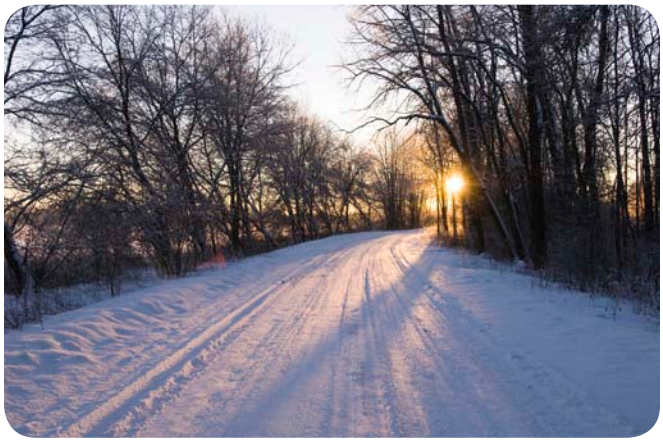


Every winter is different—the number and type of storms, the range of temperatures, the amount of snow. These factors and more combine to create varying challenges for the county highway departments each year.

This winter was significantly more severe than normal in the southern half of the state, with many locations shattering seasonal snowfall records. In northern Wisconsin, snowfall was closer to an average winter. Snowfall came relatively early across the southern part of the state, and never really abated until March. Nineteen winter storms or lake-effect events produced 6 or more inches of snow across at least a portion of the state. Nine of these events produced more than a foot of snow, and three produced at least 18 inches.

This section describes the weather Wisconsin experienced during the 2007-2008 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.

Winter Weather, 2007-2008

	Statewide average	Range across counties
Total snowfall[1]	104.9 inches	56 – 217 inches
Winter Severity Index	37.2	25.7 – 58.9
Winter storms	38	25 – 61
Frost events	3	0 – 15
Freezing rain events	3	0 – 10

1. All data in this table is from Winter Storm Reports, 2007-2008.

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 62 for more information.*

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 are also 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 the lower temperatures. Storms with high winds also are a challenge, because the 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

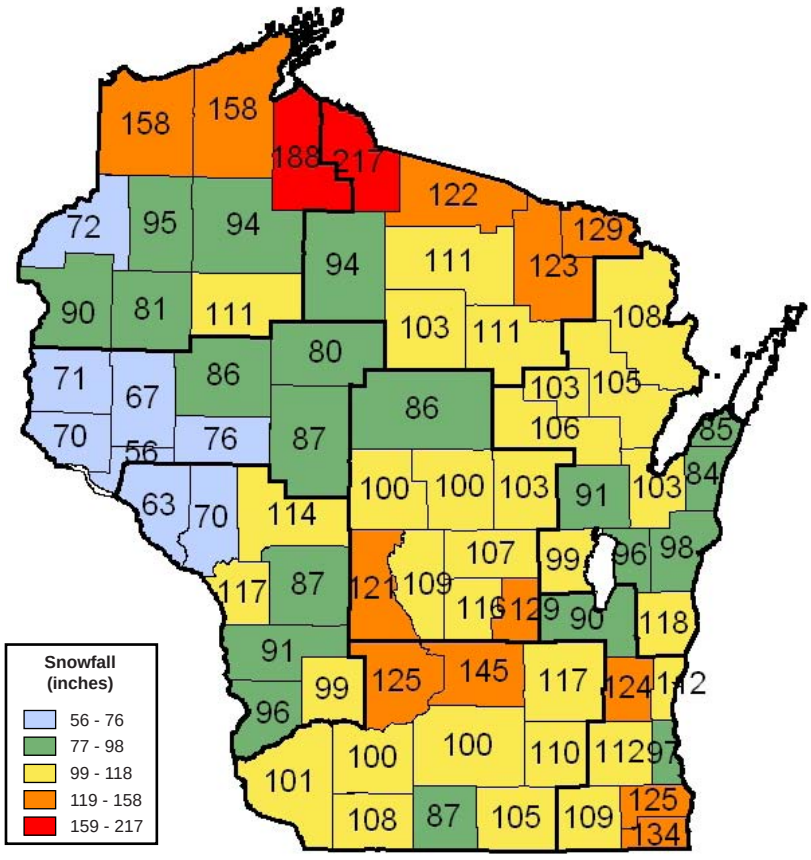
The winter of 2007-2008 was one for the record books, especially across southern Wisconsin. Many locations across southern Wisconsin shattered seasonal snowfall records. For instance:

- Madison recorded 101 inches of snow; the previous record was 75 inches, and normal snowfall is about 50 inches.
- In Milwaukee County, the city of West Allis recorded 122 inches of snow; the previous record was 82.5 inches. Normal snowfall for the city of Milwaukee is about 52 inches.

Snowfall came relatively early across the southern part of the state, and never really abated until March. According to the National Weather Service, 19 winter storms or lake-effect events produced 6 or more inches of snow across at least a portion of the state this winter. Nine of these events produced more than a foot of snow, and three of those produced at least 18 inches.

The first of these three severe storms hit northern and central Wisconsin on December 22-23, when as much as 20 inches fell across

Figure 2.1. Statewide Snowfall, 2007-2008 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.

that area. The second event, from February 5 to 6, produced blizzard conditions and dropped as much as 21 inches of snow across south central Wisconsin. A final event on March 21 dropped 18 inches from La Crosse to Milwaukee.

But these heavy events weren't the only story. Wisconsin remained in the path of most storms throughout the winter. One event after another pummeled the state. At least 20 NWS observing locations across southern Wisconsin recorded record snowfalls.

Across the north, this year's weather was more similar to a normal winter. As is typical, the lake effect areas across the northern tier of counties received over 100 inches of snow. Snowfall was normal to even slightly below normal in western Wisconsin.

During the 2007-2008 winter season, county highway departments responded to:

- A statewide average of 38 winter storm events per county, with a high of 61 in Iron County and a low of 25 in Dunn County.
- A statewide average of 3 frost events.
- A statewide average of 3 freezing rain events.

Figure 2.1 shows the total snowfall received in Wisconsin this winter based on storm reports data. Snowfall varied quite a bit across the state; the highest snowfall recorded was in Iron County, at 217 inches; the lowest was in Pepin County, at 56 inches. Statewide, this winter's total snowfall was significantly above normal in the south and slightly above normal in the north.

On average, temperatures were below normal statewide this winter.

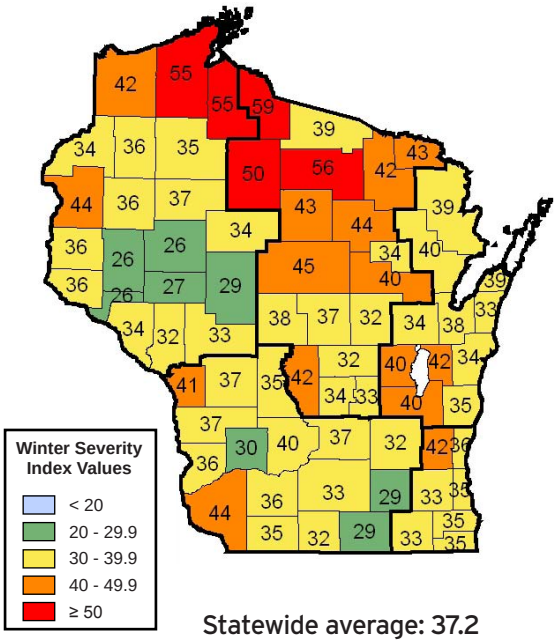
Winter Severity Index

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

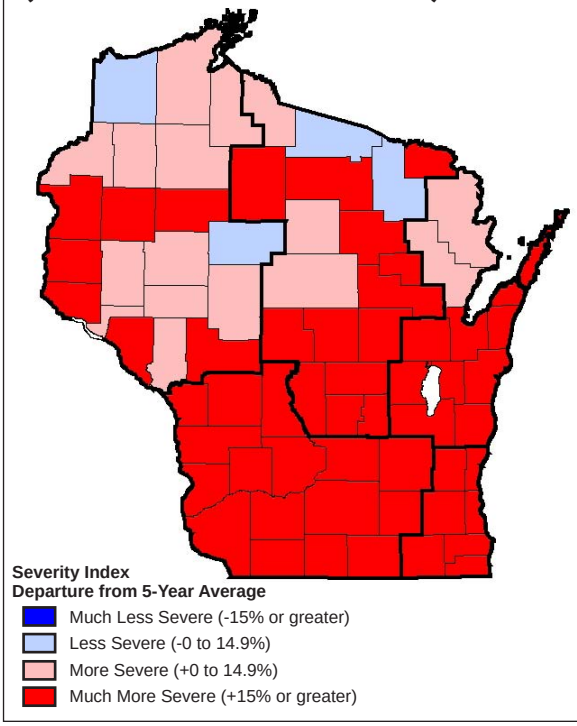
Figure 2.2. Winter Severity Index, 2007-2008



Statewide average: 37.2

Note: If you are looking at a black-and-white version 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. 2007-2008 Winter Severity Index vs. 5-Year Average (2002-2003 to 2006-2007)



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.

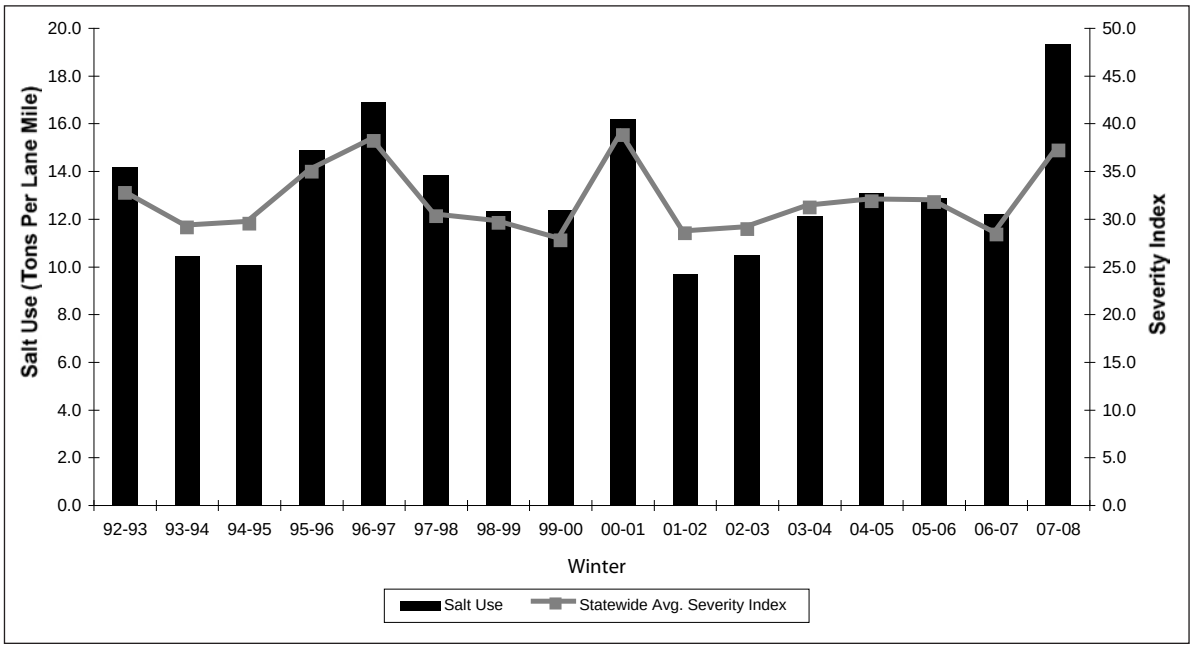
2. Regional comparisons. Since snowfall, number of storms, and other factors vary widely across the state, the severity index also helps WisDOT compare resources use from one region or county to another within a single winter. This allows WisDOT to assess whether materials are being used consistently, 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. The index expresses winter severity on a scale from 0 to 100. This winter:

- The statewide average Winter Severity Index was 37.2, which is 21 percent higher than the average of the previous 10 winters (30.7)
- Iron County had the highest severity index at 58.9
- Dunn County had the lowest severity index at 25.7

The high of 58.9 is higher than what is usually recorded as the state's highest severity index in the northern "snow belt" part of the state, and the low of 25.7 is higher than the state's typical lowest severity index as well. With few exceptions across the state, this winter was 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

Figure 2.4. Salt Use per Lane Mile and Average Severity Index
From Salt Inventory Reporting System, 1992-2008



compares to the average of the previous five years in that county. For more detail on how each county's severity index compares with the five-year average, see Figure 2.5 on page 29.

As Figure 2.3 shows, all the counties in the Southwest and Southeast regions experienced a much more severe winter than in recent years. Because of the high number of more urban lane miles in these regions that receive 24-hour maintenance, this increase in severity had a noticeable impact on statewide materials use and costs.

Figure 2.4 plots the average statewide salt use per lane mile versus the average statewide Winter Severity Index. As expected, salt use tends to increase as the severity index increases. This year's total salt use was higher than average relative to the severity index, which may be partly due to the timing of storms. This winter crews faced multiple storms in quick succession spread across many months, as well as extended bouts of lower temperatures when salt is less effective, which may lead crews to use more salt than they would need to on warmer days.

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 39), Figure 4.2 (winter costs; page 66), and Figure 4.6 (winter crashes; page 71).

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 three winters with previous years'. 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 30, 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. The salt use figures in this table are estimates from the storm reports.

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County-by-County Figure and Table for Section 2: Winter Weather

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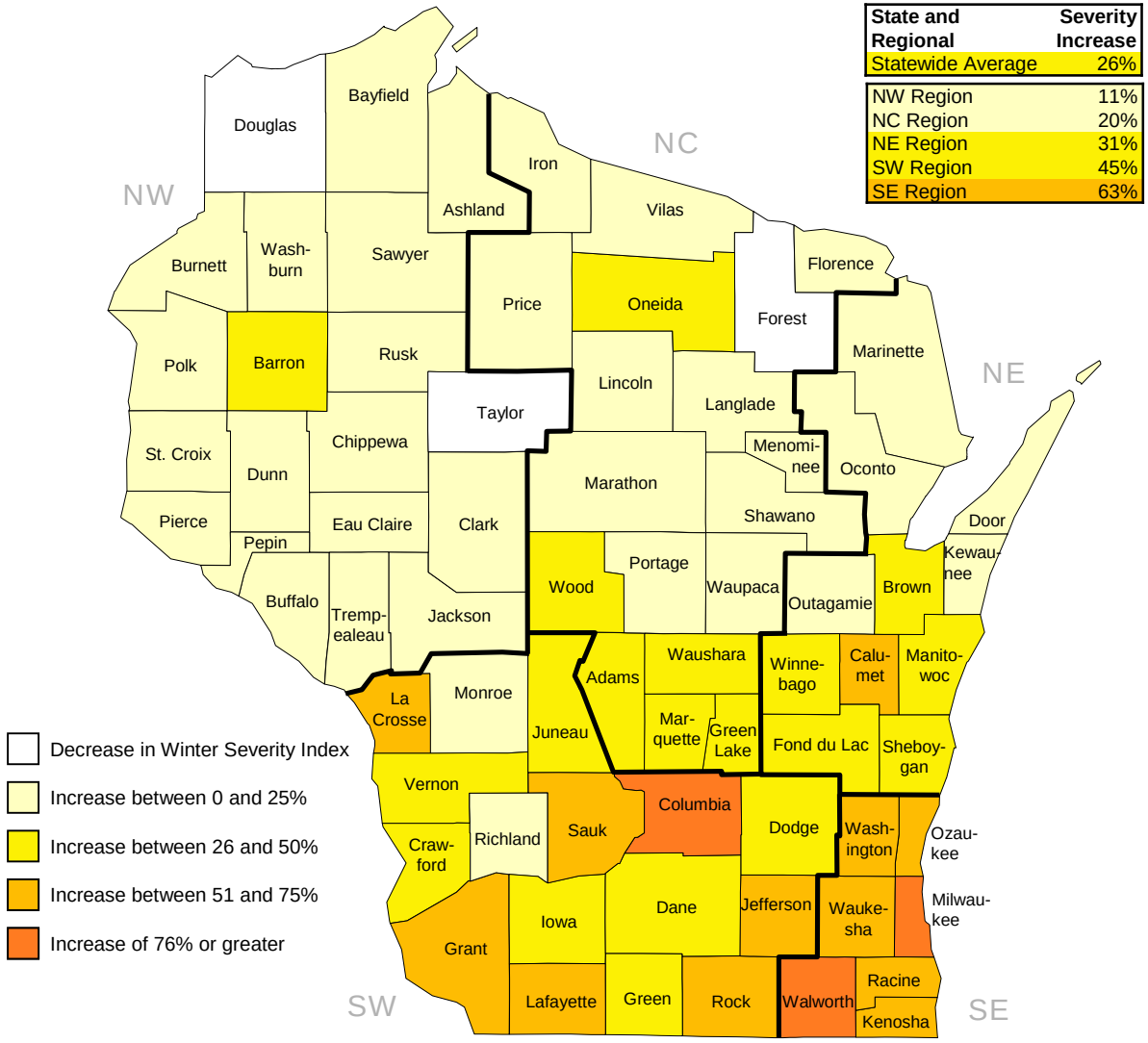
Figure 2.5. 2007-2008 Winter Severity Index vs. 5-Year Average

County	Severity Increase
Douglas	-14%
Taylor	-4%
Forest	-1%
Chippewa	3%
Clark	4%
Vilas	5%
Marinette	6%
Dunn	7%
Trempealeau	8%
Eau Claire	11%
Marathon	11%
Rusk	12%
Bayfield	12%
Burnett	12%
Oconto	12%
Iron	12%
Sawyer	13%
Pepin	13%
Ashland	13%
Lincoln	13%
Washburn	14%
Monroe	16%
Florence	16%
Langlade	16%
St. Croix	16%
Buffalo	18%
Pierce	18%
Portage	18%
Waupaca	20%
Richland	21%
Menominee	21%
Price	21%
Polk	22%
Jackson	23%
Kewaunee	23%
Door	24%

County	Severity Increase
Shawano	24%
Outagamie	24%
Barron	27%
Wood	28%
Marquette	30%
Waushara	30%
Oneida	30%
Vernon	31%
Fond du Lac	32%
Dodge	34%
Green Lake	34%
Dane	35%
Iowa	37%
Crawford	37%
Juneau	42%
Sheboygan	44%
Manitowoc	44%
Green	48%
Brown	48%
Winnebago	49%
Adams	50%
Calumet	51%
Racine	51%
Sauk	56%
Lafayette	57%
Waukesha	58%
Washington	59%
Jefferson	60%
La Crosse	60%
Kenosha	61%
Grant	62%
Ozaukee	63%
Rock	73%
Walworth	77%
Milwaukee	79%
Columbia	82%



State and Regional	Severity Increase
Statewide Average	26%
NW Region	11%
NC Region	20%
NE Region	31%
SW Region	45%
SE Region	63%

Note: If you are viewing 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.

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2007-2008

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	
NC	ADAMS	109.1	192.09	3684	19.18	38	22	24	10	13	18	8	7	1	7	0	8	10
	FLORENCE	128.6	141.07	2805	19.88	49	14	33	8	4	16	3	2	2	7	0	11	5
	FOREST	122.8	312.38	6706	21.47	41	17	30	4	8	18	9	5	2	7	0	9	1
	GREEN LAKE	129.0	151.30	1819	12.02	34	26	13	1	10	22	9	9	0	3	0	19	5
	IRON	217.2	250.91	5233	20.86	61	12	43	6	0	28	12	3	0	8	1	15	0
	LANGLADE	111.3	292.69	5236	17.89	46	32	9	8	4	15	13	10	0	6	2	7	0
	LINCOLN	103.3	418.33	4764	11.39	48	22	24	7	11	22	4	4	1	4	9	15	0
	MARATHON	85.8	869.61	13143	15.11	49	30	16	7	3	49	8	10	7	13	12	33	20
	MARQUETTE	116.4	243.77	4800	19.69	34	15	21	6	11	3	1	1	2	0	0	2	4
	MENOMINEE	102.5	90.26	1752	19.41	36	14	19	4	5	31	5	3	1	9	1	25	0
	ONEIDA	110.7	389.73	7449	19.11	51	27	23	5	1	39	5	6	8	29	2	7	6
	PORTAGE	100.1	504.28	7836	15.54	43	10	32	4	3	21	7	0	2	8	3	12	3
	PRICE	94.2	320.57	5168	16.12	50	23	36	5	7	29	11	1	6	18	7	5	7
	SHAWANO	105.9	509.14	6662	13.08	39	18	24	5	1	33	17	24	6	4	7	26	4
	VILAS	121.6	305.24	6867	22.50	50	18	31	1	0	11	1	0	0	8	0	2	4
	WAUPACA	102.6	541.92	7810	14.41	36	19	16	2	1	29	4	5	1	7	1	15	2
	WAUSHARA	107.3	345.71	4126	11.93	32	22	12	5	4	8	3	3	0	3	0	5	2
	WOOD	99.8	362.92	4976	13.71	35	19	26	6	6	13	5	8	3	6	0	4	13
Region Average		114.9	346.77	5602	16.85	43	20	24	5	5	23	7	6	2	8	3	12	5

Final totals as of Thursday, August 28, 2008

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2007-2008

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	
NE	BROWN	102.9	712.86	14294	20.05	40	16	23	1	3	19	10	1	0	4	11	1	2
	CALUMET	95.6	200.86	2564	12.77	39	10	30	0	6	42	25	2	1	13	0	23	12
	DOOR	84.5	251.87	3449	13.69	34	25	14	2	15	33	31	25	15	8	0	8	14
	FOND DU LAC	90.0	579.80	10169	17.54	34	12	33	6	5	34	18	2	4	14	0	22	13
	KEWAUNEE	83.6	110.41	1369	12.40	35	25	10	0	0	23	0	14	0	3	0	6	0
	MANITOWOC	98.1	415.29	7864	18.94	36	27	10	0	5	19	15	15	1	19	1	18	8
	MARINETTE	108.5	372.18	5641	15.16	41	20	28	2	8	29	6	4	0	15	4	17	0
	OCONTO	105.5	425.43	5826	13.69	40	21	18	4	9	44	6	10	5	9	19	31	4
	OUTAGAMIE	91.2	506.23	11051	21.83	40	30	10	2	9	17	9	8	1	6	2	9	1
	SHEBOYGAN	117.8	518.90	10125	19.51	35	18	25	0	5	29	14	6	8	7	4	20	9
	WINNEBAGO	98.6	549.02	10094	18.39	43	14	35	3	4	30	1	9	6	3	4	17	2
Region Average		97.8	422.08	7495	16.72	38	20	21	2	6	29	12	9	4	9	4	16	6

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2007-2008

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	
NW	ASHLAND	187.7	247.57	2558	10.33	54	29	21	5	9	34	6	8	3	4	1	18	2
	BARRON	80.7	422.39	2207	5.22	38	16	19	3	2	28	6	5	3	7	5	12	0
	BAYFIELD	158.4	316.90	4105	12.95	53	20	29	4	4	28	16	16	7	10	3	21	5
	BUFFALO	62.9	315.77	2098	6.64	33	20	15	3	3	24	14	4	1	14	0	9	6
	BURNETT	71.8	233.64	2864	12.26	31	18	14	7	4	13	10	2	2	3	0	4	0
	CHIPPEWA	86.0	667.85	6726	10.07	26	19	8	0	10	20	8	8	4	16	10	6	0
	CLARK	86.8	402.28	5018	12.47	32	12	18	4	2	4	1	0	5	3	0	0	5
	DOUGLAS	158.1	439.23	5782	13.16	41	30	11	1	0	34	16	11	4	23	11	9	0
	DUNN	66.9	516.55	8416	16.29	25	10	14	1	0	9	1	1	0	3	3	1	0
	EAU CLAIRE	76.4	555.74	8841	15.91	29	23	5	3	10	8	2	5	2	6	0	4	1
	JACKSON	114.0	504.10	8603	17.07	34	17	13	0	2	27	9	0	1	2	0	20	9
	PEPIN	56.3	110.91	1014	9.14	30	12	17	2	5	15	4	7	4	6	0	5	3
	PIERCE	70.4	364.82	4385	12.02	35	14	27	6	11	27	14	7	10	17	13	8	6
	POLK	90.5	385.05	5099	13.24	40	27	11	2	1	42	28	13	2	7	0	6	0
	RUSK	110.8	213.47	1850	8.67	39	18	14	7	6	25	5	8	0	6	8	20	0
	SAINT CROIX	70.9	616.98	9482	15.37	44	35	6	5	7	17	8	5	3	3	3	6	0
	SAWYER	94.0	367.44	3242	8.82	37	22	8	5	7	15	4	7	2	8	0	4	0
	TAYLOR	80.4	234.37	2706	11.55	29	13	19	7	6	29	10	9	5	18	7	15	6
	TREMPEALEAU	70.4	431.24	6175	14.32	34	12	20	4	8	29	10	6	4	11	6	18	4
	WASHBURN	95.3	372.14	7709	20.72	39	13	23	4	2	18	5	8	1	5	2	2	13
Region Average		94.4	385.92	4944	12.31	36	19	16	4	5	22	9	7	3	9	4	9	3

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2007-2008

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	
SE	KENOSHA	134.0	553.35	12108	21.88	35	21	18	0	11	19	7	8	2	3	2	14	5
	MILWAUKEE	97.0	,789.02	55279	30.90	37	30	8	4	9	1	0	0	0	0	1	0	6
	OZAUKEE	112.2	304.03	8183	26.92	41	18	22	2	2	39	7	0	1	3	2	33	2
	RACINE	124.9	587.21	16283	27.73	35	17	24	1	1	20	6	6	1	3	0	10	5
	WALWORTH	109.2	689.25	19024	27.60	36	31	3	3	1	19	4	4	1	4	1	16	0
	WASHINGTON	124.4	580.03	13628	23.50	38	25	16	5	13	24	10	1	8	2	15	15	7
	WAUKESHA	111.7	,055.27	41673	39.49	34	19	17	4	6	9	4	2	0	1	1	7	1
Region Average		116.2	794.02	23740	28.29	37	23	15	3	6	19	5	3	2	2	3	14	4

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2007-2008

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	145.3	745.80	23221	31.14	38	18	19	1	10	26	13	2	0	2	0	19	9
	CRAWFORD	95.9	385.21	4815	12.50	31	5	26	2	8	36	16	16	3	10	0	23	2
	DANE	99.9	,674.08	43773	26.15	35	22	14	2	5	11	4	1	2	3	2	8	4
	DODGE	116.7	606.62	16214	26.73	34	20	17	0	3	21	13	5	2	3	1	12	8
	GRANT	100.8	624.14	10132	16.23	38	23	15	3	13	47	22	27	2	12	4	32	5
	GREEN	87.0	311.45	3842	12.34	34	17	23	1	7	52	11	2	1	10	0	46	2
	IOWA	100.3	451.03	8520	18.89	35	21	14	1	6	32	5	13	0	5	0	23	0
	JEFFERSON	110.0	458.21	14871	32.45	32	16	16	1	3	7	5	0	1	2	0	0	0
	JUNEAU	120.6	498.13	9563	19.20	35	22	13	4	7	15	7	1	0	1	0	12	0
	LA CROSSE	116.9	480.28	10377	21.61	36	20	22	2	11	35	17	16	3	16	2	15	12
	LAFAYETTE	107.6	293.88	3574	12.16	33	21	11	1	8	17	8	3	0	2	2	2	1
	MONROE	87.0	643.69	9240	14.35	37	20	17	6	9	25	13	9	1	9	9	12	7
	RICHLAND	99.3	328.72	2884	8.77	28	17	9	2	4	28	6	5	0	28	6	24	3
	ROCK	105.1	592.56	15290	25.80	31	14	17	1	6	0	0	0	0	0	0	0	0
	SAUK	124.7	591.55	16204	27.39	41	18	30	6	2	23	5	1	2	13	0	16	19
	VERNON	91.3	450.00	5153	11.45	32	20	11	3	4	31	13	6	4	17	1	16	5
Region Average		106.8	570.96	12355	19.82	34	18	17	2	7	25	10	7	1	8	2	16	5

Table 2.1. Storms and Incidents

From Winter Storm Reports, 2007-2008

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		--	462	8972	17.34	37.8	19.6	18.9	3.4	5.7	23.7	8.8	6.3	2.5	7.9	2.9	13.0	4.4

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3 Snow and Ice Control

In this section...

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 considerable skills and experience to combine these pieces in the most efficient way possible for each storm.

This section describes the counties' response to the 2007-2008 winter season, including materials use, best practices in equipment and technology, and training efforts. Choosing the right strategy at the right time is the hallmark of efficient winter maintenance practices. Newer tools like Road Weather Information Systems can give patrol superintendents more precise information to make the best decisions for their roads, which helps the counties conserve resources.

Statewide Materials Use

	2007-2008
Total salt used[1]	644,485 tons
Total salt used per lane mile	19.4 tons
Total cost of salt used[2]	$26,611,765
Average cost per ton of salt	$41.69
Total prewetting agents used[3]	1,293,655 gal.
Counties prewetting salt	65 of 72 (90%)
Total abrasives used	80,133 cubic yards
Counties prewetting abrasives	7 of 72 (10%)
Total anti-icing agents used	331,179 gal.
Counties equipped to use anti-icing	65 of 72 (90%)

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 products, equipment, best practices and more.

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

3A. Materials

After decades of use, salt and sand remain the primary materials used in winter maintenance. The advent of prewetting technology has improved the efficiency of materials use, and proactive anti-icing applications have reduced the amount of salt needed to keep roads clear.

Salt

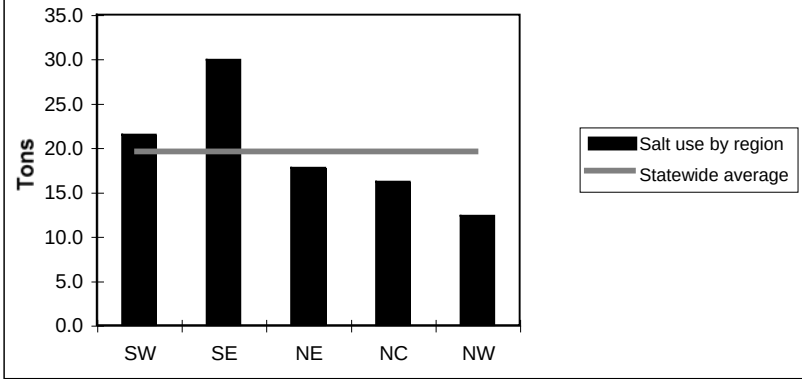
Salt is a critical part of a highway crew's response to winter storms. When salt combines with ice or snow, it creates a brine solution with a lower freezing point than water. This solution then acts to break the bond between the ice or packed snow and the pavement, which allows the snow to be removed more easily through plowing.

Because of cost and environmental concerns, maintenance crews strive to use the smallest amount of salt necessary to provide an appropriate level of service for each roadway. Using anti-icing agents can help reduce overall materials use; see pages 42 to 43 for details on statewide anti-icing use.

Historically, counties have used more salt during more severe winters; see Figure 2.4 on page 24 for a detailed comparison. This winter was the second-most severe of the last 10 winters—this winter's statewide Winter Severity Index of 37.2 was 21 percent higher than the previous 10-year average of 30.7. And at 644,485 tons, statewide salt use was the highest on record, beating out the previous record of 521,056 tons set in 2000-2001. See Table 1.5 on page 15 for county-by-county salt use data for this winter.

Several factors contributed to this year's record-setting salt use total. More lane miles are added to the state highway system each year, and total lane miles have increased 9 percent since the last severe winter in 2000-2001. And the more urban areas of southern Wisconsin tend to have more lane miles that require 24-hour coverage, so severe weather there has a significant impact on statewide salt use. Timing of storms was also a factor, with multiple back-to-back events often leading to packed snow that required more salt to remove. Below-normal temperatures across the state this winter posed challenges as well, since salt works less efficiently in colder temperatures.

Figure 3.1. Salt Used per Lane Mile
From Salt Inventory Reporting System, 2007-2008



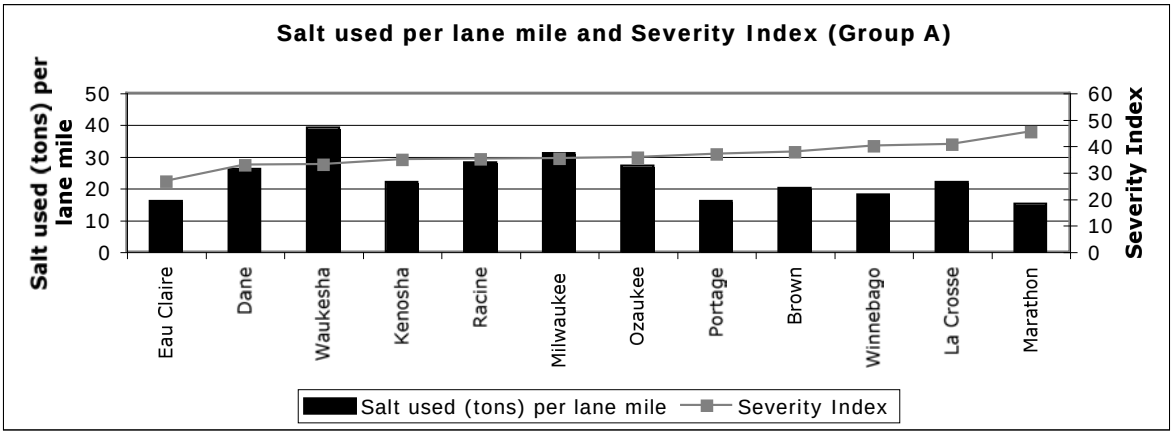
Because of these factors, some areas of Wisconsin experienced a salt shortage this winter. WisDOT and the counties dealt with shortages by using salt/sand mixtures on the state highway system instead of pure salt, and by trucking salt within the state. The Southwest Region received salt from the Northwest Region toward the end of the winter, and Wisconsin also sent trucks to depots in Minnesota to pick up salt, as well as working to find new suppliers.

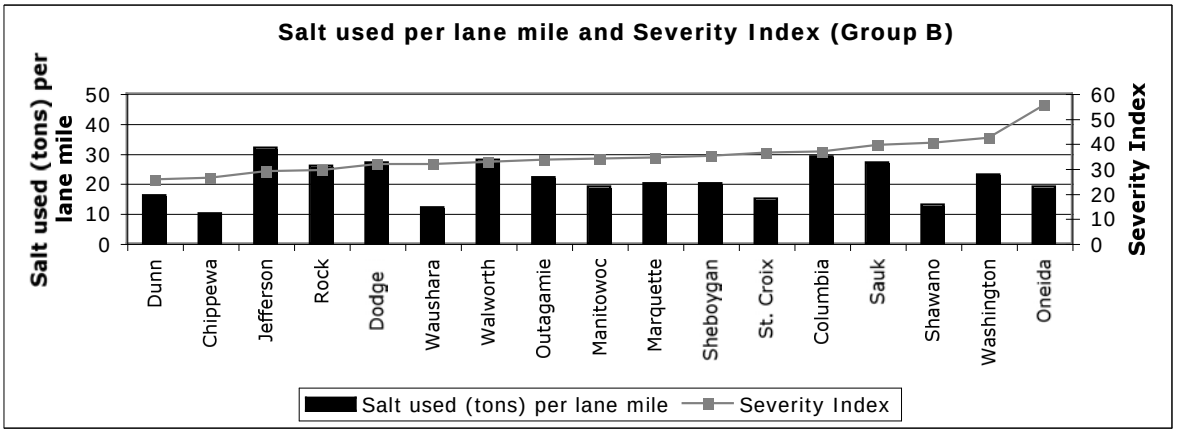
Reflecting this year's severe weather, Wisconsin counties used a statewide average of 19.4 tons of salt per lane mile, an increase of 60 percent over the average of the five previous years. (See Figure 3.4 on page 53 for a county-by-county comparison.) This rate is similar to the nearby states of Illinois (19.2 tons per lane mile) and Indiana (20.2 tons per lane mile), higher than Iowa (12.3 tons per lane mile) and Minnesota (7.5 tons per lane mile), and lower than Michigan (27.2 tons per lane mile).

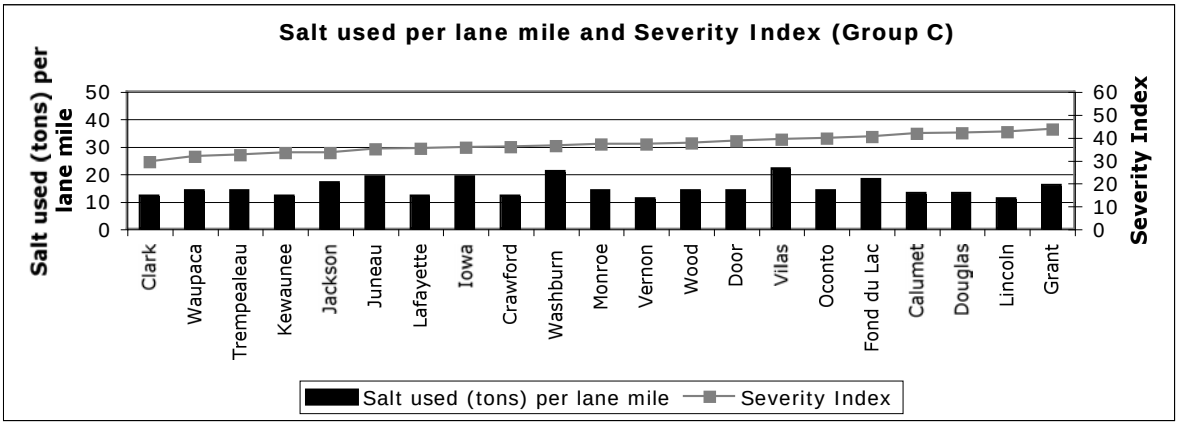
Figure 3.1 shows the regional levels of salt use per lane mile. Counties in the Southeast Region used an average of 29.9 tons of salt per lane mile, which reflects the greater number of highways in these counties receiving 24-hour service.

Figure 3.2. Salt Used per Lane Mile and Severity Index

From Salt Inventory Reporting System, 2007-2008







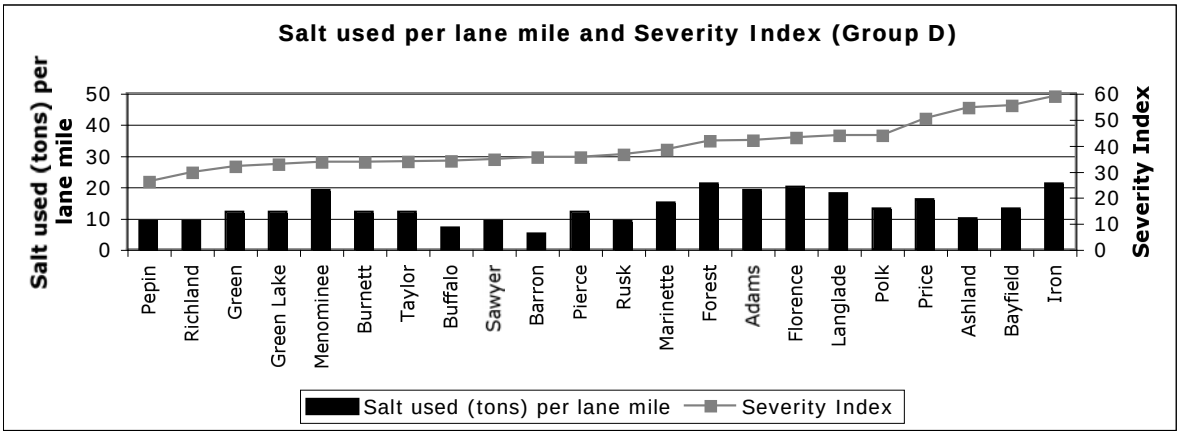


Figure 3.2 on page 39 shows salt use per lane mile in each county, overlaid with severity index to allow a further "apples to apples" comparison of salt use in each county. The counties in Winter Service Groups A and B have more urban highways and tend to use more salt per lane mile for a given level 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 152 of the Appendix.

Cost of Salt

This winter, salt shortages had a marked impact on statewide salt expenditures. WisDOT spent $26,611,765 on salt statewide—an average of $41.69 per ton for 400,200 tons of salt purchased under the department's original contract with suppliers (about $16.6 million was contracted for), but an average of $76 per ton for 130,300 tons of additional salt purchased under supplemental contracts totaling about $9.9 million. In some counties, WisDOT paid up to $101 per ton for supplemental salt. Supplemental salt purchases made up 25 percent of total salt tons purchased this winter, and 37 percent of total salt expenditures.

Counties spent $1.1 million this year trucking salt from depots and from county to county, compared with last year's expenditures of $300,000. The Southwest Region, which faced the greatest shortages, contributed nearly half of this year's total. For more on costs, see Section 4 on page 66.

Higher fuel prices have raised salt transportation costs in recent years: The average of $41.69 per ton paid under the original salt contract is an increase of 18 percent compared with the average of $35.22 two winters ago.

A Note About Materials Data

This winter marks the first 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 of correlation with storm events that is not available from SIRS or from final financial data. The source of each table's data is indicated below the table title.

Table 3.1. Statewide Sand Use
From storm reports data, 1997-2008

Year	Sand used (cubic yards)
2007-2008	80,133[1]
2006-2007	13,636
2005-2006	15,997
2004-2005	15,843
2003-2004	17,959
2002-2003	19,864
2001-2002	18,154
2000-2001	67,108[1]
1999-2000	17,677
1998-1999	35,709
1997-1998	15,254

1. Higher than normal sand use on the state system this winter and during 2000-2001 was caused by greater use of salt/sand mixes due to the low supply of salt toward the end of the winter.

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 80,133 cubic yards of sand was used by 62 counties on state highways this winter. This unusually high total was due in large part to the salt shortages in the southern counties, as many counties mixed their salt with abrasives in order to stretch their salt supplies to cover more storms. This occurred during the 2000-2001 winter as well (see Table 3.1), which was also unusually severe.

With this winter as the exception, use of abrasives has been declining in recent years (see Table 3.1), which is a positive trend and a goal for the department—the disadvantages of abrasive use include potential environmental impacts such as clogged storm drains, siltation of streams and lakes, and air pollution. Abrasives are also very expensive when sweeping and cleanup costs are considered. This year, counties in the southwest corner of the state, which tend to have more hilly terrain and lower-volume roads, used 76 percent of the statewide total, or 60,693 cubic yards. The Southeast and Northeast regions used the least sand (1,394 and 2,802 cubic yards, respectively).

Table 3.1 compares this winter's sand use with previous years'. Refer to Table A-8 on page 146 of the Appendix for county-by-county sand use data for this winter.

Cost of Sand

The billed cost of sand varies greatly throughout the state, from a low cost of about $3.50 per cubic yard in Racine and Kenosha County to a high cost of about $34.00 per cubic yard in Green County, depending on the local availability of the sand and transportation costs. The average billed cost of sand purchased by most counties is in the range of $10.00 to $16.00 per cubic yard. (All material costs are 2002-2003 data.)

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.

Prewetting

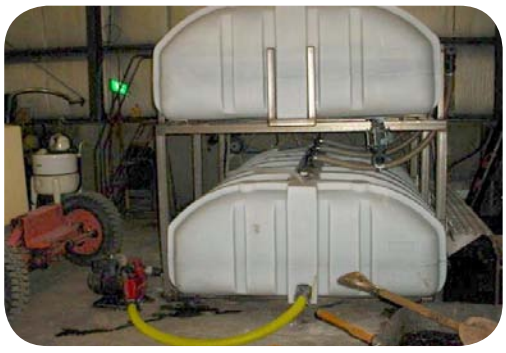
Prewetting salt and sand with liquid deicing agents before or during their application to the pavement has several advantages. When used with salt, prewetting reduces loss of salt from bouncing and traffic action, which reduces the amount of material needed. Prewetting also improves salt penetration 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 temperatures down to about 15°F, whereas agents such as magnesium chloride and calcium chloride are effective at lower temperatures, to about 0°F. See Table 3.2 on page 42 for details on statewide prewetting agent use.

BEST PRACTICES: Salt brine

At about 15 cents per gallon including material costs, salt brine is an inexpensive choice for anti-icing (see Table 3.5 on page 44). Salt brine use has increased significantly since counties first tested it a decade ago; 41 counties used salt brine for anti-icing this winter, and 44 used it for prewetting (48 counties used salt brine for at least one purpose).

Statewide, the counties used a total of 1,273,881 gallons of salt brine for prewetting and anti-icing this winter. This is the highest total in state history, including the highest amount used for prewetting. This reflects a continuing upward trend—statewide salt brine use has increased 83 percent since the 2004-2005 season. See Table A-6 on page 138 of the Appendix for details on this year's salt brine use.



A salt brine production unit

Salt brine is most effective at temperatures of 15°F or above, so it isn't the most efficient choice for all temperatures. But it can be a cost-effective deicing agent for many conditions. Salt brine is typically produced at the county yard using salt brine production units such as the one shown above. Many counties own salt brine production units, while others purchase salt brine from neighboring counties.

For more information on applying salt brine, see https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/best-practices/pdf/iik4.pdf.

At about 15 cents per gallon for material and production costs, salt brine is a relatively inexpensive choice for prewetting (see Table 3.5 on page 44). Salt brine use has increased significantly since counties first tested it a decade ago; 44 counties used salt brine for prewetting this winter (see Table A-6 on page 138 of the Appendix for details). Counties used a record amount of salt brine for prewetting this winter—968,472 gallons, which was a 70 percent increase over the previous record of 570,203 set in 2005-2006.

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 140 for details.

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. This winter, only 6 counties used exclusively calcium chloride products for prewetting salt, down from 10 two winters ago.

Table 3.2. Statewide Prewetting Agent Use for Salt

Chemical	Gallons used	Counties using
Salt brine	965,797	44
Calcium chloride-based products		
Calcium chloride – solid	151 tons	6
Calcium chloride – liquid	153,384	15
Calcium chloride with rust inhibitor	19,725	3
Magnesium chloride-based products		
Magnesium chloride	40,845	11
Freeze Guard	2,867	2
Agricultural-based products		
Ice Ban-M80	14,235	40
Ice Ban-MC90	700	1
Ice Ban-MC95	74,975	12
GeoMelt	15,615	1
Total	**1,288,997 gallons of liquid; 151 tons solid CaCl**	**65**

While prewetting salt is a common practice in Wisconsin—65 of 72 counties (90 percent) prewetted their salt this winter—prewetting abrasives is far less common. Only 8 counties used prewetted abrasives this winter (see Table A-8 on page 146 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. 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.

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 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.

This winter, counties used 331,179 gallons of anti-icing liquid (see Table A-4 on page 130 for details). Currently, 65 of 72 counties (90 percent) are equipped to perform anti-icing operations, and this winter 52 counties made at least

one anti-icing application. (Counties may choose not to use anti-icing 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. However, the use of anti-icing liquid was down 32 percent this year, likely the result of back-to-back storm events that didn't allow crews enough time to anti-ice between storms and kept them from achieving bare pavement conditions. Below-normal temperatures across the state may be another factor that resulted in a decrease in the use anti-icers this year. Salt brine, the most commonly used anti-icing agent, has limited effectiveness at temperatures below 15°F.

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 Meridian weather forecast system, and 59 weather and pavement sensors across the state. See page 45 for more information on RWIS.

Anti-icing Costs

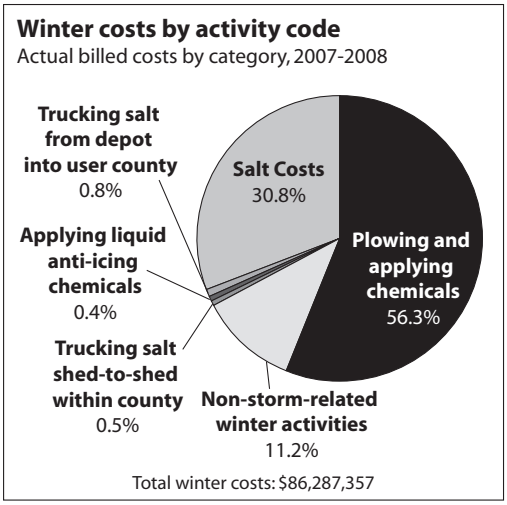
In Wisconsin, proactive anti-icing applications for possible frost events are about three times less costly than reactive deicing operations for actual frost events. Table 3.3 compares the two strategies based on storm reports data. Costs vary from year to year in part because of variations in the number of counties reporting this data and the number of events represented.

Table 3.3. Cost of Anti-icing vs. Deicing

Winter Service Group	Average cost of anti-icing treatment for possible frost				Average cost of deicing treatment for frost event				Counties anti-icing
	2004-2005	2005-2006	2006-2007	**2007-2008**	2004-2005	2005-2006	2006-2007	**2007-2008**	**2007-2008**
A	$1,046	$800	$2,765	**$1,437**	$3,746	$5,348	$3,919	**$2,804**	12
B	$647	$1,028	$838	**$760**	$2,161	$3,329	$3,517	**$5,817**	15
C	$758	$791	$820	**$725**	$1,969	$1,934	$1,485	**$3,157**	16
D	$587	$803	$610	**$566**	$1,604	$1,254	$1,842	**$2,081**	15

At $378,135, anti-icing costs made up only 0.4 percent of total winter maintenance costs this winter (see Figure 3.3). This percentage has remained fairly steady over the years—always less than 1 percent of total statewide winter costs. Investing in anti-icing is a cost-effective way to reduce overall materials use.

Figure 3.3. Anti-icing as a Percentage of Winter Costs



Note: Total cost data differs slightly from cost data elsewhere in this report due to rounding.

Anti-icing Agents

As with prewetting, the use of salt brine for anti-icing operations has increased significantly since its introduction a decade ago, including an 85 percent increase between the 2004-2005 and 2006-2007 winter seasons, but fell this winter due to the factors mentioned earlier. This winter, 41 of 72 counties (57 percent) used a total of 305,409 gallons of salt brine for anti-icing. This is a 33 percent decrease compared with last year, with the Southeast Region seeing the steepest decline. See Table A-6 on page 138 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 3.4 shows the agents used for anti-icing in Wisconsin this winter; see Table A-4 on page 130 of the Appendix for county-by-county anti-icing data.

Table 3.4. Statewide Anti-icing Agent Use

Chemical	Gallons used	Counties using
Salt brine	305,409	41
Calcium chloride – liquid	195	2
Magnesium chloride	3,415	8
Ice Ban-M80	2,765	1
Ice Ban-MC95	4,315	5
GeoMelt	15,080	3
Total	**331,179**	

Cost of Deicing Agents

The cost of agents used for prewetting and anti-icing varies. Salt brine can be produced relatively cheaply (about $0.15 per gallon) at the county yard using salt brine production units purchased by WisDOT. Many counties have their own salt brine production units; others purchase salt brine from neighboring counties. Other agents tend to be more expensive, but may be useful at lower temperatures.

Based on a 2007-2008 survey, the average billed cost of selected agents is detailed in Table 3.5. The unit cost of all products varies among counties based on the amount of material ordered and transportation costs.

Table 3.5. Cost of Prewetting and Anti-icing Agents

Chemical	Average (per gallon)	Range (per gallon)
Salt brine	$0.15	$0.05 - $0.40 (42 counties)
Calcium chloride	$0.67	$0.42 - 1.07
Calcium chloride with rust inhibitor	$0.87	$0.87 (1 county)
Magnesium chloride	$0.81	$0.30 - 1.07
Freeze Guard	$0.64	$0.64 (1 county)
Ice Ban M-80	$0.96	$0.90-$1.05 (3 counties)
GeoMelt	$1.49	$1.02-$1.95 (2 counties)

STAYING INFORMED: Find the latest research and share information with colleagues

Looking for more information about winter maintenance in Wisconsin? WisDOT's extranet site features detailed reports on products, equipment, RWIS technology, best practices and more, as well as previous years' annual winter maintenance reports. See https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm.

WisDOT also encourages all counties to join the new Google Groups discussion list established for Wisconsin county maintenance staff. The Wisconsin County Maintenance Group provides a forum for county maintenance staff to discuss what's working well and what needs improvement in their winter maintenance operations. Visit the group at http://groups.google.com/group/wisconsin-county-maintenance/.

Wisconsin County Maintenance Group on Google Groups

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.

A roadside weather sensor.

Road Weather Information Systems

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:

- 59 weather and pavement condition sensors along state highways.
- Detailed weather forecasts from Meridian forecast service.
- A winter storm warning service for county highway departments.
- Over 500 mobile infrared pavement temperature sensors on patrol trucks around the state.

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

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

- Coordinating with Meridian on forecast services.
- Performing an annual weather forecast verification study, and monitoring comments from counties using the service.
- Providing RWIS training for regional operations staff and county highway departments.
- Overseeing maintenance and repair of the department's RWIS equipment.

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 the Aurora research program (see page 48), and in multistate RWIS user group projects.
- Participating in national RWIS initiatives, including MDSS and Clarus (see page 49).
- Serving on WisDOT's 511 System Planning Committee.
- 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.
- Maintenance of traveler weather information systems at rest areas and the Kenosha weigh station.
- Supporting counties' use of vehicle-mounted infrared pavement temperature sensors.
- RWIS program management (budgeting, billing, planning, etc.).

Weather Forecast Service Use and Satisfaction

The weekly winter storm reports ask the counties to report whether they used the Meridian forecast service, and ask them to rate the quality of the forecast if they did use it. The Meridian forecast was used in 87 percent of winter storm events this year. Regionally, the usage rate varied from a high of 96 percent in the Northeast Region to a low of 77 percent in the North Central Region. The Northeast Region rated the service the highest (2.52 on a scale of 1 to 3), while the Southeast Region rated it lowest at 2.24. The statewide average was 2.37, similar to last year's 2.35. For more details on the evaluation of the Meridian forecast service, see a summary report on page 113 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 118 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.

Equipment Calibration

Ensuring and reporting correct calibration of winter operations equipment—including salt spreaders, anti-icing applicators, and prewetting application equipment—is a key step in providing consistent materials application. WisDOT tracked the counties' equipment calibration efforts from 2003-2007. In the 2006-2007 winter, 94 percent of winter vehicles were calibrated prior to the start of the season in the counties reporting their calibration activities. Once several years of data have been collected, WisDOT may consider making equipment calibration a performance measure in the Compass program.

Previous years' equipment calibration reports are available at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm.

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.

WisDOT has set a deadline of November 1, 2010, for all trucks on state winter maintenance patrol sections to be equipped with ground speed controllers. See Guideline 36.25 in the Winter Maintenance Manual for more information.

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. 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.

Winter maintenance technology and equipment

- Counties tested bridge deck anti-icing technologies that automate treatment during storm events and winter concept vehicles that included the latest in winter maintenance equipment and technology.
- Rubber-coated snowplow blades, end loader bucket scales and a variety of salt spreaders are among the winter maintenance equipment options evaluated by Wisconsin counties.
- Past test projects that have become operational include mobile pavement temperature sensors and salt brine production units.

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).

County Highway Department Innovations

The staffs of county highway departments continually encounter challenges as they perform winter maintenance work, and when they can't find a product that solves their problem, they devise their own solutions. A sampling of recent innovative solutions developed or purchased by Wisconsin's county highway departments is available online at https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm.

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.** Wisconsin is the lead state in this pooled fund project, which focuses on rigorous testing of winter maintenance materials, equipment and methods for use by highway maintenance crews. Launched in 2004, Clear Roads now has 14 member states and completed its first research project in 2006—a synthesis of methods for eliminating icing and fogging on snowplow windshields, windows and mirrors. A project on the calibration accuracy of manual and ground-speed-control spreaders was completed in 2008. Projects on laboratory testing of snowplow blades and performance standards for deicing agents were begun in 2007 and are expected to be completed in 2009.

Clear Roads also publishes an e-newsletter of winter maintenance news items, publications and research in progress. Read the newsletter online at http://www.clearroads.org/resources.html.

See http://www.clearroads.org for more information about this pooled fund project, including details on completed Clear Roads projects.

• **Aurora.** Aurora is an international pooled fund partnership of public agencies that work together to perform joint research on road weather information systems (RWIS). Its membership includes 14 state DOTs and three international agencies. WisDOT has been a member of Aurora since 1997, but the department did not fund participation in this project in 2009.

The Aurora program performs research in many RWIS-related areas, some of which have applications in Wisconsin. WisDOT is the project champion for a study of the new Vaisala Spectro pavement sensor, which identifies and distinguishes between water, snow, ice, slush and frost on roadway surfaces. The sensor helps maintenance crews identify current driving conditions, and provides pavement information to initiate automatic deicer spraying equipment. This study, performed by the Ontario Ministry of Transport and the University of North Dakota under WisDOT's guidance, has been completed and final reports are being prepared.

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:

- Developing and implementing a computer-based training program on anti-icing practices and RWIS systems for snowplow drivers, managers and operators.
- 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.

In addition, WisDOT participates in the following partnership initiatives:

• **Maintenance Decision Support System.** The objective of this FHWA project is to produce a prototype tool for decision support to winter road maintenance managers. The concept is to use small-scale computer model weather forecasts combined with rules of practice for winter maintenance to generate treatment recommendations throughout storm events.

This project is a multiyear effort, and WisDOT continues to monitor its progress. The major obstacle to full MDSS implementation in Wisconsin is in providing feedback to the system. The MDSS can easily generate initial predictions, but requires input as to what maintenance actions actually occurred. If a system can be put into place where this can be easily accomplished, perhaps with the use of GPS/AVL by county highway departments, it will become much easier to implement the entire MDSS. For now, the greatest value of the project for Wisconsin continues to be in anticipated increases in forecast accuracy. The results of a multi-state MDSS pooled fund project to conduct benefit-cost analyses have been promising, but there is much work to be done before implementation of MDSS is likely to occur.

See http://www.rap.ucar.edu/projects/rdwx_mdss/ for more information.

• **Clarus.** A joint effort of FHWA and the National Weather Service, this initiative aims to consolidate all road weather data into a national database. A WisDOT representative attended the annual project meeting in Reno, Nev., in August 2008. WisDOT continues to participate through its membership in the North/West Passage group, one of three teams that submitted a concept of operations detailing how the Clarus output would be used. Clarus has reached the demonstration phase, with teams of contractors and states being chosen to implement the previously-developed concepts of operations. Due to limitations placed on the proposing teams by FHWA, WisDOT will not be participating in the demonstrations.

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

• **Midwest Snow and Ice Group.** This group of nine Midwest states comes together to discuss winter maintenance issues including materials, equipment and new technologies. Members emphasize learning from each other's experiences and sharing specifications and test results. The group has an annual face-to-face meeting and periodic teleconferences during the year.

A subcommittee of the Midwest Snow and Ice Group was formed to develop specifications and laboratory performance testing procedures for liquid and solid anti-icing and deicing materials used in the Midwest. Interim specifications for liquid materials were developed in 2002, and the subcommittee continues to meet via teleconference on general winter operations issues.

See http://rebar.ecn.purdue.edu/snownice/index.htm for more information.

3C. Labor

Over 1,500 employees of Wisconsin's county highway departments are licensed to operate a snowplow, and over 700 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 union contracts, which also define when overtime hours can be charged. This winter, counties spent $24.8 million on labor, for an average of $746 per lane mile. Contrasted with last year's expenditures of $14.4 million (an average of $437 per lane mile), this year's significant increase is primarily due to the severity of the winter, in addition to a slight increase in the average percentage of overtime hours. An average of 29 percent of counties' winter maintenance costs were spent on labor, with a high of 37 percent in the Southeast Region, where hourly labor rates tend to be higher. See Table 4.10 on page 82 for county-by-county labor expenditures, and see Table 3.6 on page 54 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:

- **Winter Operations Workshops.** Facilitated by BHO staff, these interactive one-day workshops for WisDOT regional staff and county highway department patrol superintendents cover winter maintenance topics such as use of RWIS and weather forecast programs, anti-icing, living snow fences, and winter maintenance guidelines. The workshops were first held in October 2004 and held again at five locations in October 2005.

- **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).

  Some counties participated in a statewide Snowfighters' Roadeo in September 2005 at Lambeau Field in Green Bay, which was hosted by the Wisconsin chapter of the American Public Works Association. A number of counties have also sent representatives to the Wisconsin County Highways Association Snowfighters' Roadeos held each June (most recently in Lake Delton, Wis.).

Past training efforts have included:

- **Division of State Patrol Winter Maintenance Training Sessions.** Presented by BHO, this training was last held in November 2007 with the new DSP trooper recruit class. As a follow-up to these sessions, local meetings of WisDOT regional operations staff, county highway departments and WisDOT regional state patrol staffs were held prior to the winter season.

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

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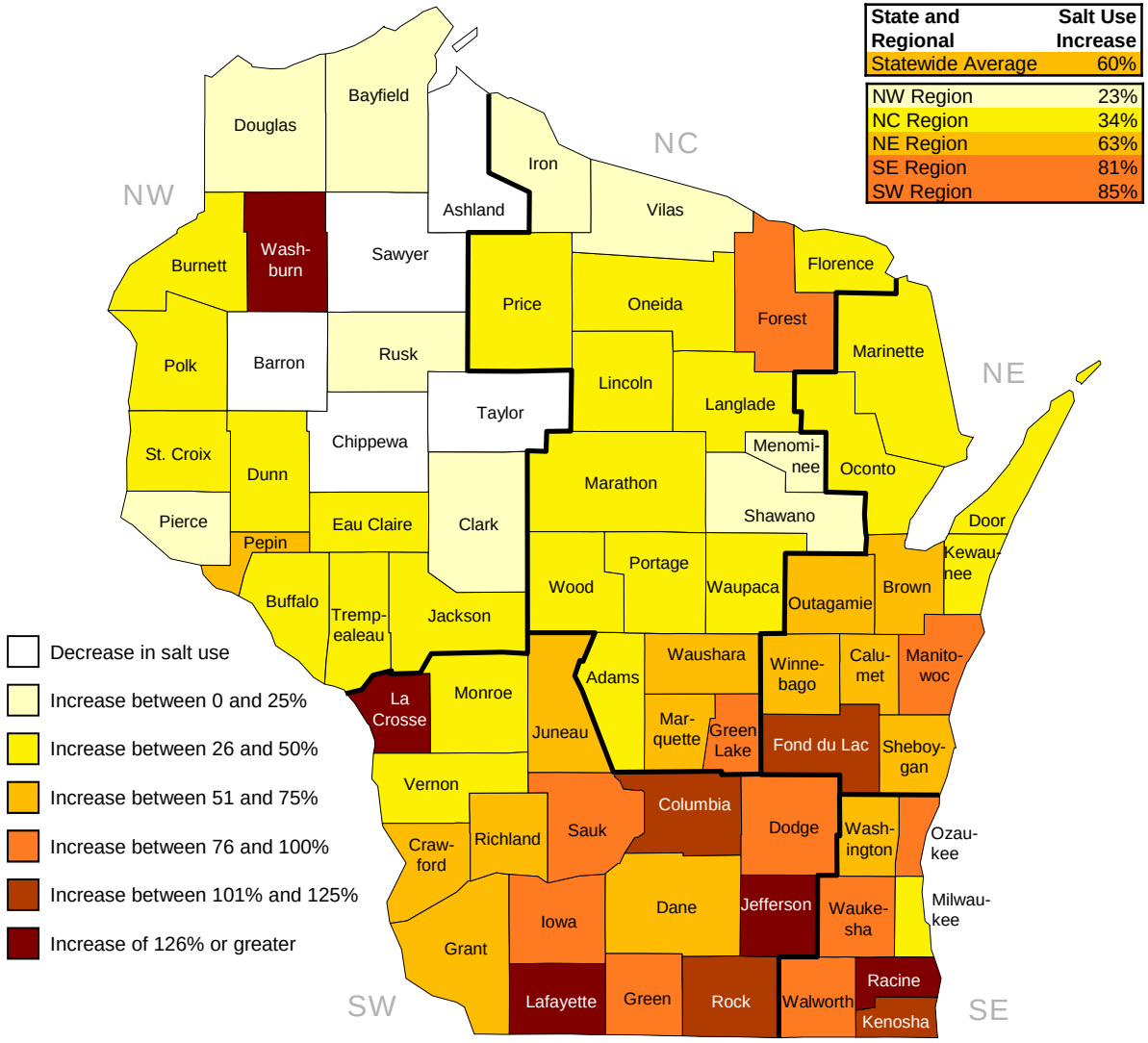
Figure 3.4. 2007-2008 Salt Use per Lane Mile vs. 5-Year Average

County	Salt Use Increase
Chippewa	-24%
Ashland	-14%
Taylor	-8%
Barron	-3%
Sawyer	-1%
Bayfield	3%
Iron	8%
Rusk	9%
Douglas	11%
Pierce	11%
Clark	16%
Vilas	16%
Menominee	17%
Shawano	21%
Polk	26%
Oneida	26%
Price	26%
Langlade	28%
Lincoln	28%
Marinette	29%
Vernon	32%
Burnett	32%
Marathon	32%
Florence	33%
Dunn	33%
Portage	35%
Buffalo	38%
Door	38%
Oconto	39%
Monroe	40%
Eau Claire	42%
Jackson	45%
Kewaunee	45%
St. Croix	46%
Trempealeau	47%
Milwaukee	48%

County	Salt Use Increase
Waupaca	48%
Wood	49%
Adams	50%
Brown	53%
Richland	53%
Washington	54%
Grant	56%
Juneau	56%
Waushara	58%
Winnebago	58%
Calumet	59%
Crawford	61%
Forest	62%
Pepin	64%
Marquette	68%
Dane	69%
Sheboygan	69%
Outagamie	72%
Walworth	76%
Green Lake	81%
Green	86%
Dodge	87%
Ozaukee	88%
Waukesha	90%
Manitowoc	92%
Iowa	93%
Sauk	98%
Columbia	105%
Fond du Lac	114%
Rock	116%
Kenosha	117%
Washburn	128%
Jefferson	135%
La Crosse	140%
Lafayette	150%
Racine	152%



State and Regional	Salt Use Increase
Statewide Average	60%
NW Region	23%
NC Region	34%
NE Region	63%
SE Region	81%
SW Region	85%

Note: If you are viewing 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.

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

From Winter Storm Reports, 2007-2008

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
MARATHON	NC	869.61	45.31	15.11	$491	4444	4700	9144	51.4%	10.51	0.23
LA CROSSE	SW	480.28	40.63	21.61	$566	3532	2654	6186	42.9%	12.88	0.32
PORTAGE	NC	504.28	37.05	15.54	$544	2923	3149	6072	51.9%	12.04	0.32
EAU CLAIRE	NW	555.74	26.71	15.91	$400	2211	2809	5020	56.0%	9.03	0.34
WINNEBAGO	NE	549.02	40.16	18.39	$597	2678	4907	7585	64.7%	13.82	0.34
RACINE	SE	587.21	35.07	27.73	$769	2857	4563	7420	61.5%	12.64	0.36
BROWN	NE	712.86	37.74	20.05	$714	4523	5519	10042	55.0%	14.09	0.37
OZAUKEE	SE	304.03	35.81	26.92	$646	2851	1382	4233	32.7%	13.92	0.39
MILWAUKEE	SE	1789.02	35.42	30.90	$841	12671	12392	25063	49.4%	14.01	0.40
WAUKESHA	SE	1055.27	33.06	39.49	$745	4591	10023	14614	68.6%	13.85	0.42
DANE	SW	1674.08	32.89	26.15	$784	12148	15057	27205	55.3%	16.25	0.49
KENOSHA	SE	553.35	34.92	21.88	$1,123	4349	6102	10451	58.4%	18.89	0.54
Group A Avg		802.90	36.23	23.31	$685	4981	6105	11086	54.0%	13.49	0.38

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

From Winter Storm Reports, 2007-2008

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
SAINT CROIX	NW	616.98	36.43	15.37	$336	2056	3017	5073	59.5%	8.22	0.23
ONEIDA	NC	389.73	55.48	19.11	$631	3128	2286	5413	42.2%	13.89	0.25
WAUSHARA	NC	345.71	31.78	11.93	$381	1356	1661	3017	55.1%	8.73	0.27
MANITOWOC	NE	415.29	34.00	18.94	$454	1774	2133	3907	54.6%	9.41	0.28
SHAWANO	NC	509.14	40.33	13.08	$463	3461	2545	6006	42.4%	11.80	0.29
WASHINGTON	SE	580.03	42.20	23.50	$601	2973	4477	7450	60.1%	12.84	0.30
SHEBOYGAN	NE	518.90	35.07	19.51	$509	2611	2967	5578	53.2%	10.75	0.31
MARQUETTE	NC	243.77	34.44	19.69	$449	1074	1576	2650	59.5%	10.87	0.32
SAUK	SW	591.55	39.50	27.39	$518	4063	3836	7899	48.6%	13.35	0.34
DUNN	NW	516.55	25.70	16.29	$417	1957	2577	4534	56.8%	8.78	0.34
DODGE	SW	606.62	31.75	26.73	$480	3370	3589	6959	51.6%	11.47	0.36
CHIPPEWA	NW	667.85	26.36	10.07	$442	2476	3933	6409	61.4%	9.60	0.36
ROCK	SW	592.56	29.31	25.80	$584	2383	3999	6382	62.7%	10.77	0.37
COLUMBIA	SW	745.80	36.86	29.45	$678	4422	5954	10375	57.4%	13.91	0.38
WALWORTH	SE	689.25	32.53	27.60	$675	2319	6227	8545	72.9%	12.40	0.38
JEFFERSON	SW	458.21	28.84	32.45	$541	2065	3403	5469	62.2%	11.93	0.41
OUTAGAMIE	NE	506.23	33.57	21.83	$549	4504	2620	7123	36.8%	14.07	0.42
Group B Avg		529.07	34.95	21.10	$512	2705	3341	6046	55.1%	11.34	0.33

Final totals as of Thursday, September 11, 2008

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

From Winter Storm Reports, 2007-2008

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
WASHBURN	NW	372.14	36.37	20.72	$300	1223	1444	2667	54.1%	7.17	0.20
DOUGLAS	NW	439.23	42.14	13.16	$392	1945	1720	3665	46.9%	8.34	0.20
VERNON	SW	450.00	37.11	11.45	$284	2021	1572	3593	43.8%	7.98	0.22
MONROE	SW	643.69	37.05	14.35	$381	2499	3195	5694	56.1%	8.85	0.24
TREMPEALEAU	NW	431.24	32.41	14.32	$305	1890	1456	3346	43.5%	7.76	0.24
VILAS	NC	305.24	39.28	22.50	$425	1717	1303	3020	43.2%	9.89	0.25
CLARK	NW	402.28	29.40	12.47	$339	1183	1796	2979	60.3%	7.41	0.25
WOOD	NC	362.92	37.69	13.71	$446	1656	1805	3460	52.2%	9.53	0.25
JUNEAU	SW	498.13	34.98	19.20	$383	1786	2671	4456	59.9%	8.95	0.26
DOOR	NE	251.87	38.54	13.69	$512	982	1530	2511	60.9%	9.97	0.26
OCONTO	NE	425.43	39.77	13.69	$455	2447	1994	4441	44.9%	10.44	0.26
GRANT	SW	624.14	43.67	16.23	$446	3558	3667	7225	50.8%	11.58	0.27
CRAWFORD	SW	385.21	35.93	11.84	$401	2090	1700	3790	44.9%	9.84	0.27
LINCOLN	NC	418.33	42.54	11.39	$465	3124	1851	4975	37.2%	11.89	0.28
WAUPACA	NC	541.92	31.86	14.41	$406	2222	2746	4968	55.3%	9.17	0.29
JACKSON	NW	504.10	33.37	17.07	$375	3234	1696	4930	34.4%	9.78	0.29
KEWAUNEE	NE	110.41	33.35	12.40	$417	626	459	1084	42.3%	9.82	0.29
LAFAYETTE	SW	293.88	35.21	12.16	$437	1092	2080	3172	65.6%	10.79	0.31
CALUMET	NE	200.86	41.71	12.77	$652	1388	1472	2860	51.5%	14.24	0.34

Final totals as of Thursday, September 11, 2008

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

From Winter Storm Reports, 2007-2008

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
FOND DU LAC	NE	579.80	40.43	17.54	$634	3818	4465	8283	53.9%	14.29	0.35
IOWA	SW	451.03	35.64	18.89	$588	3028	3596	6623	54.3%	14.68	0.41
Group C Avg		413.90	37.07	14.95	$431	2073	2105	4178	50.3%	10.11	0.27

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

From Winter Storm Reports, 2007-2008

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	316.90	55.32	12.95	$371	2077	1027	3104	33.1%	9.79	0.18
RUSK	NW	213.47	36.50	8.67	$262	799	595	1394	42.7%	6.53	0.18
ASHLAND	NW	247.57	54.54	10.33	$409	1171	1246	2416	51.6%	9.76	0.18
POLK	NW	385.05	43.94	13.24	$380	1519	1634	3153	51.8%	8.19	0.19
FLORENCE	NC	141.07	43.00	19.88	$341	510	622	1132	54.9%	8.02	0.19
PRICE	NC	320.57	50.42	16.12	$409	1227	1797	3024	59.4%	9.43	0.19
PIERCE	NW	364.82	35.60	12.02	$298	1378	1149	2526	45.5%	6.92	0.19
SAWYER	NW	367.44	34.72	8.82	$316	1381	1136	2516	45.1%	6.85	0.20
BURNETT	NW	233.64	33.75	12.26	$301	787	907	1694	53.6%	7.25	0.21
TAYLOR	NW	234.37	33.93	11.55	$283	1155	560	1715	32.6%	7.32	0.22
MENOMINEE	NC	90.26	33.63	19.41	$232	478	186	664	28.0%	7.35	0.22
MARINETTE	NE	372.18	38.48	15.16	$386	1453	1742	3195	54.5%	8.58	0.22
BARRON	NW	422.39	35.58	5.22	$350	1888	1556	3443	45.2%	8.15	0.23
BUFFALO	NW	315.77	34.08	6.64	$321	1405	1161	2566	45.2%	8.13	0.24
IRON	NC	250.91	58.90	20.86	$631	2410	1130	3540	31.9%	14.11	0.24
ADAMS	NC	192.09	42.11	19.18	$467	982	982	1964	50.0%	10.22	0.24
RICHLAND	SW	328.72	29.72	8.77	$318	1346	1178	2523	46.7%	7.68	0.26
LANGLADE	NC	292.69	43.82	17.89	$477	1679	1652	3331	49.6%	11.38	0.26
FOREST	NC	312.38	41.90	21.47	$451	1939	1613	3552	45.4%	11.37	0.27

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

From Winter Storm Reports, 2007-2008

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
GREEN LAKE	NC	151.30	32.74	12.02	$353	808	547	1355	40.4%	8.95	0.27
PEPIN	NW	110.91	26.23	9.14	$321	383	436	819	53.2%	7.38	0.28
GREEN	SW	311.45	32.01	12.28	$640	2619	2716	5335	50.9%	17.13	0.54
Group D Avg		271.63	39.59	13.36	$378	1336	1162	2498	46.0%	9.11	0.24

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4 Performance

In this section...

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

	2007-2008 Statewide
Total lane miles	33,297
Total patrol sections	768
Average lane miles per patrol section	43
Average time to bare/wet pavement[1]	3.27 hours
Average crew reaction time from start of storm	2.66 hours
Total winter costs[2]	$86,287,363
Total winter costs per lane mile	$2,591
Total winter crashes[3]	12,060
Total winter crashes per 100 million VMT	43

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 0.4 percent of total winter maintenance costs this year. *See page 43 for more information on anti-icing costs.*

4A. 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.

Storm Reports

One way that 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. The 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

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

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

Winter Patrol Sections

Many factors influence 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 768 winter patrol sections, an average of 10.7 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 (Group D). 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 4.1 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 77.

Table 4.1. Average Patrol Section Lengths by Winter Service Group

Winter service group	Average patrol section length (lane miles)	Range of average patrol section lengths by county (lane miles)
A	39.3	29 – 51
B	44.5	34 – 62
C	45.7	20 – 61
D	47.7	31 – 73
Statewide average	43.4	20 – 73

BEST PRACTICES: Proactive approach

In general, a faster reaction time leads to faster clear pavement. WisDOT encourages county highway departments to have crews on the roads as soon as possible after a storm begins, within the guidelines for each county's service group and each highway's expected level of service.

Responding at the beginning of a storm reduces the amount of traffic that has packed down the snow before the plows and salt spreaders go to work. Since packed snow tends to require more effort to remove, minimizing the thickness of packed snow allows the counties to conserve resources and operate more efficiently.

For more information, contact Mike Sproul at michael.sproul@dot.state.wi.us or (608) 266-8680.

4B. 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 these 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 4.2 shows the average reaction time to storm events in each Winter Service Group. The counties have become more proactive in responding to winter storm events over the last six winter seasons, responding an average of 16 percent faster this winter than in 2001-2002. 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.

After increasing somewhat during the previous two winters, the statewide average reaction time fell slightly this year, from 2.53 hours in 2006-2007 to 2.48 this winter.

Table 4.2. Maintenance Crew Reaction Time

From winter storm reports, 2001-2008

	Average reaction time (hours)							Percent change
Winter Service Group	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2007-2008 vs. 2001-2002
A	1.89	1.44	1.45	1.25	1.55	1.70	1.50	-21%
B	2.17	1.92	2.01	1.97	1.59	1.80	1.73	-20%
C	3.36	2.92	2.89	2.42	2.79	2.82	2.86	-15%
D	4.34	3.56	4.37	3.23	3.60	3.81	3.83	-12%
Statewide average (unweighted)	**2.94**	**2.46**	**2.68**	**2.22**	**2.38**	**2.53**	**2.48**	**-16%**

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 would be expected that an urban freeway (Category 1) would receive more materials, labor and equipment—and would show a quicker recovery to bare/wet pavement—than a rural two-lane highway (Category 5). For more information on these categories, see page 10.

Table 4.3. Average Time to Bare/Wet Pavement

Highway Category	Average Time to Bare/Wet Pavement (hours after end of storm)				
	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
1	1.07	1.86	-1.21	-2.50	2.20
2	1.31	1.91	0.20	-0.55	0.76
3	1.52	2.08	1.77	1.57	3.14
4	2.45	1.95	2.47	2.70	4.01
5	3.63	2.03	3.40	2.73	4.84
Statewide average	**2.63**	**2.07**	**1.92**	**1.46**	**3.27**

Note: "Average Time to Bare/Wet Pavement" is defined as the time from the end of the storm to the time that the pavement was reported to be bare or wet. A negative "hours after end of storm" number or an extremely low number is caused by a number of storm events when the pavement was reported to be bare/wet before the reported end of the storm or the pavement was bare/wet at the same time as the end of the storm.

"Time to bare/wet pavement" is measured from the reported end time of a storm. Table 4.3 shows that the trend for average time to bare/wet pavement is as expected: More heavily traveled highways show a shorter average time to bare/wet pavement. From storm to storm, however, most variability is due to weather effects (type, duration and severity of storms throughout the winter season), according to analysis performed through the Compass program.

The average time to bare/wet pavement decreased over the first four winters that this measure was tracked, but this winter multiple factors combined to make it more challenging for crews to clear roads quickly, which increased the statewide average to 3.27 hours. On several occasions, multiple events in quick succession each contributed significant amounts of snow. These back-to-back storms created manpower issues, as counties had to temporarily suspend their plowing efforts to allow plow operators to rest. Vehicle traffic during these rest periods tended to pack snow and make it more difficult and time-consuming to remove.

In addition, this winter's below-normal temperatures decreased the effectiveness of salt, which increased the time required to return pavement to bare/wet conditions. And salt shortages in some parts of the state led crews to use more salt-sand mixtures, which are also less efficient at melting snow and ice.

4C. Compass

Developed in 2001, Compass is WisDOT's quality assurance and asset management program for highway 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 2003-2004 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 4.4 on page 66 gives the statewide average values for these measures for the last five winters. More detail on these measures is provided later in this section.

Table 4.4. Statewide Compass Measures for Winter

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
Time to bare/wet pavement (after end of storm)	2 hours, 38 minutes	2 hours, 4 minutes	1 hour, 55 minutes	1 hour, 28 minutes	3 hours, 16 minutes
Cost per lane mile	$1,279	$1,374	$1,400	$1,549	$2,591
Winter Severity Index	31.2	31.9	31.8	28.4	37.2
Cost per lane mile per Winter Severity Index point	$40.99	$43.07	$44.03	$54.54	$69.65
Winter weather crashes	26 per 100 million vehicle miles traveled	25 per 100 million vehicle miles traveled	24 per 100 million vehicle miles traveled	23 per 100 million vehicle miles traveled	43 per 100 million vehicle miles traveled

WisDOT plans to gather several years of baseline data before establishing 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:

1. Percent of winter operations equipment that is calibrated before winter begins (see https://trust.dot.state.wi.us/extntgtwy/dtid_bho/extranet/winter/reports/reports.shtm for a report on winter equipment calibration from 2003-2007).
2. Average traffic speed recovery after a storm event (progress reports are available from WisDOT)

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

4D. Costs

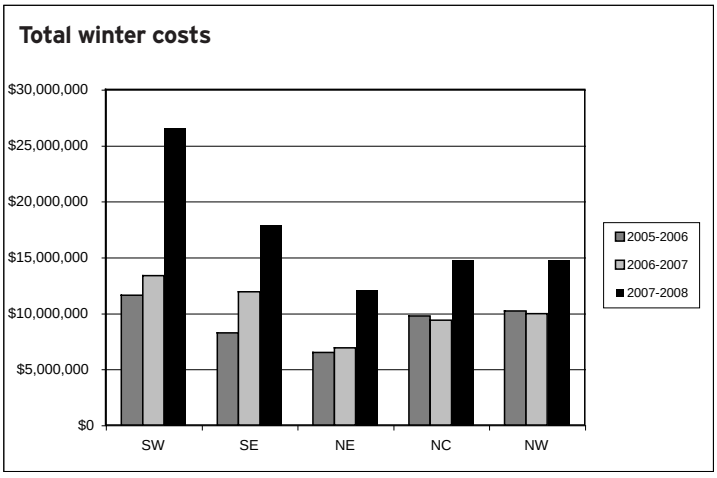
The total billed cost of statewide winter operations this year was $86.3 million. This figure is 68 percent higher than last year's total costs and 100 percent more than the average of costs in the previous five years—*double* the cost of an average recent Wisconsin winter.

Clearly, this winter's severe weather was the biggest reason for this increase. But the counties faced challenges on multiple fronts this year as severe weather combined with factors such as increased salt costs and equipment expenses, both driven by rising fuel prices.

Salt shortages had a marked impact on expenditures as well. WisDOT spent $26,611,765 on salt statewide—an average of $41.69 per ton for 400,200 tons of salt purchased under the department's original contract with suppliers (about $16.6 million was contracted for), but an average of $76 per ton for 130,300 tons of additional salt purchased under supplemental contracts totaling about $9.9 million. In some counties, WisDOT paid up to $101 per ton for supplemental salt. Supplemental salt purchases made up 25 percent of total salt tons purchased this winter, and 37 percent of total salt expenditures.

Counties spent $1.1 million this year trucking salt from depots and from county to county, compared

Figure 4.1. Change in Costs Since 2005-2006



with last year's expenditures of $300,000. The Southwest Region, which faced the greatest shortages, contributed nearly half of this year's total. Higher fuel prices have raised salt transportation costs in recent years: The average of $41.69 per ton paid under the original salt contract is an increase of 18 percent compared with the average of $35.22 two winters ago.

As Figure 4.1 shows, the Southwest Region experienced the greatest increase in costs compared with the two previous winters. The region's unusually severe weather accounted for most of this increase; on average, counties in the region experienced a 45 percent higher severity index this winter compared with the previous five winters. As noted above, the region's salt shortage also contributed to the higher overall winter expenditures. The Southeast Region experienced a 63 percent higher average severity index than the five-year average, and saw a substantial increase in costs as well. The average severity index increased more moderately in northern Wisconsin, even declining slightly in three counties, and cost increases there were more moderate as well.

Figure 4.8 on page 87 shows county-by-county cost increases compared with the average of the previous five winters. Nine counties saw increases of more than 150 percent—all in the Southwest Region. An additional 17 counties, also primarily in the south, saw increases of between 101 and 150 percent. Every county recorded an increase, with Bayfield County reporting the lowest increase at 26 percent.

Individual expenditure categories reflected similar increases in response to the severe winter, especially in the Southwest Region:

- Salt expenditures increased 68 percent statewide, with a 94 percent increase in the Southwest Region.

- Equipment expenditures increased 71 percent statewide compared with last year, following a 17 percent annual increase the previous winter. The Southwest and Northeast Regions registered the steepest increases this year at 96 percent and 90 percent, respectively.

- Labor expenditures increased 57 percent statewide (84 percent in the Southwest Region) compared with last year. Percentages of overtime increased only slightly over last year.

- Expenditures for materials other than salt increased 157 percent statewide over last year, with a 305 percent increase in the Southwest Region reflecting that region's dramatic increase in sand use.

Figure 4.5 on page 71 shows each region's expenditures per lane mile in each category.

Figure 4.2. Winter Costs per Lane Mile

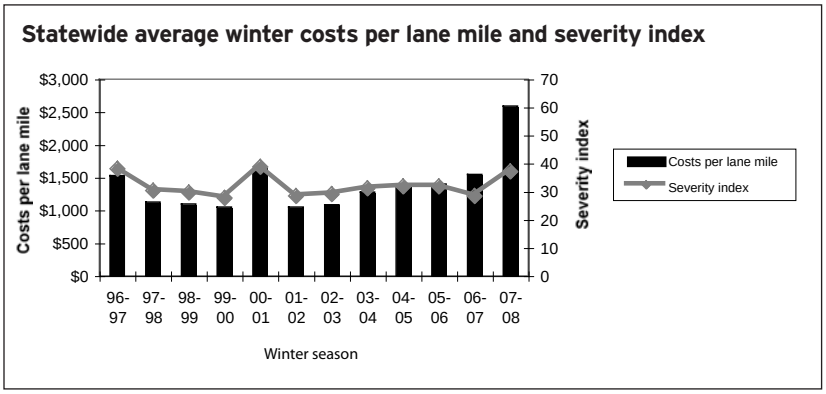


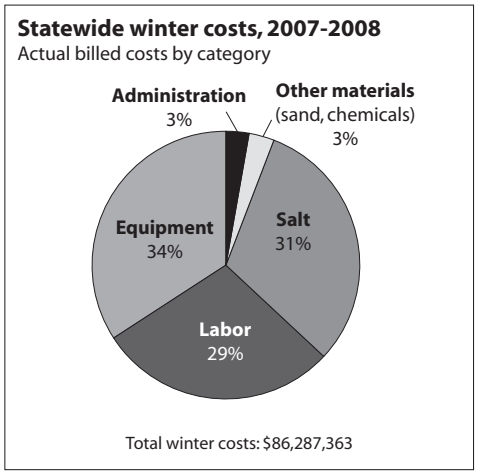
Table 4.5. Total Winter Costs Relative to Winter Severity

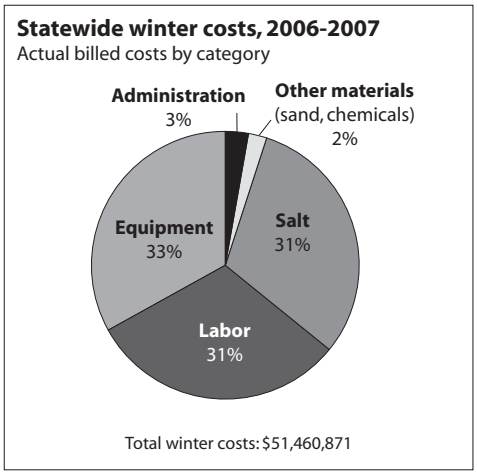
Region	Average Winter Severity Index	Actual cost per lane mile	Relative cost per severity index point
SW	35.07	$2,909	$82.95
SE	35.57	$3,233	$90.89
NE	37.53	$2,618	$69.76
NC	41.24	$2,373	$57.54
NW	35.65	$1,914	$53.69
Statewide	**37.20**	**$2,591**	**$69.65**

This winter's statewide average cost per lane mile of $2,591 was higher than the two previous years' averages of $1,549 and $1,400 per lane mile, and significantly higher than the average of the previous several years (around $1,100 to $1,200). Figure 4.2 on page 67 shows the trends in winter costs per lane mile and severity index over the last 12 winters. On the whole, winter costs per lane mile tend to increase as statewide average severity increases, and this winter's higher relative costs were affected by higher salt costs and equipment costs than the state experienced in previous years, both driven by higher fuel prices.

Table 4.5 on page 67 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.

Figure 4.3. Statewide Winter Costs by Category





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 3.5 on page 44 for details on deicing agent costs).

- **Administrative costs** are calculated at 4.5 percent of each county's combined labor, equipment and materials costs, and cover the overhead costs for office activities.

A comparison of total costs from year to year shows that the breakdown of costs among these five categories stays very similar from year to year, even when winter severity varies significantly. To illustrate this, Figure 4.3 shows the breakdown of costs for this winter compared with last winter, when the statewide severity index of 28.4 was much more moderate.

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

Figure 4.4. Regional Winter Costs by Category

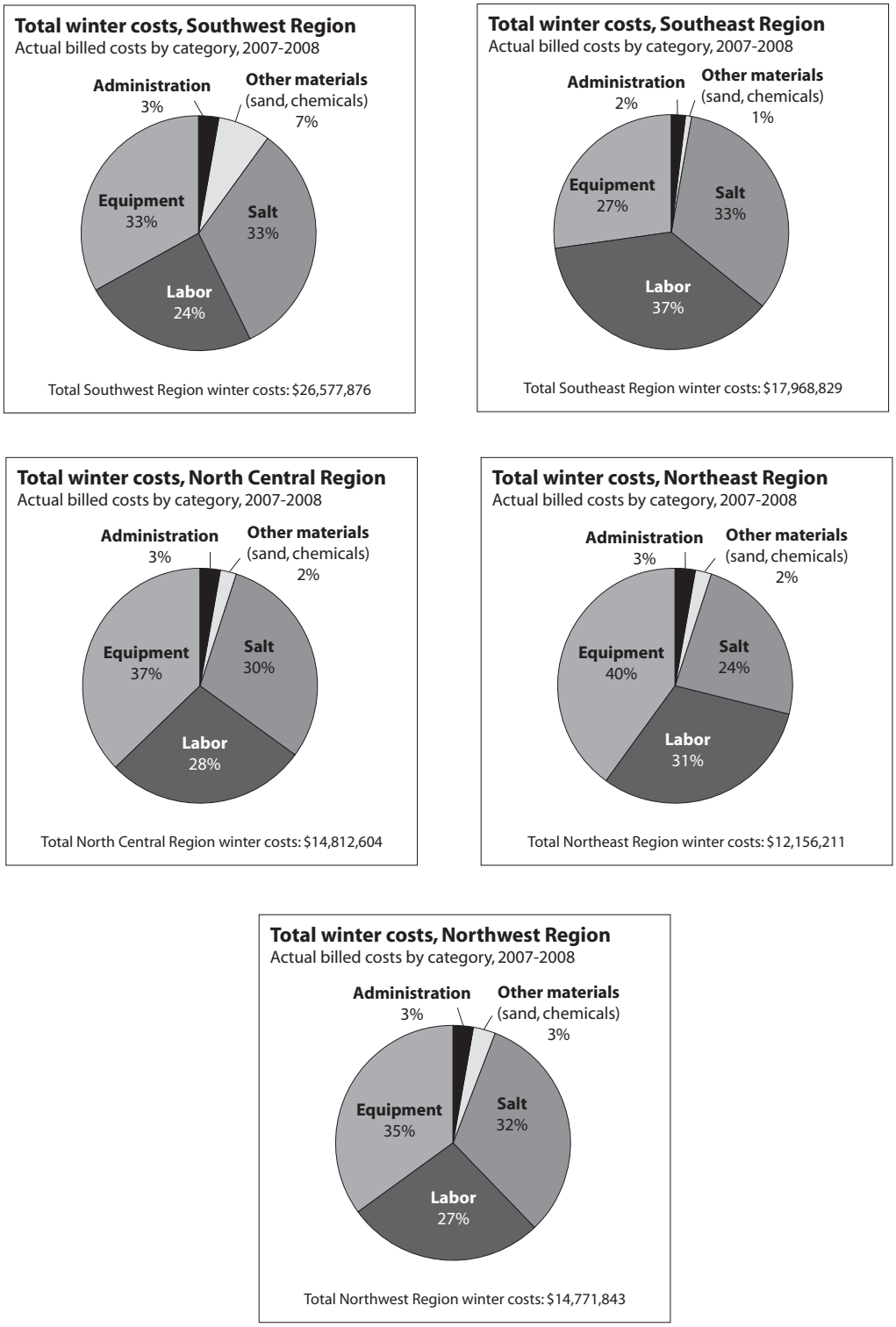


Table 4.6. Winter Costs as Billed to WisDOT by Counties

From WisDOT accounting system, 2007-2008

	Labor Costs	Equipment Costs	Cost of Other Materials (Sand, Chemicals)	Administration Costs	Cost of Salt Used	Total Costs for Winter	5-Year Avg. Cost for Winter ('03-'07 Avg.)	% Costs over 5-Year Average
Region 1 / Southwest	$6,461,698	$8,872,311	$1,792,857	$767,369	$8,683,641	$26,577,876	$10,336,000	257%
Region 2 / Southeast	$6,563,936	$4,940,631	$232,312	$343,331	$5,888,619	$17,968,829	$8,481,700	212%
Region 3 / Northeast	$3,728,294	$4,865,305	$237,388	$395,514	$2,929,710	$12,156,211	$6,078,700	200%
Region 4 / North Central	$4,078,401	$5,509,983	$354,031	$444,065	$4,426,124	$14,812,604	$8,843,600	167%
Region 5 / Northwest	$3,999,735	$5,147,152	$511,170	$430,115	$4,683,671	$14,771,843	$9,330,300	158%
Region Totals	$24,832,064	$29,335,382	$3,127,758	$2,380,394	$26,611,765	$86,287,363	$43,070,300	200%

prepared by: Cathy Meinholz/Bureau of Highway Operations

September 8, 2008

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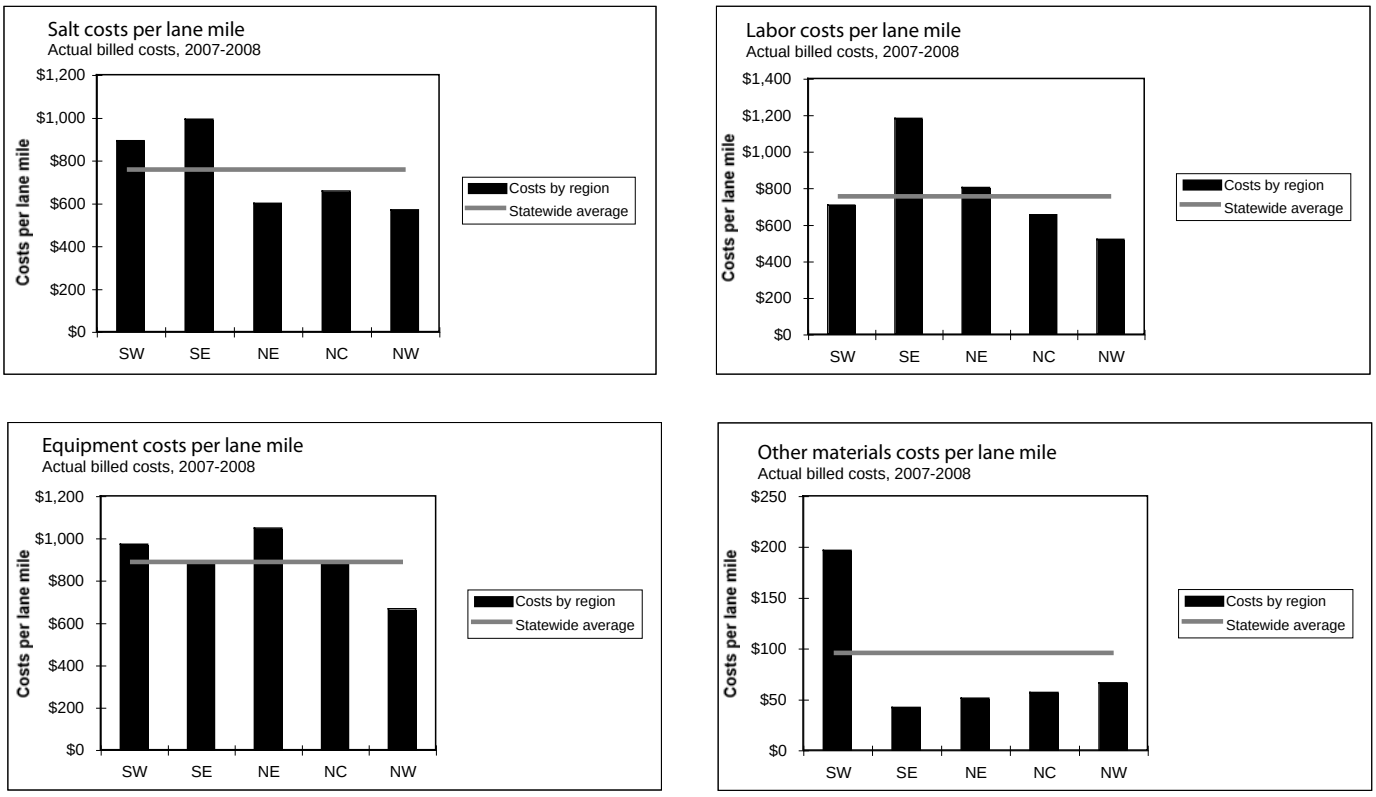
Figure 4.5. Costs per Lane Mile by Category



counties, while equipment expenditures make up a smaller percentage of that region's total expenditures. Figure 4.4 on page 69 shows the distribution of costs by category for each region.

Statewide winter cost data is presented in Table 4.6 on page 70. County-by-county cost data is available in Table 4.10 on page 82.

A Note About Cost Data

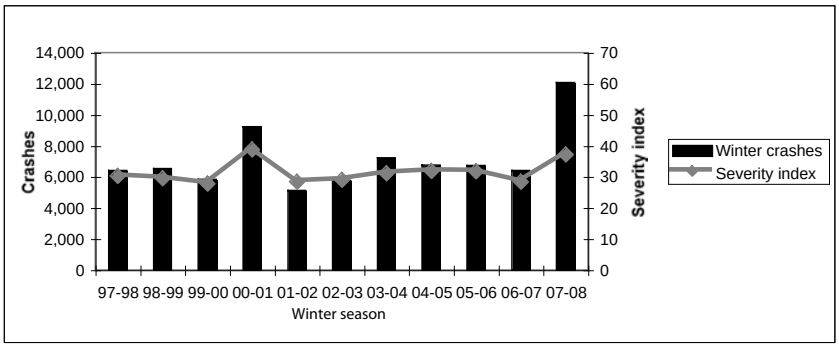
The tables at the end of this section were generated with data from two sources—final costs as billed to WisDOT, and preliminary costs from the winter storm reports. The tables created from preliminary storm reports data (such as Table 4.11 on page 88, Cost per Lane Mile per Severity Index Ranking) are 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.

Figure 4.6. Statewide Winter Crashes and Severity Index



Source: WisDOT Bureau of Transportation Safety

This year, there were 12,060 reported winter weather crashes (those that occurred on pavements covered with snow, slush or ice). The crash rate (number of crashes per 100 million vehicle miles traveled) increased this year to a statewide average of 43, up from last year's crash rate of 23. Last year, 6,402 winter crashes were reported.

Crash rates tend to increase in more severe winters, and this winter's rate was similar to the crash rate of 42 in the 2000-2001 winter (though total crashes that year were substantially lower, at 9,238). Figure 4.6 shows the trends in total crashes statewide over the last 10 years overlaid with the Winter Severity Index.

It's important to note that crash rates provide only a portion of the picture of overall winter safety. Crash rates include only "reportable" crashes, which exclude those that cause property damage under $1,000 that aren't required by law to be reported to police. Also, crashes in urban areas are more likely to occur at lower speeds and cause fewer deaths, while crashes on high-speed rural roads are more likely than low-speed crashes to be fatal.

Crashes and Vehicle Miles Traveled

More urban areas such as the Southeast Region often have fewer winter weather crashes per 100 million vehicle miles traveled. This is partly due to the fact that a single crash in a county with low VMT has a bigger impact on the overall crash rate. In addition, urban regions have more highways with 24-hour coverage, which means that these roadways are more likely to be in passable condition. This year, all regions saw a significant increase in crash rates that was likely due to the severity of the winter, frequency of weekend storms and moderate temperatures that made for more slippery driving conditions. The Southwest Region had the highest crash rate, at 57 crashes per 100 million VMT; the more rural Northwest Region showed the lowest crash rate at 35 crashes per 100 million VMT (see Table 4.7). Table 4.12 on page 95 gives the estimated number of vehicle miles traveled in each county this winter (November 2007 to April 2008), and the number of crashes that occurred in each county.

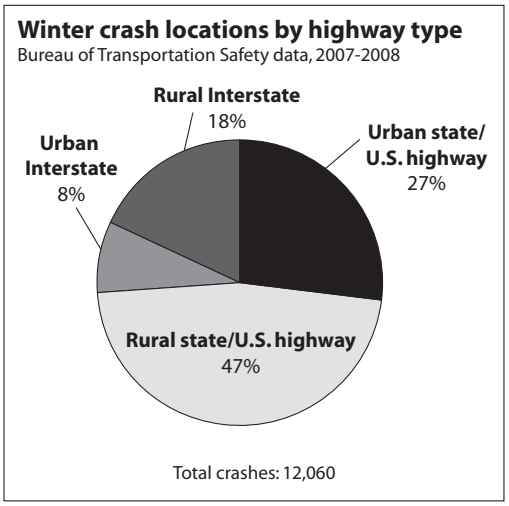
Table 4.7. Crashes and Vehicle Miles Traveled by Region

Region	VMT (100 million)	Crashes	Crashes per 100 million VMT	Average Winter Severity Index
NC	33.97	1,387	41	41.24
NE	50.20	2,165	43	37.53
NW	39.45	1,379	35	35.65
SE	86.14	3,166	37	35.57
SW	69.55	3,963	57	35.07
Statewide	**279.31**	**12,060**	**43**	**37.20**

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 shows that most winter crashes occur on rural state or U.S. highways, largely because there are more lane miles in this category than in the others. Table 4.13 on page 98 shows the breakdown of crashes in each county according to highway type.

Figure 4.7. Winter Crash Locations



How VMT Is Calculated

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 sold, fuel tax collected, and average vehicle miles per gallon.

Total winter VMT for all counties is shown in Table 4.12 on page 95. This winter, total VMT ranged from a low of 22.2 million in Menominee County to a high of 3.5 billion in Milwaukee County. VMT estimates at the county level tend to be less reliable than at the statewide level, because current traffic counts are not available for all counties, and more variability exists in the data at finer levels of resolution.

4F. Customer Satisfaction

Over the last several years, WisDOT has gauged customer satisfaction with winter road conditions primarily through two types of surveys—a biannual survey of state troopers and a periodic survey of state residents.

State Troopers Winter Road Condition Survey

In April of 1999, 2001, 2003 and 2005, WisDOT surveyed State Patrol troopers on their opinions of the winter road conditions during the previous winter season. In general, the majority (70 to 75 percent) of the troopers that responded to the survey were satisfied with the winter maintenance activities performed by county highway departments on the state trunk highway system. A summary of the survey results was provided to the WisDOT regional highway operations staff, and copies of the summaries are available from BHO. WisDOT discontinued the surveys after 2005 because the comments received were very similar each year.

Highway Operations Customer Satisfaction Survey

WisDOT has periodically surveyed Wisconsin residents on their opinions of highway maintenance and traffic operations on the state highway system. Highlights of the most recent survey included:

- Over 90 percent of respondents rated state and county efforts to provide "good winter driving conditions " as excellent or good.
- 58 percent of respondents reported having seen or heard a WisDOT media spot or poster about winter driving conditions. Of those who had, 74 percent said that it made them more conscious and cautious while driving.
- When respondents were asked to allocate funds among nine different service areas, the highest allocations were for snow and ice removal. This indicates the importance of winter operations to users of the state highway system.

Copies of the complete survey are available from WisDOT.

WisDOT also conducted a survey in February 2004 that included questions about winter operations. Respondents gave the category "pavement clear of snow and ice" an average satisfaction rating of 7.47 on a scale of 0 to 10, where 10 indicated the greatest satisfaction.

Although a comprehensive survey on highway maintenance has not been conducted recently, the results of the earlier surveys remain relevant today because the level of service provided this winter is consistent or greater than the level of service provided at the time of the earlier surveys. Some highways have been upgraded from 18- to 24-hour coverage over the last several years, and money spent on winter maintenance per lane mile has been fairly consistent over the years with fluctuations in the severity index.

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 2008 Survey	Lane Miles per Patrol Section	Winter Service Group
Adams	192.09	5	38.42	D
Florence	141.07	3	47.02	D
Forest	312.38	6	52.06	D
Green Lake	151.30	3	50.43	D
Iron	250.91	6	41.82	D
Langlade	292.69	6	48.78	D
Lincoln	418.33	10	41.83	C
Marathon	869.61	19	45.77	A
Marquette	243.77	5	48.75	B
Menominee	90.26	2	45.13	D
Oneida	389.73	10	38.97	B
Portage	504.28	13	38.79	A
Price	320.57	6	53.43	D
Shawano	509.14	14	36.37	B
Vilas	305.24	5	61.05	C
Waupaca	541.92	12	45.16	C
Waushara	345.71	6	57.62	B
Wood	362.92	18	20.16	C
Region Average			**45.09**	

NW Region

County	Lane Miles	Winter Patrol Sections 2008 Survey	Lane Miles per Patrol Section	Winter Service Group
Ashland	247.57	5	49.51	D
Barron	422.39	11	38.40	D
Bayfield	316.90	6	52.82	D
Buffalo	315.77	10	31.58	D
Burnett	233.64	5	46.73	D
Chippewa	667.85	16	41.74	B
Clark	402.28	10	40.23	C
Douglas	439.23	9	48.80	C
Dunn	516.55	11	46.96	B
Eau Claire	555.74	14	39.70	A
Jackson	504.10	9	56.01	C
Pepin	110.91	3	36.97	D
Pierce	364.82	7	52.12	D
Polk	385.05	7	55.01	D
Rusk	213.47	7	30.50	D
Saint Croix	616.98	10	61.70	B
Sawyer	367.44	5	73.49	D
Taylor	234.37	4	58.59	D
Trempeleau	431.24	10	43.12	C
Washburn	372.14	7	53.16	C
Region Average			**47.86**	

NE Region

County	Lane Miles	Winter Patrol Sections 2008 Survey	Lane Miles per Patrol Section	Winter Service Group
Brown	712.86	18	39.60	A
Calumet	200.86	6	33.48	C
Door	251.87	6	41.98	C
Fond du Lac	579.80	16	36.24	C
Kewaunee	110.41	3	36.80	C
Manitowoc	415.29	11	37.75	B
Marinette	372.18	8	46.52	D
Oconto	425.43	9	47.27	C
Outagamie	506.23	15	33.75	B
Sheboygan	518.90	11	47.17	B
Winnebago	549.02	15	36.60	A
Region Average			**39.74**	

SW Region

County	Lane Miles	Winter Patrol Sections 2008 Survey	Lane Miles per Patrol Section	Winter Service Group
Columbia	745.80	15	49.72	B
Crawford	385.21	7	55.03	C
Dane	1674.08	35	47.83	A
Dodge	606.62	17	35.68	B
Grant	624.14	11	56.74	C
Green	311.45	7	44.49	D
Iowa	451.03	9	50.11	C
Jefferson	458.21	13	35.25	B
Juneau	498.13	10	49.81	C
LaCrosse	480.28	13	36.94	A
Lafayette	293.88	6	48.98	C
Monroe	643.69	13	49.51	C
Richland	328.72	6	54.79	D
Rock	592.56	13	45.58	B
Sauk	591.55	12	49.30	B
Vernon	450.00	10	45.00	C
Region Average			**47.17**	

SE Region

County	Lane Miles	Winter Patrol Sections 2008 Survey	Lane Miles per Patrol Section	Winter Service Group
Kenosha	553.35	19	29.12	A
Milwaukee	1789.02	35	51.11	A
Ozaukee	304.03	8	38.00	A
Racine	587.21	17	34.54	A
Walworth	689.25	14	49.23	B
Washington	580.03	14	41.43	B
Waukesha	1055.27	31	34.04	A

	Lane Miles	Winter Patrol Sections 2008 Survey	Lane Miles per Patrol Section
Statewide Totals	33,296.72	768.0	43.36
Statewide Averages	462.45	10.7	43.36
Group A Averages	802.90	19.75	39.34
Group B Averages	529.07	12.18	44.53
Group C Averages	413.90	9.33	45.74
Group D Averages	271.63	5.82	47.66

Final totals as of 11/18/2008

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

From Winter Storm Reports, 2007-2008

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		
MARATHON	NC	2.42	2.52	3.13	3.59	2.45	45.31	39.09
LA CROSSE	SW	3.03	2.92	2.69	2.57	2.92	40.63	46.97
PORTAGE	NC	1.86	1.87	1.63	1.16	2.01	37.05	52.25
BROWN	NE	3.71	3.86	3.06	0.66	3.38	37.74	53.08
WINNEBAGO	NE	1.86	2.15	2.06	1.59	2.06	40.16	53.15
EAU CLAIRE	NW	0.69	0.74	0.86	0.88	0.88	26.71	63.12
RACINE	SE	1.26	1.06	0.88	0.88	1.04	35.07	63.86
OZAUKEE	SE	0.84	0.85	0.32	1.98	0.83	35.81	72.28
MILWAUKEE	SE	0.00	0.00	0.00	0.00	0.00	35.42	74.33
KENOSHA	SE	0.64	0.65	0.69	0.64	0.65	34.92	77.43
WAUKESHA	SE	1.70	1.69	1.43	2.12	1.70	33.06	85.15
DANE	SW	0.17	0.16	0.15	0.14	0.14	32.89	96.48
Group A Averages		1.51	1.54	1.41	1.35	1.50	36.23	64.77

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

From Winter Storm Reports, 2007-2008

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)						
SHAWANO	NC	3.17	3.18	2.46	3.09	3.18	40.33	40.50
ONEIDA	NC	4.95	4.92	5.27	3.73	4.91	55.48	40.77
WAUSHARA	NC	1.79	2.26	1.78	1.57	1.91	31.78	43.63
SAINT CROIX	NW	1.23	1.07	0.81	0.81	0.92	36.43	45.33
MANITOWOC	NE	5.59	6.03	2.84	2.76	4.10	34.00	50.06
SHEBOYGAN	NE	2.26	2.47	1.91	1.74	2.41	35.07	54.17
MARQUETTE	NC	1.61	1.68	1.82	2.04	1.48	34.44	54.20
WASHINGTON	SE	1.69	1.74	1.44	1.55	1.66	42.20	54.36
OUTAGAMIE	NE	3.13	3.13	3.15	2.89	2.56	33.57	62.40
DUNN	NW	0.94	0.91	1.64	0.98	0.98	25.70	67.57
DODGE	SW	0.84	0.88	0.57	0.76	0.84	31.75	68.18
SAUK	SW	1.35	1.33	1.32	1.07	1.36	39.50	72.00
WALWORTH	SE	0.18	0.26	0.53	1.14	0.33	32.53	73.34
ROCK	SW	0.40	0.41	0.50	0.69	0.29	29.31	79.22
CHIPPEWA	NW	1.63	1.57	2.29	1.80	1.73	26.36	85.61
JEFFERSON	SW	2.30	2.30	1.66	1.68	2.30	28.84	89.10
COLUMBIA	SW	-1.55	-1.51	-0.95	-0.73	-1.55	36.86	90.08
Group B Averages		1.85	1.92	1.71	1.62	1.73	34.95	62.97

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

From Winter Storm Reports, 2007-2008

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)						
DOUGLAS	NW	2.09	2.09	1.29	2.00	2.00	42.14	32.51
VERNON	SW	3.86	3.79	3.75	4.78	3.95	37.11	34.89
LINCOLN	NC	4.65	4.60	4.37	4.15	4.65	42.54	38.17
OCONTO	NE	2.40	2.43	2.43	2.14	2.44	39.77	38.50
DOOR	NE	3.75	3.69	3.60	3.72	3.70	38.54	41.64
MONROE	SW	1.50	1.51	1.45	1.58	1.52	37.05	42.01
TREMPEALEAU	NW	0.00	0.00	0.00	0.00	0.00	32.41	42.09
WOOD	NC	4.90	4.74	5.05	4.06	4.79	37.69	43.40
GRANT	SW	1.36	1.31	0.74	1.00	1.21	43.67	43.89
KEWAUNEE	NE	4.74	4.74	2.94	4.78	4.78	33.35	45.27
CRAWFORD	SW	4.18	3.25	3.62	3.32	3.90	35.93	46.08
WASHBURN	NW	4.23	3.83	4.60	3.85	4.38	36.37	46.40
CALUMET	NE	4.25	4.25	2.94	4.00	4.29	41.71	46.95
WAUPACA	NC	2.49	2.45	2.89	3.20	2.45	31.86	48.55
LAFAYETTE	SW	2.68	2.68	2.28	2.33	2.88	35.21	49.46
CLARK	NW	3.61	3.75	3.55	3.76	3.55	29.40	50.56
JACKSON	NW	-0.19	-0.10	-0.13	0.06	-0.10	33.37	50.70
FOND DU LAC	NE	1.16	1.09	0.24	0.82	0.93	40.43	52.18
VILAS	NC	4.41	4.55	2.50	4.33	4.33	39.28	54.29
IOWA	SW	2.51	2.44	2.94	3.62	2.50	35.64	70.15
JUNEAU	SW	1.62	1.71	1.82	1.44	1.83	34.98	71.79
Group C Averages		2.87	2.80	2.52	2.81	2.86	37.07	47.12

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

From Winter Storm Reports, 2007-2008

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)						
BAYFIELD	NW	2.71	2.55	2.94	3.00	2.78	55.32	26.20
ASHLAND	NW	4.84	4.68	3.61	4.73	4.63	54.54	26.51
RUSK	NW	4.53	4.93	5.40	7.34	4.86	36.50	28.12
BUFFALO	NW	3.43	3.49	3.24	2.69	3.41	34.08	30.11
SAWYER	NW	4.09	4.09	3.70	3.85	4.28	34.72	31.18
BARRON	NW	2.49	2.45	2.71	3.44	2.49	35.58	32.23
PRICE	NC	4.56	4.86	5.01	5.70	4.85	50.42	33.65
BURNETT	NW	4.22	4.31	3.88	3.28	4.15	33.75	35.56
PIERCE	NW	3.07	2.77	3.71	2.91	3.20	35.60	36.56
TAYLOR	NW	1.87	1.84	1.50	1.93	2.06	33.93	38.67
MARINETTE	NE	4.17	4.02	4.06	3.90	4.03	38.48	38.87
GREEN LAKE	NC	5.99	6.20	4.20	4.86	5.68	32.74	40.19
POLK	NW	2.68	2.73	3.27	1.33	2.59	43.94	40.32
FLORENCE	NC	4.95	5.30	4.55	5.16	5.08	43.00	40.67
RICHLAND	SW	3.44	3.39	3.09	2.65	3.55	29.72	41.78
MENOMINEE	NC	4.90	4.72	3.79	4.00	4.99	33.63	41.97
PEPIN	NW	2.74	2.65	2.67	2.19	2.82	26.23	42.28
IRON	NC	3.94	4.32	2.90	4.20	4.20	58.90	42.73
LANGLADE	NC	4.49	4.54	4.30	5.05	4.32	43.82	43.15
FOREST	NC	3.52	3.72	3.65	3.15	3.87	41.90	46.44
ADAMS	NC	5.39	5.48	4.50	4.26	5.31	42.11	59.40
GREEN	SW	1.24	1.23	1.07	1.07	1.22	32.01	68.90
Group D Averages		3.78	3.83	3.53	3.67	3.83	39.59	39.34

Table 4.10. Winter Maintenance Costs per Lane Mile, Fiscal Year 2008

Final billed costs from the WisDOT accounting system

	Labor	Labor Costs per Lane Mile	Equipment	Equip. Costs per Lane Mile	Materials	Materials Costs per Lane Mile	Admin.	Cost of Salt Used	Tons of Salt Used	Total FY 2008 Winter Costs	2008 LOS Lane Miles	Winter Costs per Lane Mile
REGION 1 / SOUTHWEST												
Columbia	$676,421	$907	$1,012,572	$1,358	$277,464	$372	$88,494	$1,059,369	21,965	$3,114,320	745.80	$4,176
Crawford	$222,649	$578	$316,422	$821	$22,868	$59	$25,254	$205,383	4,559	$792,576	385.21	$2,058
Dane	$1,557,387	$930	$1,509,911	$902	$855,671	$511	$176,534	$1,826,196	43,773	$5,925,699	1,674.08	$3,540
Dodge	$423,583	$698	$750,864	$1,238	$19,302	$32	$53,491	$619,876	16,214	$1,867,116	606.62	$3,078
Grant	$328,081	$526	$540,670	$866	$66,812	$107	$42,016	$456,548	10,132	$1,434,127	624.14	$2,298
Green	$213,308	$685	$309,616	$994	$52,369	$168	$25,859	$178,972	3,826	$780,124	311.45	$2,505
Iowa	$341,876	$758	$516,987	$1,146	$102,791	$228	$42,998	$417,569	8,520	$1,422,221	451.03	$3,153
Jefferson	$443,018	$967	$516,229	$1,127	$39,249	$86	$44,288	$542,196	14,871	$1,584,980	458.21	$3,459
Juneau	$248,141	$498	$296,375	$595	$66,625	$134	$27,501	$482,932	9,563	$1,121,574	498.13	$2,252
La Crosse	$315,182	$656	$480,097	$1,000	$51,916	$108	$37,560	$441,023	10,377	$1,325,778	480.28	$2,760
Lafayette	$185,610	$632	$302,831	$1,030	$71,498	$243	$24,971	$168,429	3,574	$753,339	293.88	$2,563
Monroe	$256,803	$399	$469,839	$730	$26,411	$41	$33,854	$410,212	9,240	$1,197,119	643.69	$1,860
Richland	$139,087	$423	$187,007	$569	$20,436	$62	$15,260	$141,229	2,884	$503,019	328.72	$1,530
Rock*	$499,609	$843	$724,307	$1,222	$15,664	$26	$55,630	$632,858	15,290	$1,928,068	592.56	$3,254
Sauk	$394,817	$667	$639,760	$1,081	$56,729	$96	$48,829	$870,304	16,204	$2,010,439	591.55	$3,399
Vernon	$216,126	$480	$298,824	$664	$47,052	$105	$24,830	$230,545	5,153	$817,377	450.00	$1,816
SW TOTAL	**$6,461,698**	**$707**	**$8,872,311**	**$971**	**$1,792,857**	**$196**	**$767,369**	**$8,683,641**	**196,145**	**$26,577,876**	**9,135.35**	**$2,909**

Table 4.10. Winter Maintenance Costs per Lane Mile, Fiscal Year 2008

Final billed costs from the WisDOT accounting system

	Labor	Labor Costs per Lane Mile	Equipment	Equip. Costs per Lane Mile	Materials	Materials Costs per Lane Mile	Admin.	Cost of Salt Used	Tons of Salt Used	Total FY 2008 Winter Costs	2008 LOS Lane Miles	Winter Costs per Lane Mile
REGION 2 / SOUTHEAST												
Kenosha	$646,275	$1,168	$557,803	$1,008	$10,079	$18	$54,603	$410,352	12,108	$1,679,112	553.35	$3,034
Milwaukee	$3,056,708	$1,709	$963,848	$539	$67,316	$38	$0	$1,887,237	55,279	$5,975,109	1,789.02	$3,340
Ozaukee	$307,210	$1,010	$356,492	$1,173	$10,606	$35	$30,344	$274,290	8,183	$978,942	304.03	$3,220
Racine	$644,898	$1,098	$698,501	$1,190	$7,944	$14	$60,745	$589,768	16,283	$2,001,856	587.21	$3,409
Walworth	$622,872	$904	$758,619	$1,101	$15,813	$23	$62,784	$663,188	19,024	$2,123,276	689.25	$3,081
Washington	$470,034	$810	$651,850	$1,124	$61,688	$106	$53,204	$547,709	13,628	$1,784,485	580.03	$3,077
Waukesha	$815,939	$773	$953,518	$904	$58,866	$56	$81,651	$1,516,074	41,673	$3,426,048	1,055.27	$3,247
SE TOTAL	**$6,563,936**	**$1,181**	**$4,940,631**	**$889**	**$232,312**	**$42**	**$343,331**	**$5,888,619**	**166,178**	**$17,968,829**	**5,558.16**	**$3,233**
REGION 3 / NORTHEAST												
Brown	$610,042	$856	$877,121	$1,230	$18,494	$26	$67,143	$427,519	14,294	$2,000,319	712.86	$2,806
Calumet	$173,241	$862	$232,419	$1,157	$4,163	$21	$18,442	$87,202	2,564	$515,467	200.86	$2,566
Door	$214,497	$852	$259,164	$1,029	$32,020	$127	$22,756	$124,474	3,449	$652,911	251.87	$2,592
Fond du Lac	$452,311	$780	$602,814	$1,040	$31,587	$54	$48,476	$399,542	10,169	$1,534,730	579.80	$2,647
Kewanee	$72,662	$658	$132,622	$1,201	$9,161	$83	$9,650	$50,776	1,369	$274,871	110.41	$2,490
Manitowoc	$426,334	$1,027	$396,175	$954	$32,790	$79	$38,338	$274,619	7,864	$1,168,256	415.29	$2,813
Marinette	$229,488	$617	$254,245	$683	$5,880	$16	$21,988	$216,332	5,641	$727,933	372.18	$1,956
Oconto	$217,719	$512	$363,712	$855	$2,321	$5	$26,269	$206,182	5,826	$816,203	425.43	$1,919
Outagamie	$459,954	$909	$603,590	$1,192	$64,606	$128	$50,375	$376,831	11,051	$1,555,356	506.23	$3,072
Sheboygan	$380,846	$734	$501,078	$966	$8,054	$16	$39,869	$393,268	10,125	$1,323,115	518.90	$2,550
Winnebago	$491,200	$895	$642,365	$1,170	$28,312	$52	$52,208	$372,964	10,094	$1,587,049	549.02	$2,891
NE TOTAL	**$3,728,294**	**$803**	**$4,865,305**	**$1,048**	**$237,388**	**$51**	**$395,514**	**$2,929,710**	**82,446**	**$12,156,211**	**4,642.85**	**$2,618**

Table 4.10. Winter Maintenance Costs per Lane Mile, Fiscal Year 2008

Final billed costs from the WisDOT accounting system

	Labor	Labor Costs per Lane Mile	Equipment	Equip. Costs per Lane Mile	Materials	Materials Costs per Lane Mile	Admin.	Cost of Salt Used	Tons of Salt Used	Total FY 2008 Winter Costs	2008 LOS Lane Miles	Winter Costs per Lane Mile
REGION 4 / NORTH CENTRAL												
Adams	$146,970	$765	$171,754	$894	$7,282	$38	$14,477	$186,521	3,684	$527,004	192.09	$2,744
Florence	$60,320	$428	$118,626	$841	$15,836	$112	$8,765	$129,956	2,805	$333,503	141.07	$2,364
Forest	$150,926	$483	$305,787	$979	$39,138	$125	$21,557	$310,604	6,706	$828,012	312.38	$2,651
Green Lake	$91,971	$608	$107,396	$710	$4,797	$32	$9,165	$74,252	1,819	$287,581	151.30	$1,901
Iron	$233,533	$931	$311,429	$1,241	$11,476	$46	$25,031	$245,218	5,233	$826,687	250.91	$3,295
Langlade	$217,985	$745	$313,432	$1,071	$9,852	$34	$24,146	$219,879	5,236	$785,294	292.69	$2,683
Lincoln	$257,718	$616	$380,561	$910	$11,472	$27	$29,216	$210,855	4,764	$889,822	418.33	$2,127
Marathon	$525,012	$604	$734,032	$844	$40,696	$47	$58,223	$560,680	13,143	$1,918,643	869.61	$2,206
Marquette	$164,040	$673	$195,616	$802	$14,022	$58	$16,775	$211,200	4,800	$601,653	243.77	$2,468
Menominee	$23,948	$265	$57,264	$634	$6,033	$67	$3,926	$62,757	1,752	$153,928	90.26	$1,705
Oneida	$340,219	$873	$413,454	$1,061	$14,142	$36	$34,426	$342,887	7,449	$1,145,128	389.73	$2,938
Portage	$387,179	$768	$423,144	$839	$32,659	$65	$36,989	$331,306	7,836	$1,211,277	504.28	$2,402
Price	$179,818	$561	$242,206	$756	$13,191	$41	$19,256	$256,168	5,168	$710,639	320.57	$2,217
Shawano	$310,890	$611	$419,179	$823	$35,211	$69	$34,334	$238,494	6,662	$1,038,108	509.14	$2,039
Vilas	$210,447	$689	$308,276	$1,010	$20,700	$68	$24,193	$332,169	6,867	$895,785	305.24	$2,935
Waupaca	$338,482	$625	$470,776	$869	$48,929	$90	$38,618	$300,060	7,810	$1,196,865	541.92	$2,209
Waushara	$210,864	$610	$251,482	$727	$21,838	$63	$21,595	$178,697	4,126	$684,476	345.71	$1,980
Wood	$228,079	$628	$285,569	$787	$6,757	$19	$23,373	$234,421	4,976	$778,199	362.92	$2,144
NC TOTAL	**$4,078,401**	**$653**	**$5,509,983**	**$883**	**$354,031**	**$57**	**$444,065**	**$4,426,124**	**100,836**	**$14,812,604**	**6,241.92**	**$2,373**

Table 4.10. Winter Maintenance Costs per Lane Mile, Fiscal Year 2008

Final billed costs from the WisDOT accounting system

	Labor	Labor Costs per Lane Mile	Equipment	Equip. Costs per Lane Mile	Materials	Materials Costs per Lane Mile	Admin.	Cost of Salt Used	Tons of Salt Used	Total FY 2008 Winter Costs	2008 LOS Lane Miles	Winter Costs per Lane Mile
REGION 5 / NORTHWEST												
Ashland	$140,772	$569	$213,397	$862	$24,199	$98	$17,027	$107,922	2,558	$503,317	247.57	$2,033
Barron	$276,971	$656	$334,630	$792	$10,443	$25	$27,908	$97,969	2,207	$747,921	422.39	$1,771
Bayfield	$187,644	$592	$228,314	$720	$27,674	$87	$19,188	$157,635	4,105	$620,455	316.90	$1,958
Buffalo	$122,791	$389	$151,017	$478	$6,117	$19	$12,428	$87,612	2,098	$379,965	315.77	$1,203
Burnett	$95,404	$408	$137,094	$587	$12,127	$52	$10,934	$114,997	2,864	$370,556	233.64	$1,586
Chippewa	$411,129	$616	$443,747	$664	$45,682	$68	$40,237	$403,275	6,726	$1,344,070	667.85	$2,013
Clark	$200,285	$498	$258,115	$642	$7,634	$19	$20,972	$281,200	5,018	$768,206	402.28	$1,910
Douglas	$221,251	$504	$327,666	$746	$58,347	$133	$27,182	$218,906	5,782	$853,352	439.23	$1,943
Dunn	$367,693	$712	$362,724	$702	$18,633	$36	$33,375	$424,572	8,416	$1,206,997	516.55	$2,337
Eau Claire	$369,059	$664	$429,902	$774	$31,258	$56	$37,196	$460,541	8,841	$1,327,956	555.74	$2,390
Jackson	$230,971	$458	$360,298	$715	$24,727	$49	$27,227	$400,794	8,603	$1,044,017	504.10	$2,071
Pepin	$62,145	$560	$60,336	$544	$10,314	$93	$5,974	$44,221	1,014	$182,990	110.91	$1,650
Pierce	$206,304	$565	$245,868	$674	$27,161	$74	$21,475	$212,250	4,385	$713,058	364.82	$1,955
Polk	$166,045	$431	$259,935	$675	$49,628	$129	$21,139	$247,927	5,099	$744,674	385.05	$1,934
Rusk	$73,403	$344	$129,862	$608	$13,492	$63	$9,376	$89,855	1,850	$315,988	213.47	$1,480
Sawyer	$124,923	$340	$176,523	$480	$5,936	$16	$13,832	$143,642	3,242	$464,856	367.44	$1,265
St. Croix	$310,148	$503	$397,442	$644	$68,642	$111	$34,765	$470,686	9,482	$1,281,683	616.98	$2,077
Taylor	$91,026	$388	$126,380	$539	$6,416	$27	$10,044	$143,247	2,706	$377,113	234.37	$1,609
Trempealeau	$199,107	$462	$281,237	$652	$47,781	$111	$22,739	$266,841	6,175	$817,705	431.24	$1,896
Washburn	$142,664	$383	$222,665	$598	$14,959	$40	$17,097	$309,577	7,709	$706,962	372.14	$1,900
NW TOTAL	**$3,999,735**	**$518**	**$5,147,152**	**$667**	**$511,170**	**$66**	**$430,115**	**$4,683,671**	**98,880**	**$14,771,843**	**7,718.44**	**$1,914**

Table 4.10. Winter Maintenance Costs per Lane Mile, Fiscal Year 2008

Final billed costs from the WisDOT accounting system

	Labor	Labor Costs per Lane Mile	Equipment	Equip. Costs per Lane Mile	Materials	Materials Costs per Lane Mile	Admin.	Cost of Salt Used	Tons of Salt Used	Total FY 2008 Winter Costs	2008 LOS Lane Miles	Winter Costs per Lane Mile
STATEWIDE SUMMARY												
SW Region	**$6,461,698**	**$707**	**$8,872,311**	**$971**	**$1,792,857**	**$196**	**$767,369**	**$8,683,641**	**196,145**	**$26,577,876**	**9,135.35**	**$2,909**
SE Region	**$6,563,936**	**$1,181**	**$4,940,631**	**$889**	**$232,312**	**$42**	**$343,331**	**$5,888,619**	**166,178**	**$17,968,829**	**5,558.16**	**$3,233**
NE Region	**$3,728,294**	**$803**	**$4,865,305**	**$1,048**	**$237,388**	**$51**	**$395,514**	**$2,929,710**	**82,446**	**$12,156,211**	**4,642.85**	**$2,618**
NC Region	**$4,078,401**	**$653**	**$5,509,983**	**$883**	**$354,031**	**$57**	**$444,065**	**$4,426,124**	**100,836**	**$14,812,604**	**6,241.92**	**$2,373**
NW Region	**$3,999,735**	**$518**	**$5,147,152**	**$667**	**$511,170**	**$66**	**$430,115**	**$4,683,671**	**98,880**	**$14,771,843**	**7,718.44**	**$1,914**
Statewide Totals	**$24,832,064**	**$746**	**$29,335,382**	**$881**	**$3,127,758**	**$94**	**$2,380,394**	**$26,611,765**	**644,485**	**$86,287,363**	**33,296.72**	**$2,591**

prepared by: Cathy Meinholz/Bureau of Highway Operations

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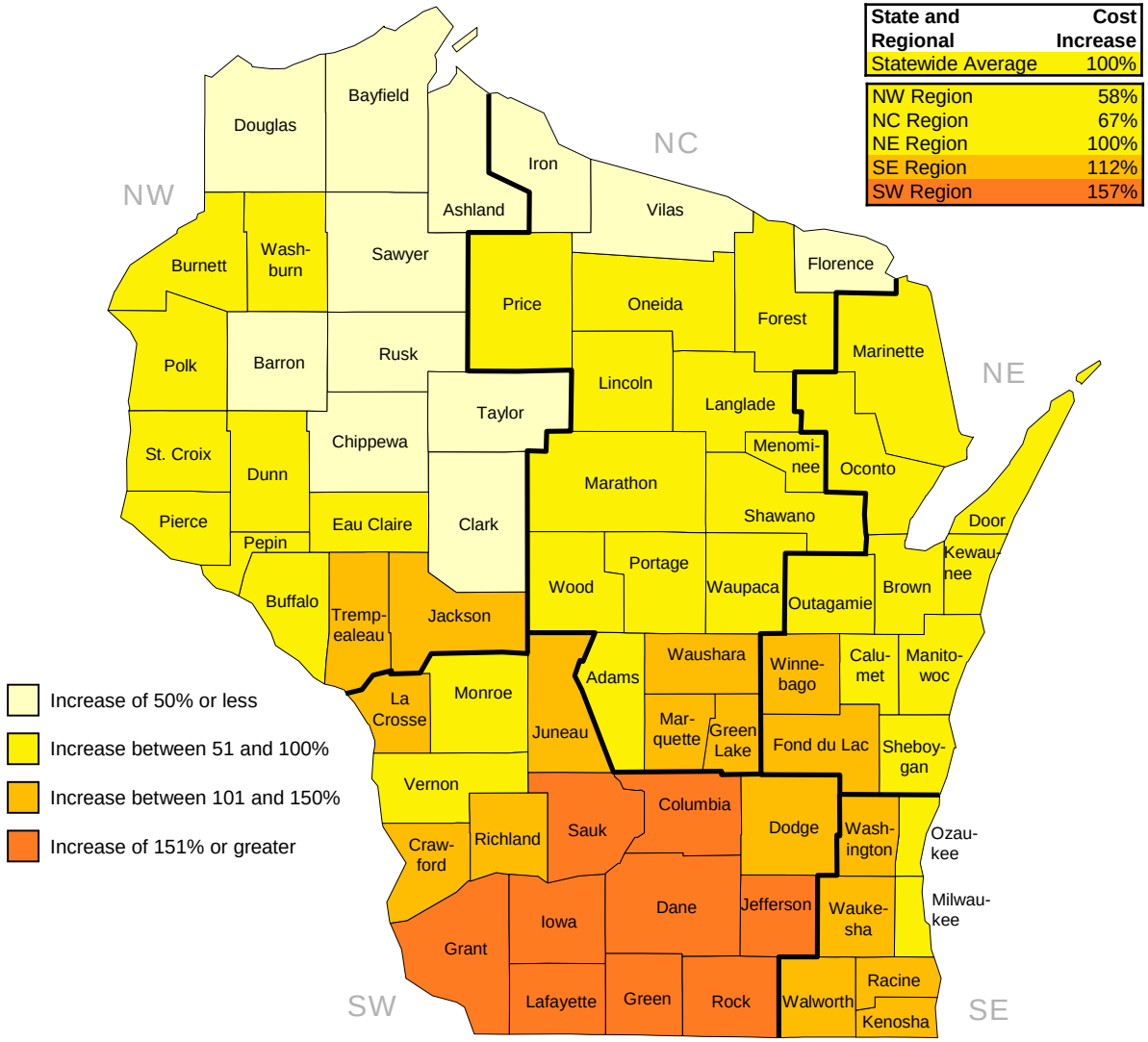
Figure 4.8. 2007-2008 Winter Costs vs. 5-Year Average

County	Cost Increase
Bayfield	26%
Taylor	27%
Barron	29%
Ashland	29%
Rusk	30%
Douglas	34%
Iron	36%
Sawyer	39%
Florence	41%
Vilas	42%
Clark	46%
Chippewa	50%
Lincoln	51%
Price	52%
Forest	52%
Burnett	54%
Polk	56%
Pierce	58%
Langlade	61%
Menominee	62%
Oneida	63%
Shawano	65%
Wood	69%
St. Croix	70%
Marathon	71%
Washburn	71%
Buffalo	73%
Dunn	77%
Kewaunee	77%
Vernon	78%
Door	88%
Milwaukee	90%
Monroe	90%
Waupaca	91%
Manitowoc	93%
Eau Claire	94%

County	Cost Increase
Ozaukee	94%
Portage	94%
Adams	94%
Pepin	95%
Brown	95%
Oconto	95%
Sheboygan	97%
Outagamie	97%
Marinette	97%
Calumet	98%
Trempealeau	101%
Washington	103%
Marquette	106%
Winnebago	106%
Jackson	106%
Green Lake	110%
Crawford	114%
Waushara	119%
Juneau	120%
Kenosha	123%
Racine	124%
Richland	129%
Dodge	129%
Walworth	130%
La Crosse	131%
Fond du Lac	132%
Waukesha	148%
Grant	152%
Green	164%
Columbia	171%
Jefferson	177%
Rock	178%
Dane	188%
Sauk	188%
Iowa	195%
Lafayette	212%



State and Regional	Cost Increase
Statewide Average	100%
NW Region	58%
NC Region	67%
NE Region	100%
SE Region	112%
SW Region	157%

Note: If you are viewing 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.

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

From Winter Storm Reports, 2007-2008

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
MARATHON	NC	869.61	45.31	85.8	13143	15.11	0.33	$1,540,000	$1,772	39.10
WINNEBAGO	NE	549.02	40.16	98.6	10094	18.39	0.46	$1,126,000	$2,098	52.24
PORTAGE	NC	504.28	37.05	100.1	7836	15.54	0.42	$982,000	$1,953	52.71
BROWN	NE	712.86	37.74	102.9	14294	20.05	0.53	$1,477,000	$2,076	54.99
LA CROSSE	SW	480.28	40.63	116.9	10377	21.61	0.53	$1,101,000	$2,294	56.46
EAU CLAIRE	NW	555.74	26.71	76.4	8841	15.91	0.60	$987,000	$1,776	66.51
OZAUKEE	SE	304.03	35.81	112.2	8183	26.92	0.75	$732,000	$2,411	67.34
RACINE	SE	587.21	35.07	124.9	16283	27.73	0.79	$1,437,000	$2,447	69.78
MILWAUKEE	SE	1,789.02	35.42	97.0	55279	30.90	0.87	$4,655,000	$2,617	73.88
KENOSHA	SE	553.35	34.92	134.0	12108	21.88	0.63	$1,534,000	$2,772	79.39
WAUKESHA	SE	1,055.27	33.06	111.7	41673	39.49	1.19	$3,163,000	$2,997	90.64
DANE	SW	1,674.08	32.89	99.9	43773	26.15	0.79	$5,560,000	$3,332	101.31
Group A Averages		802.90	36.23	105.0	20157	23.31	0.66	$2,024,500	$2,379	67.03

Final totals as of Tuesday, November 11, 2008

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

From Winter Storm Reports, 2007-2008

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
WAUSHARA	NC	345.71	31.78	107.3	4126	11.93	0.38	$479,000	$1,387	43.63
SHAWANO	NC	509.14	40.33	105.9	6662	13.08	0.32	$826,000	$1,633	40.50
SAINT CROIX	NW	616.98	36.43	70.9	9482	15.37	0.42	1,019,000	$1,651	45.33
MANITOWOC	NE	415.29	34.00	98.1	7864	18.94	0.56	$702,000	$1,702	50.06
DUNN	NW	516.55	25.70	66.9	8416	16.29	0.63	$897,000	$1,736	67.57
MARQUETTE	NC	243.77	34.44	116.4	4800	19.69	0.57	$455,000	$1,867	54.20
SHEBOYGAN	NE	518.90	35.07	117.8	10125	19.51	0.56	$979,000	$1,900	54.17
OUTAGAMIE	NE	506.23	33.57	91.2	11051	21.83	0.65	1,047,000	$2,095	62.40
DODGE	SW	606.62	31.75	116.7	16214	26.73	0.84	1,313,000	$2,165	68.18
CHIPPEWA	NW	667.85	26.36	86.0	6726	10.07	0.38	1,507,000	$2,257	85.61
ONEIDA	NC	389.73	55.48	110.7	7449	19.11	0.34	$878,000	$2,262	40.77
WASHINGTON	SE	580.03	42.20	124.4	13628	23.50	0.56	1,318,000	$2,294	54.36
ROCK	SW	592.56	29.31	105.1	15290	25.80	0.88	1,375,000	$2,322	79.22
WALWORTH	SE	689.25	32.53	109.2	19024	27.60	0.85	1,643,000	$2,386	73.34
JEFFERSON	SW	458.21	28.84	110.0	14871	32.45	1.13	1,177,000	$2,570	89.10
SAUK	SW	591.55	39.50	124.7	16204	27.39	0.69	1,682,000	$2,844	72.00
COLUMBIA	SW	745.80	36.86	145.3	21965	29.45	0.80	2,474,000	$3,321	90.08

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

From Winter Storm Reports, 2007-2008

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 B Averages		529.07	34.95	106.3	11406	21.10	0.62	1,163,000	$2,141	62.97

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

From Winter Storm Reports, 2007-2008

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
VERNON	SW	450.00	37.11	91.3	5153	11.45	0.31	$583,000	$1,295	34.89
TREMPEALEAU	NW	431.24	32.41	70.4	6175	14.32	0.44	$588,000	$1,364	42.09
DOUGLAS	NW	439.23	42.14	158.1	5782	13.16	0.31	$602,000	$1,370	32.51
CLARK	NW	402.28	29.40	86.8	5018	12.47	0.42	$598,000	$1,487	50.56
KEWAUNEE	NE	110.41	33.35	83.6	1369	12.40	0.37	$166,000	$1,510	45.27
OCONTO	NE	425.43	39.77	105.5	5826	13.69	0.34	$650,000	$1,531	38.50
WAUPACA	NC	541.92	31.86	102.6	7810	14.41	0.45	$838,000	$1,547	48.55
MONROE	SW	643.69	37.05	87.0	9240	14.35	0.39	1,002,000	$1,556	42.01
DOOR	NE	251.87	38.54	84.5	3449	13.69	0.36	$404,000	$1,605	41.64
LINCOLN	NC	418.33	42.54	103.3	4764	11.39	0.27	$677,000	$1,624	38.17
WOOD	NC	362.92	37.69	99.8	4976	13.71	0.36	$593,000	$1,636	43.40
CRAWFORD	SW	385.21	35.93	95.9	4559	11.84	0.33	$637,000	$1,656	46.08
WASHBURN	NW	372.14	36.37	95.3	7709	20.72	0.57	$628,000	$1,688	46.40
JACKSON	NW	504.10	33.37	114.0	8603	17.07	0.51	$853,000	$1,692	50.70
LAFAYETTE	SW	293.88	35.21	107.6	3574	12.16	0.35	$512,000	$1,741	49.46
GRANT	SW	624.14	43.67	100.8	10132	16.23	0.37	1,196,000	$1,916	43.89
CALUMET	NE	200.86	41.71	95.6	2564	12.77	0.31	$391,000	$1,958	46.95
FOND DU LAC	NE	579.80	40.43	90.0	10169	17.54	0.43	1,223,000	$2,109	52.18

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

From Winter Storm Reports, 2007-2008

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
VILAS	NC	305.24	39.28	121.6	6867	22.50	0.57	$649,000	$2,133	54.29
IOWA	SW	451.03	35.64	100.3	8520	18.89	0.53	1,128,000	$2,500	70.15
JUNEAU	SW	498.13	34.98	120.6	9563	19.20	0.55	1,251,000	$2,511	71.79
Group C Averages		413.90	37.07	100.7	6277	14.95	0.41	$722,333	$1,735	47.12

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

From Winter Storm Reports, 2007-2008

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
BUFFALO	NW	315.77	34.08	62.9	2098	6.64	0.19	$323,000	$1,024	30.06
RUSK	NW	213.47	36.50	110.8	1850	8.67	0.24	$225,000	$1,056	28.93
SAWYER	NW	367.44	34.72	94.0	3242	8.82	0.25	$396,000	$1,077	31.01
BARRON	NW	422.39	35.58	80.7	2207	5.22	0.15	$467,000	$1,105	31.05
PEPIN	NW	110.91	26.23	56.3	1014	9.14	0.35	$129,000	$1,163	44.33
BURNETT	NW	233.64	33.75	71.8	2864	12.26	0.36	$283,000	$1,210	35.84
RICHLAND	SW	328.72	29.72	99.3	2884	8.77	0.30	$417,000	$1,270	42.72
PIERCE	NW	364.82	35.60	70.4	4385	12.02	0.34	$471,000	$1,290	36.23
TAYLOR	NW	234.37	33.93	80.4	2706	11.55	0.34	$312,000	$1,339	39.47
GREEN LAKE	NC	151.30	32.74	129.0	1819	12.02	0.37	$207,000	$1,371	41.88
MENOMINEE	NC	90.26	33.63	102.5	1752	19.41	0.58	$127,000	$1,414	42.05
ASHLAND	NW	247.57	54.54	187.7	2558	10.33	0.19	$352,000	$1,424	26.10
MARINETTE	NE	372.18	38.48	108.5	5641	15.16	0.39	$535,000	$1,438	37.37
BAYFIELD	NW	316.90	55.32	158.4	4105	12.95	0.23	$460,000	$1,451	26.23
PRICE	NC	320.57	50.42	94.2	5168	16.12	0.32	$559,000	$1,743	34.58
FLORENCE	NC	141.07	43.00	128.6	2805	19.88	0.46	$247,000	$1,750	40.70
POLK	NW	385.05	43.94	90.5	5099	13.24	0.30	$675,000	$1,754	39.92
LANGLADE	NC	292.69	43.82	111.3	5236	17.89	0.41	$545,000	$1,871	42.71

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

From Winter Storm Reports, 2007-2008

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
FOREST	NC	312.38	41.90	122.8	6706	21.47	0.51	$656,000	$2,101	50.14
ADAMS	NC	192.09	42.11	109.1	3684	19.18	0.46	$411,000	$2,141	50.84
GREEN	SW	311.45	32.01	87.0	3826	12.28	0.38	$698,000	$2,242	70.03
IRON	NC	250.91	58.90	217.2	5233	20.86	0.35	$624,000	$2,489	42.25
Group D Averages		271.63	39.59	107.9	3495	13.36	0.34	$414,500	$1,533	39.29

Table 4.12. Crashes per 100 Million Vehicle Miles of Travel

Bureau of Transportation Safety data, November 2007 - April 2008

COUNTY	WINTER VMT	CRASHES	CRASHES/ 100,000,000 VMT
NC Region			
ADAMS	116,400,000	26	22
FLORENCE	28,500,000	14	49
FOREST	55,700,000	17	31
GREEN LAKE	93,100,000	42	45
IRON	51,200,000	10	20
LANGLADE	105,000,000	28	27
LINCOLN	196,800,000	80	41
MARATHON	753,100,000	338	45
MARQUETTE	116,200,000	46	40
MENOMINEE	22,200,000	5	23
ONEIDA	210,600,000	73	35
PORTAGE	381,400,000	177	46
PRICE	85,300,000	23	27
SHAWANO	273,700,000	116	42
VILAS	147,500,000	35	24
WAUPACA	276,600,000	152	55
WAUSHARA	172,100,000	64	37
WOOD	311,700,000	141	45
Total	**3,397,100,000**	**1,387**	**41**
NE Region			
BROWN	1,126,100,000	476	42
CALUMET	181,000,000	81	45
DOOR	167,500,000	37	22
FOND DU LAC	518,500,000	290	56
KEWAUNEE	88,600,000	23	26
MANITOWOC	398,600,000	171	43
MARINETTE	224,400,000	71	32
OCONTO	242,300,000	69	28
OUTAGAMIE	769,700,000	270	35
SHEBOYGAN	485,400,000	241	50
WINNEBAGO	817,800,000	436	53
Total	**5,019,900,000**	**2,165**	**43**

Table 4.12. Crashes per 100 Million Vehicle Miles of Travel

Bureau of Transportation Safety data, November 2007 - April 2008

COUNTY	WINTER VMT	CRASHES	CRASHES/ 100,000,000 VMT
NW Region			
ASHLAND	82,900,000	18	22
BARRON	265,500,000	66	25
BAYFIELD	99,600,000	24	24
BUFFALO	79,900,000	30	38
BURNETT	80,000,000	21	26
CHIPPEWA	375,900,000	104	28
CLARK	192,300,000	85	44
DOUGLAS	230,000,000	69	30
DUNN	310,900,000	161	52
EAU CLAIRE	504,700,000	173	34
JACKSON	262,600,000	148	56
PEPIN	34,400,000	8	23
PIERCE	147,700,000	64	43
POLK	194,000,000	37	19
RUSK	73,700,000	21	28
SAINT CROIX	525,100,000	164	31
SAWYER	96,100,000	23	24
TAYLOR	87,500,000	42	48
TREMPEALEAU	174,200,000	74	42
WASHBURN	127,800,000	47	37
Total	**3,944,800,000**	**1,379**	**35**
SE Region			
KENOSHA	709,600,000	363	51
MILWAUKEE	3,463,400,000	1,028	30
OZAUKEE	553,000,000	152	27
RACINE	738,100,000	354	48
WALWORTH	548,300,000	221	40
WASHINGTON	636,200,000	347	55
WAUKESHA	1,965,800,000	701	36
Total	**8,614,400,000**	**3,166**	**37**

Table 4.12. Crashes per 100 Million Vehicle Miles of Travel

Bureau of Transportation Safety data, November 2007 - April 2008

COUNTY	WINTER VMT	CRASHES	CRASHES/ 100,000,000 VMT
SW Region			
COLUMBIA	471,100,000	384	82
CRAWFORD	100,200,000	50	50
DANE	2,323,900,000	1,160	50
DODGE	443,200,000	220	50
GRANT	244,900,000	167	68
GREEN	148,900,000	77	52
IOWA	170,900,000	87	51
JEFFERSON	452,000,000	229	51
JUNEAU	299,900,000	191	64
LA CROSSE	472,300,000	291	62
LAFAYETTE	98,500,000	43	44
MONROE	347,300,000	232	67
RICHLAND	91,400,000	52	57
ROCK	773,000,000	460	60
SAUK	378,400,000	246	65
VERNON	139,300,000	74	53
Total	**6,955,200,000**	**3,963**	**57**
Statewide Totals	**27,931,400,000**	**12,060**	**43**

Table 4.13. Motor Vehicle Crashes* on Roads with Snow/Ice/Slush

Bureau of Transporation Safety data, Nov. 1, 2007 - April 30, 2008** — State, U.S. and Interstate highways only

NC 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	26	0	26	0	0	0	0	0	26	0	0
FLORENCE	14	0	14	0	0	0	0	0	14	0	0
FOREST	17	0	17	0	0	0	0	0	15	1	1
GREEN LAKE	42	7	35	0	0	7	0	0	35	0	0
IRON	10	0	10	0	0	0	0	0	10	0	0
LANGLADE	28	9	19	0	0	7	2	0	18	1	0
LINCOLN	80	3	77	0	0	3	0	0	25	52	0
MARATHON	338	93	215	8	22	45	48	0	79	136	0
MARQUETTE	46	0	15	0	31	0	0	0	15	0	0
MENOMINEE	5	0	5	0	0	0	0	0	5	0	0
ONEIDA	73	3	70	0	0	2	1	0	65	5	0
PORTAGE	177	51	66	16	44	36	15	0	24	41	1
PRICE	23	0	23	0	0	0	0	0	21	2	0
SHAWANO	116	5	111	0	0	3	2	0	31	80	0
VILAS	35	0	35	0	0	0	0	0	34	1	0
WAUPACA	152	10	142	0	0	5	5	0	53	89	0
WAUSHARA	64	0	38	0	26	0	0	0	34	4	0
WOOD	141	92	49	0	0	27	64	1	38	11	0
Total	1,387	273	967	24	123	135	137	1	542	423	2

NE 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	476	315	63	62	36	70	245	0	27	36	0
CALUMET	81	10	71	0	0	2	8	0	65	6	0
DOOR	37	3	34	0	0	0	3	0	33	1	0
FOND DU LAC	290	65	225	0	0	33	32	0	97	128	0
KEWAUNEE	23	0	23	0	0	0	0	0	23	0	0
MANITOWOC	171	62	44	1	64	39	23	0	39	5	0
MARINETTE	71	8	63	0	0	4	4	0	52	11	0
OCONTO	69	0	69	0	0	0	0	0	27	42	0
OUTAGAMIE	270	118	152	0	0	51	66	1	84	66	2
SHEBOYGAN	241	58	112	0	71	31	25	2	60	52	0
WINNEBAGO	436	92	344	0	0	52	40	0	85	259	0
Total	2,165	731	1,200	63	171	282	446	3	592	606	2

*Does not include deer or other animal crashes.

**2008 figures are preliminary at this time.

Table 4.13. Motor Vehicle Crashes* on Roads with Snow/Ice/Slush

Bureau of Transporation Safety data, Nov. 1, 2007 - April 30, 2008** — State, U.S. and Interstate highways only

NW Region

		Urban	Rural	Urban	Rural	Urban State Highway			Rural State Highway		
County	Total	STH	STH	IH	IH	Non-div	Divided	Unkn	Non-div	Divided	Unkn
ASHLAND	18	4	14	0	0	2	2	0	14	0	0
BARRON	66	9	57	0	0	5	4	0	29	28	0
BAYFIELD	24	0	24	0	0	0	0	0	24	0	0
BUFFALO	30	0	30	0	0	0	0	0	29	1	0
BURNETT	21	0	21	0	0	0	0	0	20	1	0
CHIPPEWA	104	11	93	0	0	2	9	0	18	75	0
CLARK	85	0	85	0	0	0	0	0	41	44	0
DOUGLAS	69	24	36	9	0	10	14	0	15	21	0
DUNN	161	28	51	8	74	8	20	0	44	7	0
EAU CLAIRE	173	60	51	0	62	4	55	1	35	16	0
JACKSON	148	0	35	0	113	0	0	0	30	4	1
PEPIN	8	0	8	0	0	0	0	0	8	0	0
PIERCE	64	4	60	0	0	3	1	0	58	2	0
POLK	37	0	37	0	0	0	0	0	35	1	1
RUSK	21	0	21	0	0	0	0	0	20	1	0
SAINT CROIX	164	7	75	13	69	3	4	0	55	20	0
SAWYER	23	0	23	0	0	0	0	0	22	1	0
TAYLOR	42	0	42	0	0	0	0	0	42	0	0
TREMPEALEAU	74	0	66	0	8	0	0	0	64	2	0
WASHBURN	47	0	47	0	0	0	0	0	13	33	1
Total	1,379	147	876	30	326	37	109	1	616	257	3

SE Region

		Urban	Rural	Urban	Rural	Urban State Highway			Rural State Highway		
County	Total	STH	STH	IH	IH	Non-div	Divided	Unkn	Non-div	Divided	Unkn
KENOSHA	363	123	157	1	82	75	48	0	59	98	0
MILWAUKEE	1,028	560	0	468	0	106	452	2	0	0	0
OZAUKEE	152	35	33	22	62	26	9	0	11	21	1
RACINE	354	192	66	7	89	109	83	0	54	12	0
WALWORTH	221	20	133	2	66	13	7	0	96	37	0
WASHINGTON	347	107	240	0	0	40	67	0	90	149	1
WAUKESHA	701	270	155	148	128	54	214	2	82	72	1
Total	3,166	1,307	784	648	427	423	880	4	392	389	3

*Does not include deer or other animal crashes.
**2008 figures are preliminary at this time.

Table 4.13. Motor Vehicle Crashes* on Roads with Snow/Ice/Slush

Bureau of Transporation Safety data, Nov. 1, 2007 - April 30, 2008** — State, U.S. and Interstate highways only

SW Region

County	Total	Urban STH	Rural STH	Urban IH	Rural IH	Urban State Highway Non-div	Urban State Highway Divided	Urban State Highway Unkn	Rural State Highway Non-div	Rural State Highway Divided	Rural State Highway Unkn
COLUMBIA	384	18	142	14	210	14	4	0	117	25	0
CRAWFORD	50	13	37	0	0	12	1	0	34	3	0
DANE	1,160	326	404	79	351	55	271	0	218	185	1
DODGE	220	23	197	0	0	15	8	0	108	89	0
GRANT	167	7	160	0	0	6	1	0	120	40	0
GREEN	77	9	68	0	0	2	7	0	65	3	0
IOWA	87	0	87	0	0	0	0	0	38	49	0
JEFFERSON	229	61	92	0	76	48	13	0	77	15	0
JUNEAU	191	0	48	0	143	0	0	0	46	2	0
LA CROSSE	291	142	70	35	44	61	81	0	43	26	1
LAFAYETTE	43	0	43	0	0	0	0	0	24	19	0
MONROE	232	34	50	8	140	16	18	0	48	2	0
RICHLAND	52	0	52	0	0	0	0	0	38	14	0
ROCK	460	92	173	70	125	46	44	2	144	29	0
SAUK	246	27	133	0	86	21	6	0	100	33	0
VERNON	74	0	74	0	0	0	0	0	71	3	0
Total	3,963	752	1,830	206	1,175	296	454	2	1,291	537	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

*Does not include deer or other animal crashes.
**2008 figures are preliminary at this time.

5 Looking Ahead

The winter of 2007-2008 was one of the snowiest on record. The amount of snowfall and lack of road salt at the end of the season led to some unusual challenges. These challenges involved stretching out the existing salt supplies and moving salt to where it was needed most. The severe winter and salt shortage (plus the potential for future salt shortages) in combination with a February snowstorm that left many motorists stranded on Interstate 90 for several hours has motivated WisDOT to take a closer look at how we do business with respect to winter maintenance.

Areas of focus for the 2008-2009 winter:

1. Counties will strictly adhere to the application guidelines.
2. WisDOT staff will take a more active role with the counties in preparation for and during winter events.
3. WisDOT will increase salt storage capacity at several strategic locations throughout the state, especially along the Interstate system.
4. WisDOT will work with the counties to identify and use alternate deicing agents when the pavement temperatures are very low and salt is less effective.
5. WisDOT will encourage counties in the Southwest and Southeast regions to incorporate underbody plows into their fleets.
6. Together with the counties, WisDOT will investigate alternative deicing agents such as IceSlicer and MSDS Nature's Thaw.
7. The Adverse Conditions Communication/Coordination Plan will be implemented to provide improved coordination during severe weather or other emergencies. As part of that plan, key WisDOT staff will be in on-call status during severe winter events.
8. WisDOT will purchase more salt than in previous years to rebuild its inventory and be prepared for another severe winter.
9. WisDOT will review the current salt contract to identify areas for improvement.
10. Regions will be more diligent in conducting post-storm analyses.
11. More emphasis will be placed on the accuracy of storm reports that are submitted by the counties.
12. WisDOT will emphasize the need for counties to keep equipment calibrated.

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