



2015-16

Winter Maintenance Report

At A Glance



Introduction

The 2015-16 winter was considered an average one in terms of few heavy and prolonged snow and ice events. MnDOT spent more dollars on snow and ice than 2014-15. Whether the state gets a lot of snow and ice in a season or smaller amounts, resources are still expended to keep roads clear, pay wages and maintain equipment.

Snapshot of winter: 2-year comparison

Category	Measure	2014-15	2015-16
Infrastructure	Lane Miles	30,546	30,632
Weather	Snowfall, MSP Airport	32.6"	36.7"
	Snowfall, statewide across districts	39.4"	52.6"
	Number of winter events, statewide average	28	27
Materials	Salt used	173,888 tons	157,812 tons
	Average weighted cost of salt per ton	\$74.36	\$75.79
	Salt brine used	2.2 million gallons	2.2 million gallons
Costs and Performance	Total plowing, salting and sanding costs	\$87.9 million*	\$94.2 million*
	Total plowing, salting and sanding costs per lane mile, statewide average	\$2,878	\$3,074
	Frequency of achieving bare lane after winter event (70% target)	87%	89%
Labor and Services	Regular labor hours	501,095	510,147
	Overtime winter labor hours	94,461	78,111

**Based on fiscal year*

Weather

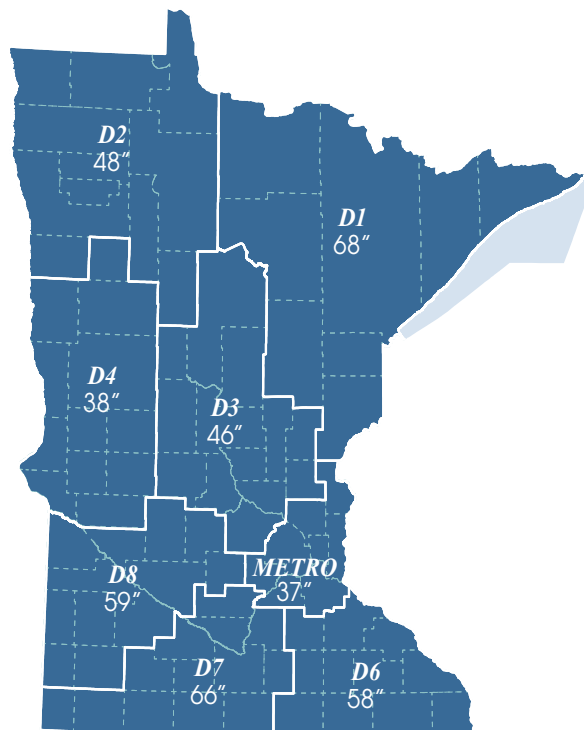
The 2015-16 season snowfall, reported at the Minneapolis - St. Paul Airport, was 36.7 inches.

That compares to 32.6 inches in 2014-15.

The 10-year average season snowfall is 49 inches.

District 1 reported the most snowfall with 79.9 inches at Grand Marais. The District 1 average was 68.5 inches. District 7 reported the second highest average with 66.4 inches, with Worthington recording 78.1 inches. District snowfall levels are determined by averaging measurements from four locations within the district as reported by MDSS.

2015-2016 Average District Snowfall

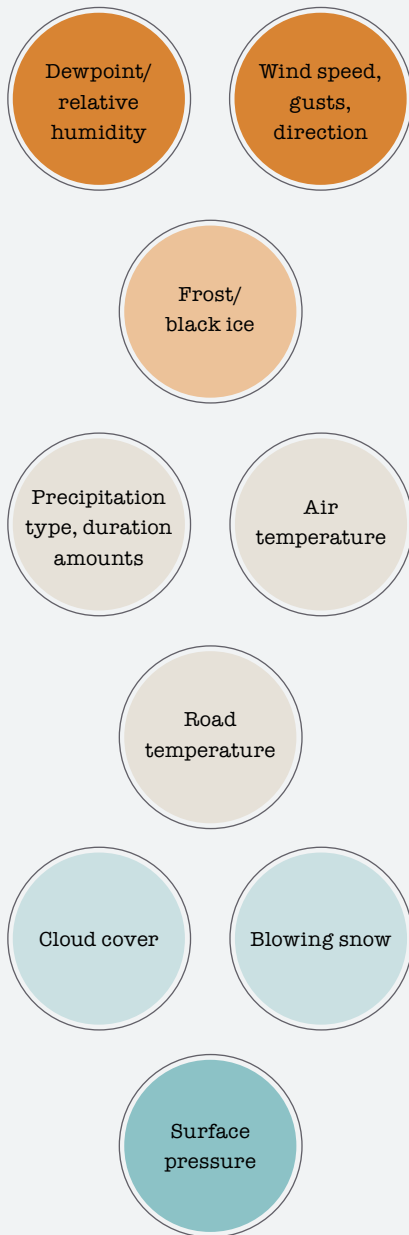


A winter event is....

Any winter weather occurrence that consumes resources necessary to prevent, minimize or regain the loss of bare lanes. Winter events can include freezing rain, drizzle/sleet, snow, drifting/blowing snow, frost, ice/black ice, refreeze or any combination of these conditions.

Winter Severity Index

MnDOT uses a Winter Severity Index to simplify the comparison of winter severity from year to year. At the end of each season, each district uses these factors to calculate a single relative number:



Official weather reporting station snowfall

	MSP Airport*	Statewide Average
2011-12	22.3"	29.5"
2012-13	67.7"	72.3"
2013-14	69.9"	75.6"
2014-15	32.6"	39.4"
2015-16	36.7"	52.6"

*The MSP Airport is the state's official weather station.

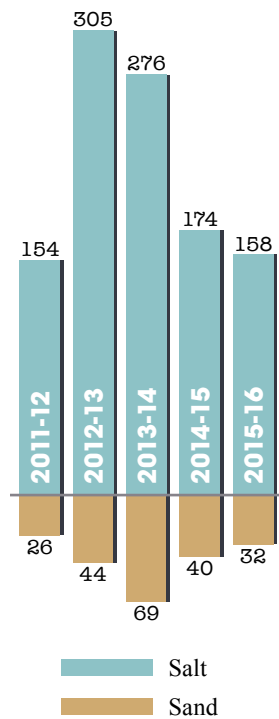


Winter Severity Index by district for past 3 years

District	2013-14	2014-15	2015-16
1	158	93	135
2	125	85	103
3	112	69	92
4	129	92	106
Metro	92	66	71
6	134	88	89
7	110	97	107
8	115	92	97
Statewide	128	87	106

Materials usage

Salt and Sand
(in thousands of tons)



2015-16 district by district average salt/sand usage for the past 5 years
(in thousands of tons)

District	Material	2011-12	2012-13	2013-14	2014-15	2015-16
1	Salt	29.0	50.0	40.7	27.4	34.6
	Sand	7.6	14.0	23.4	11.7	11.2
2	Salt	12.0	16.9	9.8	12.6	14.3
	Sand	7.8	7.6	7.4	8.2	7.7
3	Salt	17.1	39.9	35	22.2	20.7
	Sand	8.4	3.0	3.9	1.5	1.1
4	Salt	10.1	22.0	11.4	11.1	9.4
	Sand	4.9	3.7	6.4	5.5	4.4
Metro	Salt	38.6	79.9	97	44.9	31.7
	Sand	0.1	1.0	7.3	1.1	0.3
6	Salt	24.1	49.7	43	30.5	27.2
	Sand	3.5	8.3	12.1	6.8	3.8
7	Salt	16.1	27.8	23.9	15.0	8.5
	Sand	0.2	1.4	1.8	0.6	0.6
8	Salt	6.7	17.4	14.9	10.3	11.5
	Sand	1.2	5.5	6.9	4.5	2.9
Statewide	Salt	154.1	304.6	275.9	173.9	157.8
	Sand	26.1	44.3	69.1	39.8	32.0

Factors affecting use of material during winter event:

- Precipitation type
- Air Temperature
- Cloud cover
- Blowing snow
- Dew point/relative humidity
- Wind speed
- Road temperature
- Frost/black ice
- Surface pressure

Variation in salt usage from district to district depends on:

- Winter severity
- Road classification
- Level of service
- Physical environment conditions

Cost and performance of winter operations

Snow and ice expenditures were about 7.1 percent, or \$6.2 million more than the previous winter. A total of \$94.2 million was spent on materials, labor and equipment.

Salt costs*

(cost per ton 5 year average)

Year	Cost
2011-12	\$70.51
2012-13	\$69.81
2013-14	\$71.14
2014-15	\$74.36
2015-16	\$75.79

\$6/ton

more than in 2012-13

*Based on fiscal year

Historical snow and ice expenditures trend**

(costs in thousands)

Office	2011-12	2012-13	2013-14	2014-15	2015-16	5 Year Average
1	\$8,860	\$14,784	\$16,902	\$10,321	\$13,569	\$12,887
2	\$5,833	\$8,882	\$9,051	\$6,963	\$8,617	\$7,869
3	\$7,255	\$14,300	\$16,466	\$10,259	\$11,207	\$11,897
4	\$5,713	\$11,003	\$9,867	\$7,622	\$7,562	\$8,353
6	\$8,177	\$14,628	\$18,790	\$12,838	\$12,564	\$13,399
7	\$6,324	\$10,027	\$12,760	\$8,279	\$11,564	\$9,791
8	\$2,982	\$7,905	\$9,242	\$6,281	\$7,399	\$6,762
Metro	\$16,134	\$30,253	\$42,558	\$23,872	\$20,149	\$26,593
Maintenance	\$672	\$401	\$495	\$1,346	\$1,249	\$833
Other	\$33	\$96	\$98	\$126	\$97	\$90
Statewide	\$61,983	\$112,279	\$136,228	\$87,914	\$94,160	\$98,513

\$4.4

million

less than 5 year average

**Based on fiscal year

Total spent for snow and ice control and winter severity

(cost in millions; includes materials, labor and equipment.)

	Cost	Severity
2013-14	\$136	128
2014-15	\$88	87
2015-16	\$94	106

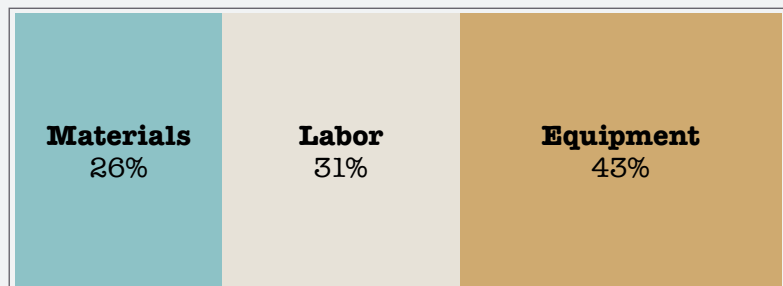
\$6 million
More than 2014-15



Factors affecting winter maintenance costs:

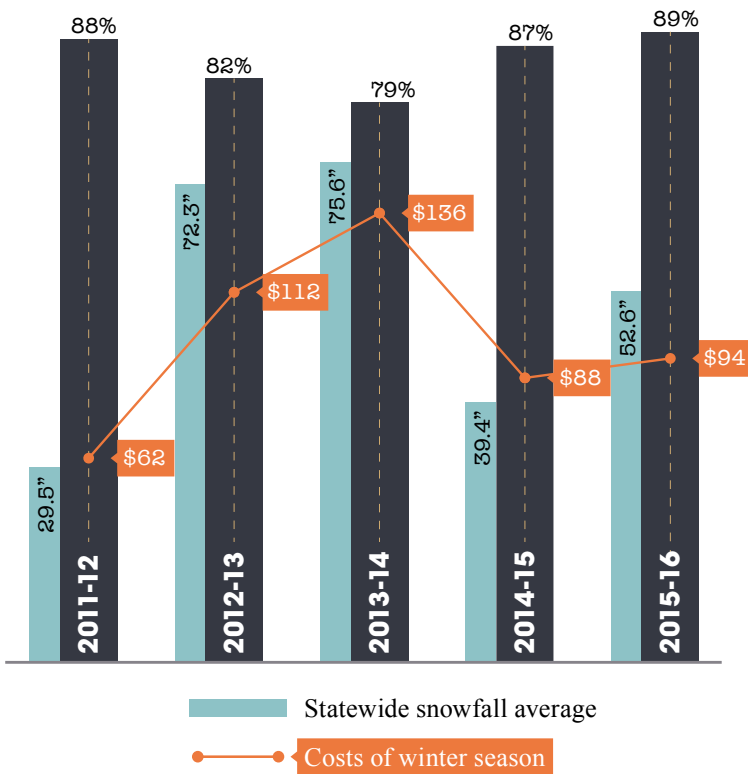
- Timing of storms
- Change in labor costs
- Inflation
- Fuel prices
- Salt, sand prices
- Winter severity index

2015-16 winter costs by category



Bare Lane Targets

Frequency of meeting bare lane targets
(cost in millions)



Meeting bare lane targets

MnDOT met its overall performance target for the season. The statewide average for meeting this target for all road classifications was 89 percent. MnDOT met or exceeded the 70 percent target the past nine out of 10 years. MnDOT worked to reduce chemicals used on roadways and invested in updates to systems and technologies.

Bare lane regain time - This is measured from the time a winter event ends to when MnDOT's snow and ice operations regain bare-lane driving conditions. The target for this measure varies by road classification, ranging from 0 to 3 hours for the state's most heavily traveled roadways to 9 to 36 hours for the least traveled secondary roads.

Frequency of meeting bare lane target -

This measure reports how often crews met the bare-lane target over an entire winter season. This target is set at 70 percent.

New Technology

MnDOT implemented new snow fighting technologies in the 2015-16 winter. The technologies made the roads safer for drivers, motorists and resulted in more efficient and effective snow and ice removing operations.

Dash cams

- Installed in 226 snowplows (about 25 percent of the snowplow fleet)
- Camera images show real-time “front seat” road conditions directly from the trucks, giving supervisors and managers visual information to make informed winter operations decisions. System can also record video.
- Interfaces with the Automated Vehicle Location system already installed in snowplows. The AVL system uses GPS technology to record snowplow locations, road conditions, weather conditions, sander controller data and other information.
- Dash cams primarily used on high-volume roads such as I-35 and I-90
- Phase 2 of the project will place the existing images on the 511 traveler information system so the public can view current road conditions



Road Weather Information Systems *(Included are wind speed/direction, pavement and air temp sensors)*

- Cameras display real-time photos of road conditions in 92 locations on the 511 traveler information system
- These cameras are in addition to the more than 800 traffic cameras already displayed on the 511 system
- RWIS stations are located along state roads and interstates. They are already used by maintenance crews but now are available to the public.

Snowplow simulator training

- New simulator is the first of its kind in the state to be used specifically for snowplow training
- Replicates winter driving conditions and situations encountered on the road
- Helps snowplow drivers improve their ability to recognize and react to a variety of road conditions to better manage risk
- More than 300 snowplow drivers were trained during the first year of operation



Ice breaker

- Breaks up ice with carbide tipped roller
- Purchased three ice breakers for districts to share
- Creates holes in the compacted snow or ice. As ice breaker rolls over the compaction, crushed snow or ice is scraped off with the snowplow underbody. Holes made are used as a pathway for deicers to get to the pavement as needed.

Driver Assist System

- Helps snowplow operators see virtual road alignments and features in blowing snow and fog
- Uses GPS technology and a front-mounted radar to provide an image of the road and any obstacles in front of the operator. Image is displayed on a monitor inside the cab.
- System also vibrates the operator's seat as a warning if the plow veers too close to the center or fog line
- System is used on same computer that contains the Automated Vehicle Location system
- System is tied into the Continuously Operating Reference Stations, a network that collects and continuously updates real-time data from the Global Navigation Satellite System.
- Used more than once during the winter of 2015-16 to find stranded vehicles and rescue motorists in southwestern Minnesota



Social Media

MnDOT launched an effort on social media to show the public a human side to snowplowing efforts. Social media posts also told about MnDOT getting ready for snow and ice events to focus on the safety aspect. The social media push helped decrease complaints from the public and increased traffic on the website.

Social media helps humanize winter work

One of the Facebook posts that helped put a “human face” to snowplowing efforts. Other posts were about MnDOT getting ready for snow and ice events to focus on the safety aspect. The social media push helped decrease complaints from the public and increased traffic on the website.

MEET DAVE.

HOW MANY YEARS HAVE YOU BEEN PLOWING WITH MnDOT?
A: I've been here for 7 years.

WHAT AREA DO YOU PLOW?
A: Spring Lake Park.

WHAT'S YOUR FAVORITE THING ABOUT THE SNOW?
A: Seeing it end.

WHAT'S YOUR BEST ADVICE FOR DRIVING IN THE SNOW?
A: Please give the plow room, do not follow too close. Give us room and time to get the roads cleared as quickly as possible.

WHAT'S SOMETHING FUN PEOPLE MAY NOT KNOW?
A: I like to golf and drag race. I enjoy going to my grandson's football games and spending time with him.

Twitter, Facebook, YouTube icons and MnDOT logo.

Post 1: Minnesota Department of Transportation, November 2, 2015. Text: "Next week is Winter Hazard Awareness Week. We've been thinking about winter for a few months now. Are you ready?" Image: "Just a few cones set up for the snow plow rodeo. #winteriscoming #MnDOT". 8 likes, 30 shares.

Post 2: Minnesota Department of Transportation, November 6, 2015. Text: "We are loving the beautiful weather! Rest assured, when the snow comes we're ready!" Image: "It's all about the practice. #winteriscoming #MnDOT". 87 likes, 30 shares.

Post 3: Minnesota Department of Transportation, November 24, 2015. Text: "They are still talking about snow on Thanksgiving. Are you ready? ow.ly/UBNqZ." Image: "This is Kirsten." Text: "Kirsten isn't ready for the first snow. She doesn't have a snow brush to clear off her car. When it snows she'll have to use her mittens. When she uses her mittens they'll fill with snow and won't get rid of the ice. Kirsten will have cold hands and an icy windshield. Don't be like Kirsten. Prepare for winter and get yourself a good snow brush." Hashtags: #DontBeKirsten #BeReadyforwinter #MnDOT. 58 likes, 29 shares.

WINTER TRAVEL RESOURCES

Make safer travel decisions this winter by using MnDOT's 511 traveler information website 511mn.org or call 511.

www.511mn.org

The screenshot displays the 511mn.org website interface. At the top, there is a navigation bar with the URL www.511mn.org. Below this, the main content area is organized into several sections:

- CURRENT WINTER ROAD CONDITIONS:** This section features a legend with four categories: Normal (green dot), Partially Covered (blue dot), Completely Covered (purple dot), and Travel Not Advised (dark purple dot). A road icon with the number 94 is shown next to the title.
- ROAD CLOSURES:** Represented by a red circle with a white horizontal bar.
- CRASHES:** Represented by a purple diamond with a white exclamation mark.
- TRAFFIC DELAY:** Represented by an orange circle.
- NATIONAL WEATHER SERVICE WARNINGS:** Represented by a blue and yellow lightning bolt icon.
- ROTATING IMAGES AND WEATHER DATA FROM WEATHER STATIONS STATEWIDE:** This section includes a small image of a snowy road and a thermometer icon. A road icon with the number 90 is also present.
- IMAGES FROM MORE THAN 800 TRAFFIC CAMERAS STATEWIDE:** This section includes a small image of a snowy road and a camera icon. A road icon with the number 35 is also present.
- TRAFFIC SPEEDS:** This section features a color-coded legend for traffic speeds: Slow (black and red bars) and Fast (yellow and green bars).
- DOWNLOAD SMARTPHONE APP FOR BOTH IPHONE AND ANDROID:** This section includes the 511 Minnesota logo.

At the bottom of the page, the Minnesota Department of Transportation logo is displayed, featuring a blue circle with a white star and the text "Minnesota Department of Transportation".

New infographics helped the traveling public access information about winter travel conditions.