2019-2020

Winter Maintenance Report
At a Glance

71.7"
State Snowfall Average

800+
Plow Trucks

1,814
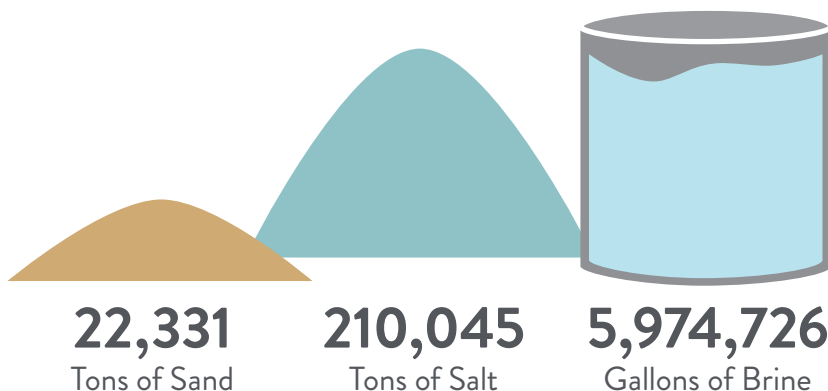Full-time and Backup Snowfighters

150
Truck Stations

30,341
Lane Miles

84%
Frequency Achieving Bare Lanes

22,331
Tons of Sand

210,045
Tons of Salt

5,974,726
Gallons of Brine

$127
Million

Total Cost of Winter

Introduction

The winter of 2019-20 was an above average season in terms of snowfall, severity index and cost when compared to the past five years. MnDOT crews cleared snow and ice off highways from October 2019 through April 2020, battling an average of 24 different winter events. Northeast Minnesota saw the most amount of snow statewide, with an average of 96.6 inches across the region. In all MnDOT spent $127 million on its snow and ice operations; which include materials, labor, equipment and other expenditures.

Snapshot of winter: two-year comparison

| Category	Measure	2018-19	2019-20
Infrastructure	Lane miles	30,426	30,341
Weather	Snowfall, near MSP Airport*	92.1"	68.1"
	Snowfall, statewide across districts*	97.2"	71.7"
	Number of winter events, statewide average	31	24
Materials	Salt used	246,505 tons	210,045 tons
	Average cost of salt per ton	$68.95	$86.43
	Salt brine used	4.6 million gallons	6 million gallons
	Sand used	35,948 tons	22,331 tons
Costs and Performance	Total plowing, salting and sanding costs	$133 million**	$127 million**
	Total plowing, salting and sanding costs per lane mile, statewide average	$4,361	$4,187
	Frequency of achieving bare lane after winter event (70% target)	84%	84%
Labor and Services (from Business Intelligence)	Regular labor hours	620,218	615,030
	Overtime winter labor hours	198,107	147,933

*Based on MnDOT Maintenance Decision Support System

**Based on fiscal year

Weather

The 2019-20 season snowfall reported near the MSP airport was 68.1 inches compared to 92.1 inches in 2018-19. The 10-year average season snowfall in Minnesota is 61.8 inches. District 1 reported the most snowfall with 116.6 inches recorded at Grand Marais and a district average of 96.6 inches. District 2 reported the second highest average with 74.4 inches for the season with 85.3 inches recorded in Crookston. District snowfall levels are determined by averaging measurements from four locations within the district as recorded by the Maintenance Decision Support System.

2019-20 Average District Snowfall*
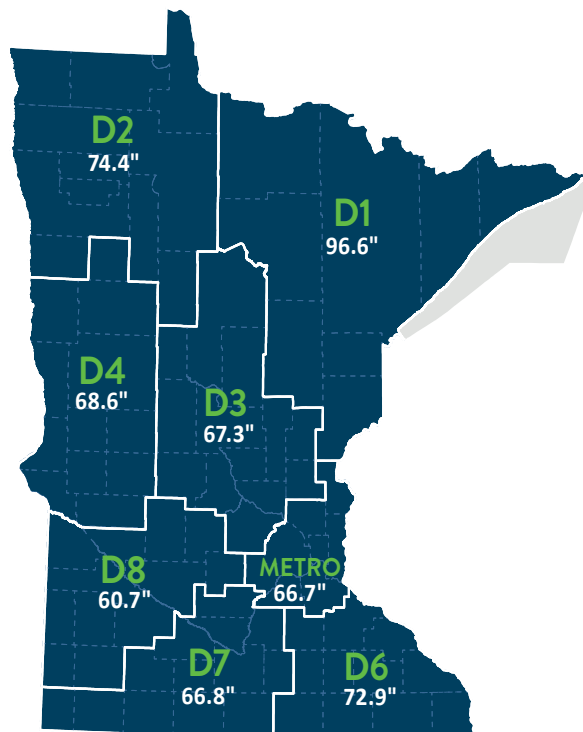
A winter event is....

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.

Snowfall amounts from MnDOT MDSS

Winter Severity Index

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

- Dewpoint/ relative humidity
- Wind speed, gusts, direction
- Frost/ black ice
- Precipitation type, duration amounts
- Air temperature
- Road temperature
- Cloud cover
- Blowing snow
- Surface pressure

Official weather reporting station snowfall

	Near MSP Airport	Statewide Average*
2015-16	36.7"	52.6"
2016-17	43.5"	54.0"
2017-18	98.4"	88.7"
2018-19	92.1"	97.2"
2019-20	68.1"	71.7"

*2015-16 reported from districts
2016-20 reported from MDSS

Winter Severity Index by district for past five years

District	2015-16	2016-17	2017-18	2018-19	2019-20
1	135	148	96	154	151
2	103	127	124	164	140
3	92	107	120	140	113
4	106	123	115	157	130
Metro	71	89	122	132	89
6	89	109	94	144	108
7	107	97	109	156	116
8	97	96	112	164	112
Statewide	106	119	115	154	128

Materials usage

**Salt and Sand
(in thousands of tons)**
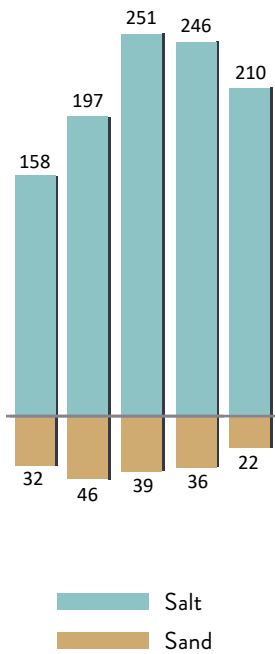
Salt
Sand

Average salt/sand usage by district for past five years
(in thousands of tons from Business Intelligence)

District	Material	2015-16	2016-17	2017-18	2018-19	2019-20
1	Salt	34.6	35.5	29.5	34.6	30.8
	Sand	11.2	18.5	10.6	13.0	8.4
2	Salt	14.3	17.5	16.6	12.6	11.8
	Sand	7.7	6.4	7.2	4.3	4.3
3	Salt	20.7	29.5	33.9	33.5	30.2
	Sand	1.1	3.8	2.2	1.2	0.5
4	Salt	9.4	10.2	13.1	10.5	11.9
	Sand	4.4	4.6	3.7	3.7	2.4
Metro	Salt	31.7	45.8	81.8	71.1	55.7
	Sand	0.3	0.9	1.2	1.2	3.4
6	Salt	27.2	34.7	42.6	44.0	38.5
	Sand	3.8	6.8	9.8	8.0	0.8
7	Salt	8.5	14.9	22.9	26.8	18.0
	Sand	0.6	0.8	1.2	1.3	2.0
8	Salt	11.5	9.3	11.0	13.4	13.1
	Sand	2.9	3.9	3.1	3.2	0.4
Statewide	Salt	157.8	197.4	251.4	246.5	210
	Sand	32.0	45.8	39.0	35.9	22.3

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
- System size
- Level of service
- Physical environment conditions

Cost and performance of winter operations

Snow and ice expenditures were about 4.7 percent, or $6 million, less than the previous winter. A total of $127 million was spent on materials, labor and equipment.

Salt costs*
(average per ton)

Year	Cost
2015-16	$75.79
2016-17	$73.99
2017-18	$60.73
2018-19	$68.95
2019-20	$86.43

$17.5/ton
more than in 2018-19

*Based on fiscal year

Historical snow and ice expenditures trend*
(in thousands)

District	2015-16	2016-17	2017-18	2018-19	2019-20	5-Year Average
1	$13,569	$12,998	$13,524	$14,910	$16,440	$14,288
2	$8,617	$9,441	$10,282	$10,209	$10,004	$9,711
3	$11,207	$12,110	$15,261	$16,179	$15,280	$14,007
4	$7,562	$8,206	$10,049	$11,587	$12,781	$10,037
Metro	$20,150	$23,507	$37,141	$34,821	$29,823	$29,088
6	$12,564	$14,118	$16,427	$18,217	$17,585	$15,782
7	$11,564	$8,865	$12,704	$14,884	$13,483X	$12,300
8	$7,399	$6,443	$7,106	$9,905	$9,181	$8,007
Other	$1,522	$1,346	$1,389	$1,975	$2,487	$1,744
Statewide	$94,154	$97,033	$123,883	$132,688	$127,064	$114,964

$12 million
more than five-year average

*Based on fiscal year

Total spent for snow and ice control and winter severity

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

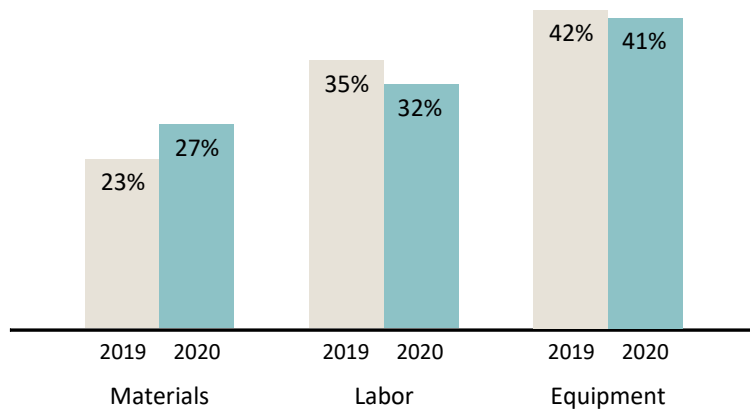|	Cost	Severity
2015-16	$94	106
2016-17	$97	119
2017-18	$124	115
2018-19	$133	154
2019-20	$127	128

$6 million
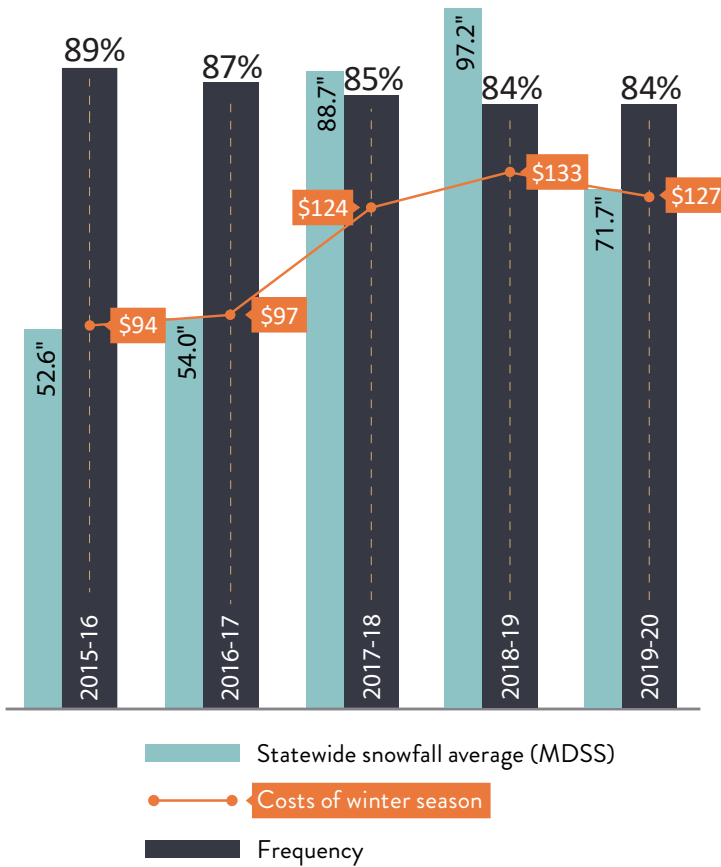less than 2018-19

Factors affecting winter maintenance costs:
- Timing of storms
- Change in labor costs
- Inflation
- Fuel prices
- Salt, chemical prices
- Winter severity

Winter maintenance costs

	Materials		Labor		Equipment	
	2019	2020	2019	2020	2019	2020
	23%	27%	35%	32%	42%	41%

Bare lane targets

Frequency of meeting bare lane targets
(cost in millions from Business Intelligence)

Legend:
- Statewide snowfall average (MDSS)
- Costs of winter season
- Frequency

Chart data:
- 2015-16: 89% frequency, 52.6" snowfall, $94 cost
- 2016-17: 87% frequency, 54.0" snowfall, $97 cost
- 2017-18: 85% frequency, 88.7" snowfall, $124 cost
- 2018-19: 84% frequency, 97.2" snowfall, $133 cost
- 2019-20: 84% frequency, 71.7" snowfall, $127 cost

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 84 percent. MnDOT met or exceeded the 70 percent target the past 10 of 10 years. MnDOT worked to reduce road salt 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.

Investing in data-driven decisions

Real-time weather data is proving to be an essential tool, for both snow fighters and the traveling public. Our snowplows tackle the elements and also work as mobile weather labs, collecting and receiving important information about changing conditions to help crews decide the best plan of action for each route. MnDOT is committed to expanding and improving our network of information and our bounty of data is growing.

Sixty-two new Road and Weather Information Systems are being built statewide to expand our weather coverage thanks to a $4.5 million investment from lawmakers. Every RWIS station offers highway camera views of conditions, current temperatures, wind speed and data about humidity, precipitation and visibility. By the end of this project, MnDOT will have 161 active RWIS sites spread out along highways in all corners of Minnesota.

That RWIS information feeds directly into the Maintenance Decision Support System, which is also collecting, receiving and analyzing weather data from snowplows along each route. This year, MnDOT is installing new rugged modems and three-way antenna systems on every snowplow in the fleet to enhance this communication. We're also working closely with our MDSS and weather partners to improve forecast modeling for the 2020-2021 season. These changes help us fine-tune MDSS so it can better fit our needs, which is why we rely on districts to maintain and calibrate equipment often to ensure data we put into the system is accurate.

Our systems also share data with the public through the 511mn.org traveler information sites, giving drivers in Minnesota the details they need to make good travel decisions. Road conditions are updated more often on 511 with the help of MDSS information. Live video from highway cameras in the Twin Cities and major Minnesota corridors is another new feature on 511. This gives users real-time views of winter road conditions and traffic impacts. More changes to 511 are coming. Look for a new map design and features to emphasize visibility concerns, including fog and blowing snow.

MnDOT's continued and growing investment in these areas ensures our team and the public will continue to get the critical, real-time data they need for work or travel. We never know what Mother Nature will hand us each winter season, but thanks to the weather information we collect and share, we will be ready for those challenges.

New survey gages motorist expectations during winter

Look at the photo below. Would you feel comfortable driving on this road condition? Would it cause you to delay or cancel your travel?

These are some of the questions we asked the public in early 2020 through an online snow and ice survey to help MnDOT maintenance teams understand more about driver expectations during, their travel habits and how they evaluate road conditions during Minnesota winters.

Between late February and early March 2020, 2,000 people completed the survey. It consisted of up to 50 questions, with participants evaluating 12 video clips showing different levels of snowy road conditions on different highways and interstates around the state. After the survey, researchers hosted several online focus groups and interviewed truck drivers one-on-one by phone to gather additional data. MnDOT conducted similar winter driving surveys in 2007 and 1999, but this year's project was the largest outreach to date.

The project team is just beginning to analyze the thousands of responses, but early results are giving us great information. The majority of respondents think Minnesota roads are maintained as well or better than neighboring states during the winter and drivers expressed a great appreciation for MnDOT workers.

"I think they do a good job. The highways and interstates are in good shape most of the time," said one woman from the Twin Cities. "I always think it's pretty amazing how fast we see pavement after a storm."

The survey also suggests many Minnesota drivers are leaving their homes earlier in the day to go to work or school compared to previous surveys. More people are driving SUVs in 2020 compared to 2007, when minivans were more popular. And most drivers we talked to are checking weather information several times a day before a winter storm, which is why we know tools like our 511mn.org traveler information system is so important.

This new information will be helpful as we continue to improve what we do at MnDOT to clear roads of snow and ice and provide a safe transportation system for our traveling public all year long.