


Achieving Optimal Spreading Rates to Protect Our Watersheds from Contamination




Mark Lundeen
Aspen Equipment Co
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Excessive amounts of Sodium (Na) are entering our watersheds in Minnesota

One of the contributing sources is road salt usage from anti/deicing operations

- Granular salt;
- Salt Brine from spraying operations;




How do clean roads lead to excessive salt use?


- Operational standard in many entities
 - Remove all snow/ice from roadway for safest conditions;
 - Unfortunately, that plan doesn't follow a measured standard;
 - Operators are tasked to keep the road clean and so:
 - **more salt on the road is better;**
 - As a result, most entities put down too much salt.

Why do well intentioned entities over salt?


- Un-calibrated salting trucks
 - Manual operator controls that cannot spread accurately;



- Oversized spreading equipment on vehicle;
 - Not capable of running lower salting application rates;



- Incorrect use of ground speed oriented controls;
Correct control hardware is not implemented or operated correctly;



Common Spreading Equipment

V Box Spreader with Conveyor




Under Tailgate Sander with Auger

Common Spreader Controls



Critical Factors in Spreading Decisions

- Road Surface Temperature
- Temperature Trend
- Material being used
 - Dry Salt
 - Pre-wetted Salt
 - Treated Salt
- Weather conditions
 - Snow
 - Freezing Rain

Salt melt rates depend on Surface Temperature

Pounds of Ice Melted Per Pound of Salt		
Pavement Temp. °F	One Pound of Salt (NaCl) melts	Melt Times
30	46.3 lbs of ice	5 min.
25	14.4 lbs of ice	10 min.
20	8.6 lbs of ice	20 min.
15	6.3 lbs of ice	1 hour
10	4.9 lbs of ice	Dry salt is ineffective and will blow away before it melts anything.
5	4.1 lbs of ice	
0	3.7 lbs of ice	
-6	3.2 lbs of ice	

It is not cost-efficient to apply salt (sodium chloride) at pavement temperatures less than 15° F.

• Reference: MN Dot Manual 2005-01: Minnesota Snow and Ice Control Handbook for Snowplow Operators

MN DOT Recommendations for Salt Use

Pavement Temp	Weather Conditions	Salting Rate (lbs/2-in mile)
>30 degrees ↑	Snow	100 lbs
30 degrees ↓	Freezing Rain	100-200 lbs
30 degrees ↓	Snow	100-200 lbs
25-30 degrees ↑	Freezing Rain	180-240 lbs
25-30 degrees ↑	Snow	150-200 lbs
25-30 degrees ↓	Freezing Rain	180-240 lbs
25-30 degrees ↓	Snow	150-200 lbs
20-25 degrees ↑	Freezing Rain	200-300 lbs
20-25 degrees ↑	Snow /Freezing Rain	200-300 lbs
20-25 degrees ↓	Snow	250-350 lbs
20-25 degrees ↓	Freezing Rain	300-400 lbs
15-20 degrees ↑	Snow	250-350 lbs
15-20 degrees ↑	Freezing Rain	300-400 lbs
15-20 degrees ↓	Snow or Freezing Rain	300-400 lbs
0-15 degrees ↓↑	Snow	Dry salt not recommended

Reference: MN Dot Manual 2005-01: Minnesota Snow and Ice Control Handbook for Snowplow Operators

Can operators manage these factors?

- Not under “typical” conditions;
 - Too many decisions to be made with inaccurate equipment sets;
 - Operator should be focusing on the road and the hazards in his/her path;
 - To reduce salt use, keep the roads clean and keep the operators safe, we need to address the equipment in use.

Select The Correct Equipment 6" or 9" sanders

The image shows two technical drawings of auger sander mechanisms. The left drawing is labeled '6 INCH AUGER' and shows a circular auger with a diameter of 6.00 inches. The right drawing is labeled '9 INCH AUGER' and shows a circular auger with a diameter of 9.00 inches. Both drawings include various dimensions and labels for components like the motor, drive shaft, and auger housing.

"V" Box Sander Select the correct gate opening

A photograph of a red truck with a 'V' box sander attachment. The sander is mounted on the back of the truck and has a large hopper for material. The truck is shown from a rear three-quarter view.

Select The Correct Spreader Control

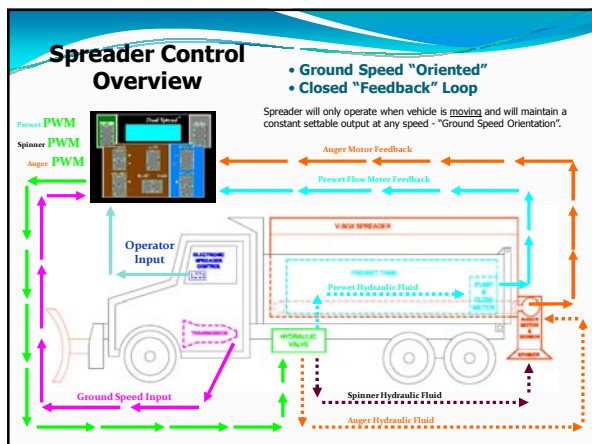
- Open loop / manual controls
- Electric operation
- Brings hydraulics out of cab
- Easy to use
- No calibration

- Closed loop controls
- Electric operation
- Easy to use
- Calibrate speed and granular output
- 95-98% accurate

Select The Correct Spreader Control

- Close Loop Controls
- Prewet Capable
- Temp change warning
- GPS / WIFI downloading
- Open source AVL Compatible

- Closed loop controls
- Granular / pre-wet / anti ice simultaneously
- **Temp Response™** spreading
- 64 MB data capacity



Implement a Calibrated Spreading System

- Ground Speed Oriented, Closed Loop;
- **Temp Response™** Automatic control of spreading prescriptions in response to surface temperature;
- Implement Pre-wetting or treated salt to further reduce salt usage;

The graph shows two data series: 'PW Salt' (Pre-wet salt) and 'Salt'. The 'PW Salt' rate is consistently higher than the 'Salt' rate. Both rates increase as road temperature decreases, peaking around 20-25 degrees Fahrenheit, and then decrease as temperature continues to drop. The 'PW Salt' rate peaks at approximately 500 lbs/100sqm, while the 'Salt' rate peaks at approximately 300 lbs/100sqm.

Cost Analysis / Retro fit existing equipment

- Auger Sizing
 - Reduce auger pitch;
 - Replace under-tailgate sander assembly;
- V Box Spreader
 - Use controlled and calibrated gate height;
 - 6 inch replacement auger
 - ~ \$300-\$500/ vehicle + installation
 - 9 inch replacement auger
 - ~ \$400-\$600/vehicle + installation
- Replacement Under Tailgate Sander
 - ~ \$1900-\$4400 / 6-9 inch / carbon to stainless steel + installation

Spreader Controls / Hydraulics

- Electric Spreader Valves, cost + installation
 - ~\$1350-\$1800 auger / spinner to auger /spinner / pre-wet
 - ~\$600-\$1000 Liquid valve
- Spreader Controls, cost + installation
 - ~\$600+ Open loop / auger / spinner
 - ~\$1700+ Closed loop / auger / spinner
 - ~\$2100 + Closed loop / auger / spinner / pre-wet
 - ~\$3500 Closed loop / auger / spinner / pre-wet / liquid with *Temp Response™*

Summary

- Update equipment to allow lower spreading rates;
- Use spreader controls that lower operator input and lessen training requirements;
- Regular personnel training;
- Results:
 - Lowered operating cost (use less salt)
 - Lowered chlorides heading toward watersheds
 - Reduced streets cleanup