Town of Linn

Matt Wittum, Highway Superintendent

March 9, 2020

Why Liquids??

- Reduce salt usage. Our reliance (as an industry) on granular material is too great.
- Activate salt quicker. Salt needs moisture to work, you are giving that to it instantly. Salt does NOT work until it is in solution. This equals a better level of service.
- In cold pavement temperatures, without “help” dry salt is useless.
- Ability for pre-event treatment (anti-icing)
- Reduces environmental impact and chloride emissions
- SALT PRICES HAVE INCREASED 167% IN THE LAST 20 YEARS.

Pounds of Ice Melted Per Pound of Salt

Temperature (F) Pavement	One pound of Salt
30	46.3 lbs of ice
25	14.4 lbs of ice
20	8.6 lbs of ice
15	6.3 lbs of ice
10	4.9 lbs of ice
5	4.1 lbs of ice
0	3.7 lbs of ice

Salt needs moisture to work!!

What Happens When Materials Hit The Road?

First, The Material Must Go Into Solution

- Liquids Are Already There
- Rock Salt Needs Moisture To Go To Work

Once In Solution (I.E. Mixed With Water)

It Lowers The Freezing Point

As Soon As It Goes Into Solution, It Starts To Dilute Out

How Long? Depends On:

Pavement Temperature

Cycle Time

Amount

- Storm Type & Amount Of Precipitation
- Amount Of Material Used

MILLS
FLEET FARM

Brine Production Process

- Salt added into livestock (aluminum) tank
- Water run up through salt into 1100 gallon tank to desired quantity
- When desired quantity is reached, 2 valves are turned so water in 1100 gallon tank can be re-circulated through salt until it reaches 23.3%
- Final product is tested with hydrometer.

Hydrometer / Salometer Chart for Salt Brine (59°F)

%Salt	Salometer Using 0 – 100%	Hydrometer Specific Gravity	Eutectic Temperature
0	0	1	32
1	4	1.007	31
2	7	1.014	30
3	11	1.021	29
4	15	1.028	27
5	19	1.036	26
6	22	1.043	25
7	26	1.051	24
8	30	1.059	23
9	33	1.067	21
10	37	1.074	20
11	41	1.082	19
12	44	1.089	17
13	48	1.097	15
14	52	1.104	13
15	56	1.112	12
16	59	1.119	9
17	63	1.127	7
18	67	1.135	4
19	70	1.143	2
20	74	1.152	0
21	78	1.159	-2
22	81	1.168	-4
23	85	1.176	-6
24	89	1.184	2
25	93	1.193	16
26	96	1.201	30
27	100	-	32

Pro vs. Con Salt Brine

PRO:

- Minimal cost to produce (2019/20 .068 cents per gallon)
- Least expensive to purchase if necessary
- Good for anti-ice and pre-wet applications (especially when introducing your agency to liquids)

CON:

- Only works when pavement temperatures are 15 degrees or higher in pre-wetting applications
- Does not have a long lasting residual in anti-ice applications. Becomes airborne easily

Pro vs. Con Blended Products

PRO:

- More versatile depending on what product and percentage blend is in regards to working pavement temperature threshold
- Longer residual effects than straight brine in anti-ice applications

CON:

- Cost of additional storage/blending equipment
- Cost of additional product(s) to blend
- Cost per gallon to produce vs. brine increases

(2019/20 cost per gallon of blend is estimated to be .47 cents/gallon)

PRO will outweigh cons as far as performance of the product versus brine.

Pro vs. Con Straight Product

Calcium Chloride (example)

Pro:

- Chart topper for performance in extreme cold conditions

Con:

- Cost to purchase vs. blended product could potentially be higher
- Very good at drawing moisture from the air, not recommended in anti-ice applications
- Will not be cost effective in warmer events
- Has an extremely high corrosion rate for equipment and infrastructure in addition to environmental impact

Why an Agriculture Product?

- We wanted a product that would be more versatile than straight brine
- Longer lasting residual effect in anti-ice operations: created a “sticky” product
- Product could be blended in somewhat off percentages without drastically changing the working temperature of the blend
- Lowered our working pavement temperature from 15 degrees to 0 in pre-wet applications
- 100% organic product which reduced the overall corrosiveness of our product.

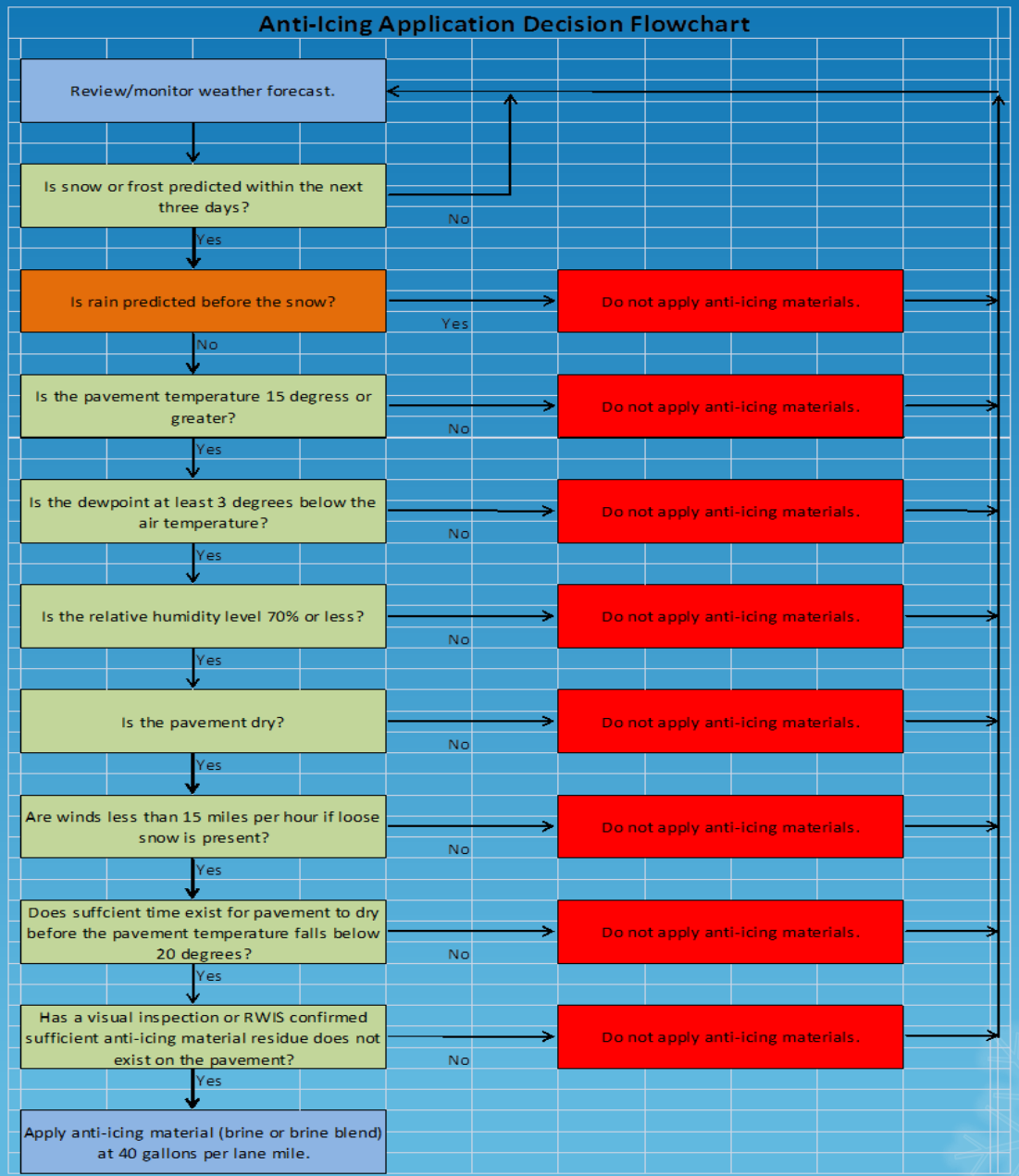
Sugar and salt working together
Sugar sticks and salt melts

Why Anti-Ice??

- Proactive approach
- Gain a head start on an event
- Increase public safety
- ¼ of the material
- 1/10 of the overall cost
- Better for the environment

SnowEx
LIQUID ANTI-ICING
STAY BACK 100 FEET
58332
SnowEx

When do we anti-ice???



Pre-Salting vs. Anti-icing

- Typical pre-salt run includes roads on both sides of the lake
- Roads need to be low speed so material is not swept off by traffic
- Roads are limited to steep hills and locations that can be difficult (ie Linn boat launch)
- Average material usage is 5 tons. $345.00

- Anti-ice "route" includes more miles of roads on both sides of the lake
- Road speed does not matter. Material stays where it is placed.
- If brine were used on the roads of traditional pre-salt applications the cost would be $20.40
- If a blend were used, the cost would be $141.00 to treat the roads.

Why is anti-icing important as far as material usage is concerned??

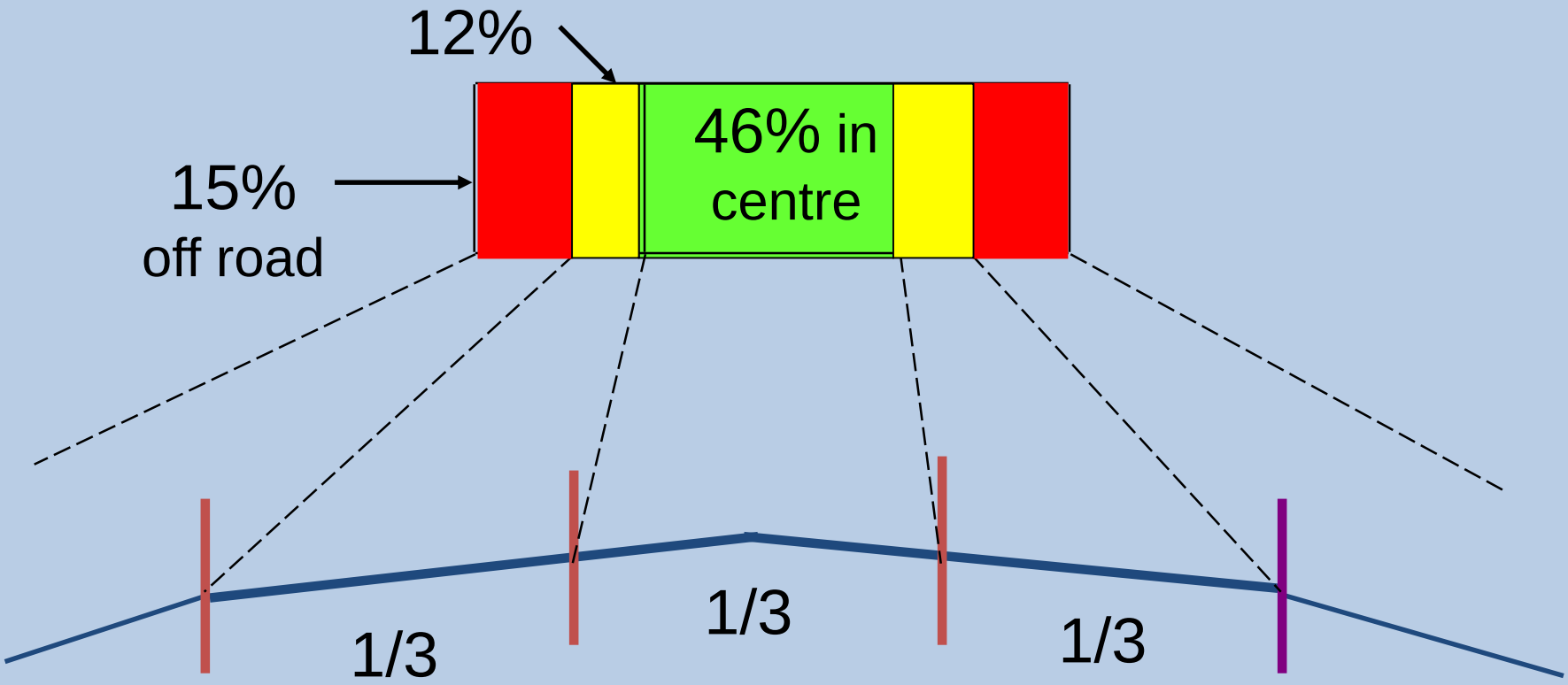
Studies have shown that it can take up to 4 TIMES the amount of material to remove a snow and ice bond once it has formed than to prevent it!!!

It Doesn’t Always Work

Why Pre-Wet??

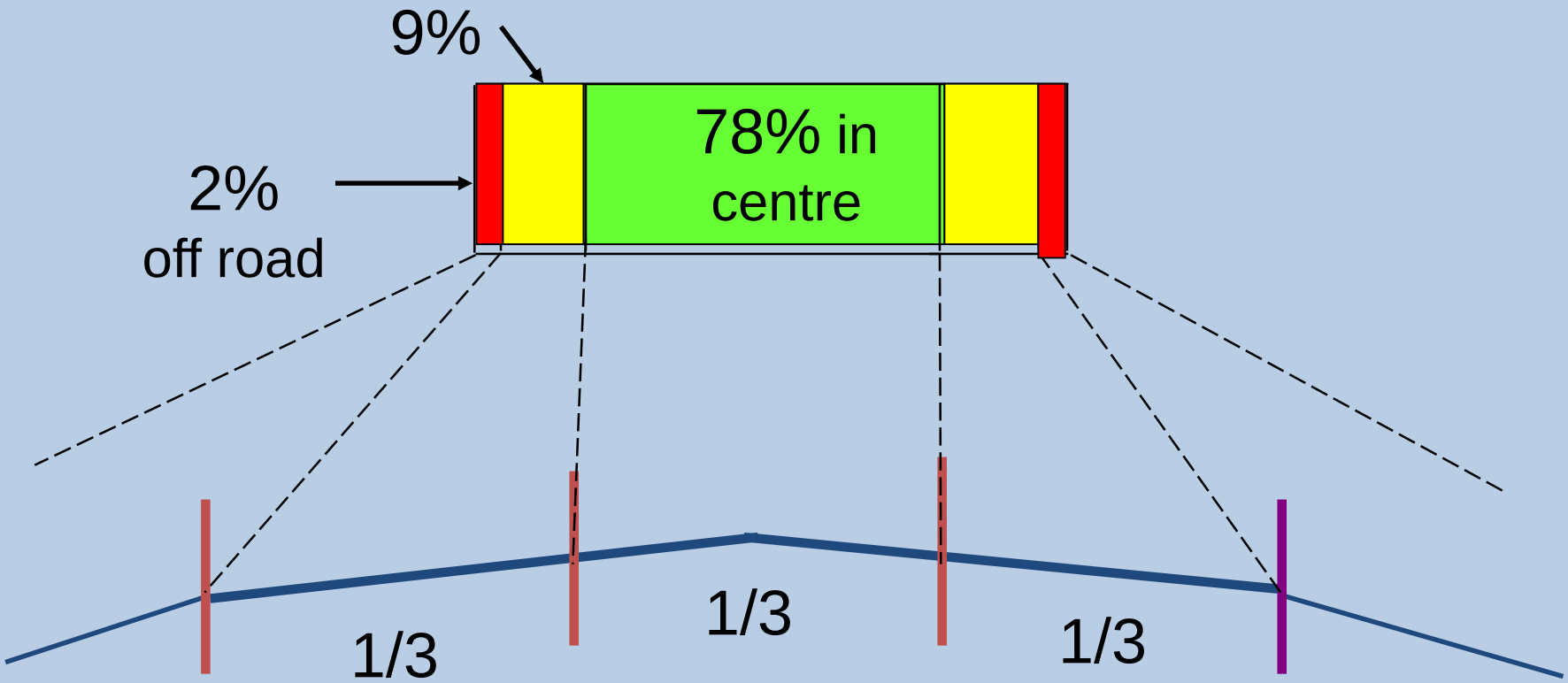
- Minimizes bounce and scatter during application
- Keeps more material on the road (less shoulder loss) 20-30% more
- Initiates brine process
- Reduces working temperature vs. dry material
- Reduces environmental impacts
- Saves money

Typical Scatter Pattern Of Road Salt



100% salt spread in centre 1/3 of road

Typical Scatter Of Pre-wet Road Salt

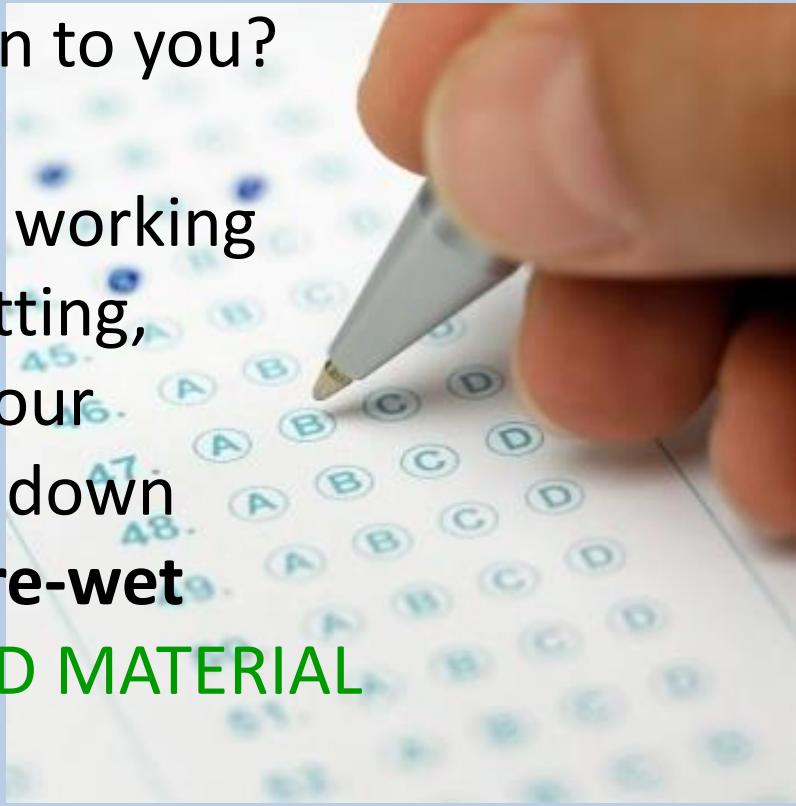


100% <u>prewetted</u> salt spread in centre 1/3 of road

26% Salt Saved

What does that mean to you?

If your methods are working
Without pre-wetting,
You can turn your
Application rates down
26% when you pre-wet
SAVING BOTH TIME AND MATERIAL



What determines how much liquid (and salt) to be applied??

Air or Pavement Temperature??

Or both??

We do NOT use air temperature to determine material application rates.

The only time we are concerned with air temperature is for a trend- pavement temperatures follow the trend of air temperatures.

ALL APPLICATION CHARTS ARE BASED ON PAVEMENT TEMPERATURE

How different?

Air and pavement temperature can vary up to 20 degrees!!

Pavement temperature & application rates- Precise/Road Watch System

Deicing Application Rate Guidelines

24' of pavement (typical two-lane road)

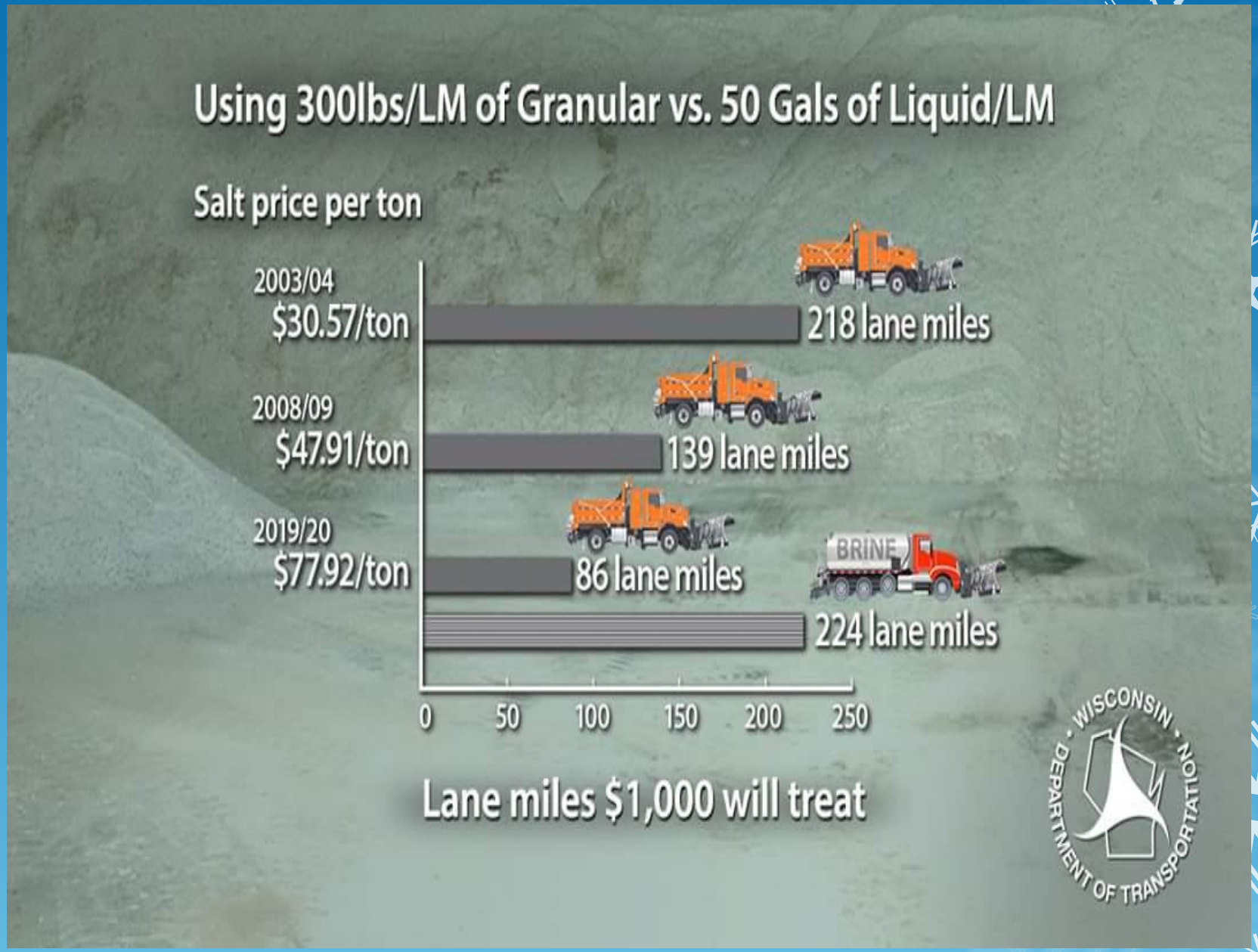
*Copy included in back pocket of this handbook

These rates are not fixed values, but rather the middle of a range to be selected and adjusted by an agency according to its local conditions and experience.

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Lbs/two-lane mile			
			Salt Pre-wetted/ Pretreated With Salt Brine	Salt Pre-wetted/ Pretreated With Other Blends	Dry Salt*	Winter Sand (abrasives)
>30° ↑	Snow	Plow treat intersections only	80	70	100-200*	Not Recommended
	Frz. rain	Apply Chemical	80-160	70-140	100-200*	Not Recommended
30° ↓	Snow	Plow & apply chemical	80-160	70-140	100-200*	Not Recom-mended
	Frz. rain	Apply Chemical	150-200	130-180	180-240*	Not Recom-mended
25-30° ↑	Snow	Plow & apply chemical	120-160	100-140	150-200*	Not Recom-mended
	Frz. rain	Apply Chemical	150-200	130-180	180-240*	Not Recom-mended
25-30° ↓	Snow	Plow & apply chemical	120-160	100-140	150-200*	Not Recom-mended
	Frz. rain	Apply Chemical	160-240	140-210	200-300*	400
20-25° ↑	Snow or frz. rain	Plow & apply chemical	160-240	140-210	200-300*	400
20-25° ↓	Snow	Plow & apply chemical	200-280	175-250	250-350*	Not Recom-mended
	Frz. rain	Apply Chemical	240-320	210-280	300-400*	400
15-20° ↑	Snow	Plow & apply chemical	200-280	175-250	250-350*	Not Recom-mended
	Frz. rain	Apply Chemical	240-320	210-280	300-400*	400
15-20° ↓	Snow or Frz. rain	Plow & apply chemical	240-320	210-280	300-400*	500 for frz. rain
0-15° ↑↓	Snow	Plow, treat with blends, sand hazardous areas	Not Recom-mended	300-400	Not Recom-mended	500-750 spot treat as needed
< 0°	Snow	Plow, treat with blends, sand hazardous areas	Not Recom-mended	400-600**	Not Recom-mended	500-750 spot treat as needed

*Dry salt is not recommended. It is likely to blow off the road before it melts ice.

**A blend of 6-8 gal/ton $MgCL^2$ or $CaCl^2$ added to NaCl can melt ice as low as –10°.


Using 300lbs/LM of Granular vs. 50 Gals of Liquid/LM
Salt price per ton
2003/04
$30.57/ton
218 lane miles
2008/09
$47.91/ton
139 lane miles
2019/20
$77.92/ton
86 lane miles
BRINE
224 lane miles
0
50
100
150
200
250
Lane miles $1,000 will treat
WISCONSIN DEPARTMENT OF TRANSPORTATION

Sand

- No melting capability
- Not environmentally friendly
- Clogs storm sewers and fills ditches
- Only provides traction for the first 12 vehicles when placed on hardpack.

What is the difference between 2 applications of a 50/50 mix at 300 lbs/mi or 1 applications of straight salt at 300 lbs/mi.??

Number of “cycles” which equals more material, time, fuel, wear and tear on equipment, increased maintenance costs.

What is the true cost of using sand??

- Hauling and mixing- $44.63 per ton
- Storm sewer cleaning
- Re-ditching
- Street sweeping
- Blowing sand off roadways
- Proper disposal- $40.00 per ton

One of our trucks was run through a material experiment.

One event the driver counted the number of rounds or cycles he made and tracked his material usage while using a 50/50 mix.

We calibrated the truck and switched to pure salt. We then compared an event with similar conditions and the same amount of rounds or cycles.

The difference in savings was as follows:

-no sand used

-used 3.5 tons less salt

-5 less trips back for material (wear and tear, fuel, time)

-salt savings alone equaled just over $225.00 for ONE truck in ONE event.

-Now, let's give that truck some liquid…….

CALIBRATION

Who does it?
How often?
Does it really matter?
Granular and liquid??

Maunal vs. ground speed systems

Every truck that dispenses material should be calibrated annually and also when a component of the hydraulic system is changed.

After calibration, it was determined that our manual systems are putting down an average to slightly above average lbs/mi (300) at setting 1. Setting 2 on these trucks put out an excessive amount of material.

In addition, with a manual system, if you are putting down 300 lbs/mi at 20 mph, you are putting down 600 at 10 mph, 1200 at 5 mph.

Ground speed systems place a desired amount of salt per mile down no matter what the speed of the truck.

Cost Savings

3 anti-ice treatments (2 brine, 1 blend) vs. pre-salting has equaled a material savings of approximately $815.00

Anti-ice application on Feb 7th saved approximately 10-11 tons of salt at the beginning of an event on the 9th. $690.00

Truck 09 calibration and material change initial evaluation $225.00

Truck 17 calibration and material change saves approximately 1.75 tons on average per round/cycle $1690.50

Truck 20 (New) conversion to ground speed controlled distribution system & liquid capable saves approximately 1.35 tons on average per round/cycle $1676.70

TOTAL APPROXIMATE SAVINGS: $4476.20 in material savings alone.

BECAUSE OF SAVINGS ALREADY REALIZED:

Some of the costs offset:

- Brine maker construction
- Anti-ice sprayer purchase (auction)
- Pre-wet system for truck 17