



This section contains concentrates on material application and ways we can be more successful at keeping material on the road.

Goal: Keep material on the driving surface

Our handicaps:

- Traffic blows it off the road
- It bounces off of the road when we apply it

Photo: Fortin Consulting

If we know where are struggle is we can take steps to remedy it.



One challenge as the industry changes from sand or salt/sand mix to straight salt is the spread pattern and spread volume.

Sand must be applied in wheel tracks, it quickly moves out of wheel tracks and renders itself useless. We have no options but to place it in the wheel tracks.

Salt: Narrow spread pattern on center line or super elevation of road. To melt & slowly migrate across drive lanes toward ditch or storm drain

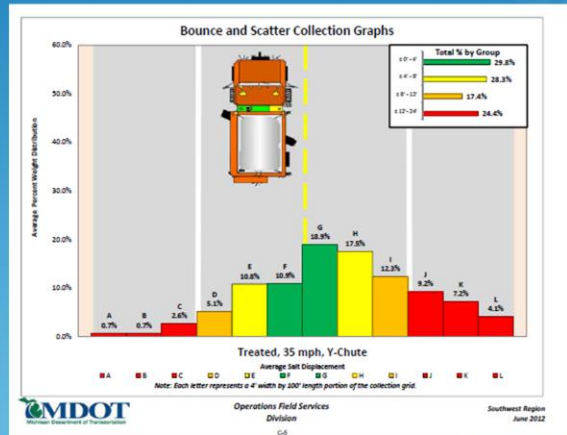


Salt is often applied in granular form. As it dissolves it runs downhill but continues melting. Because of this it is to our advantage to apply it to the highest spot of the road.

Especially in high speed roads we want a very narrow spread pattern. As we move to low speed low volume roads, they are more forgiving and we can widen our spread pattern a bit.

# Delivery methods

- Looking for ways to reduce the bounce and scatter



MDOT conducted experiments on bounce and scatter



## Salt Bounce and Scatter Study

### PROJECT SUMMARY REPORT

Final  
November 2012

Prepared By:



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## Chutes



Photo: Fortin Consulting



Photo: Fortin Consulting



Photo: Michigan DOT

Since chutes guide the salt from the truck to the pavement there is less salt bounced off of the road.

CAD drawings for chutes now on MN LTAP website

<http://www.mnltap.umn.edu/about/programs/opera/fact/documents/washingtoncad.pdf>



Dual delivery options: More likely to place salt between lanes if you have more than one option!



This truck offers a few advantages for reducing bounce and scatter:

- #1 liquid
- #2 Dual spinners
- #3 chutes



Mankato Truck Station of MnDOT is please with how the skirts work to reduce bounce and scatter.



## Holes in spinner



Reduced spinner speed

Photos: Fortin Consulting

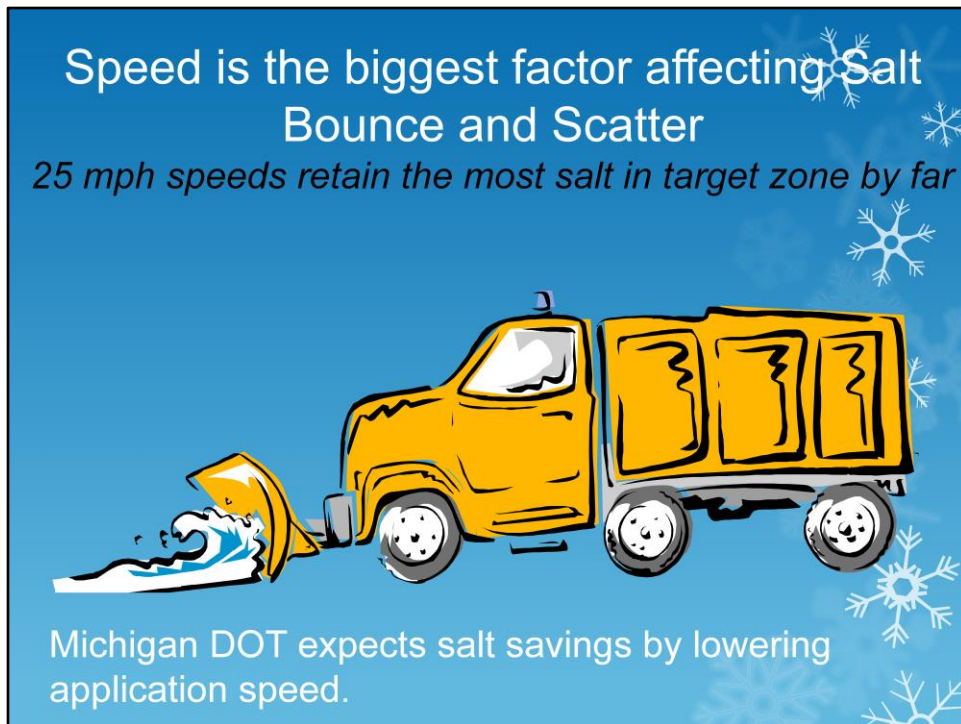
By cutting holes in the middle of the spinner or along the outer edge of the spinner you are able to get a more direct drop onto your target. Usually these spinners need a reinforcement under the spinner since they have been weakened by the holes. Some take scrap metal such as an old sign to layer under the spinner.



Zero velocity spreader matches the forward speed the truck is moving and forces salt out at the same speed but in opposite direction. This results in salt being applied as if the truck was standing still.



The lower the delivery point is to the pavement, the less bounce and scatter. This can be done as we saw previously with a chute but can also be done by lowering the spinner.



## MDOT CONCLUSION

1) Speed , by far, has the most effect on salt bounce and scatter (This can easily be ascertained by just glancing at the graphs). When looking at the numbers, the percentage of salt that remains in the target area at 25 mph is close to (if not more than) double that from correlating graphs at 35 mph. What is also interesting with the speed analysis is that there is a more dramatic spike in salt scatter when going from 25 mph to 35 mph than there is when going from 35 mph to 45 mph.

## MDOT STUDY: Slower Speeds Equal savings



When salting; slower is faster for meeting LOS

| Truck Speed   | Salt Needed    | Salt Placed    | Truck Trips | Truck Miles | Route Time          |
|---------------|----------------|----------------|-------------|-------------|---------------------|
| <b>25 mph</b> | <b>7 Tons</b>  | <b>7 Tons</b>  | <b>1</b>    | <b>40</b>   | <b>1 Hr 45 Min</b>  |
| <b>35 mph</b> | <b>10 Tons</b> | <b>14 Tons</b> | <b>2</b>    | <b>80</b>   | <b>2 Hr 30 Min*</b> |

*Assumptions:*

- Avg route length in the SW Region is 40 miles.
- 7 ton truck bed capacity.
- 350lb rate needed to meet LOS.

*\* Does not include down time to reload.*



This slide gives a real good idea on how salting at slower speeds saves time and money!

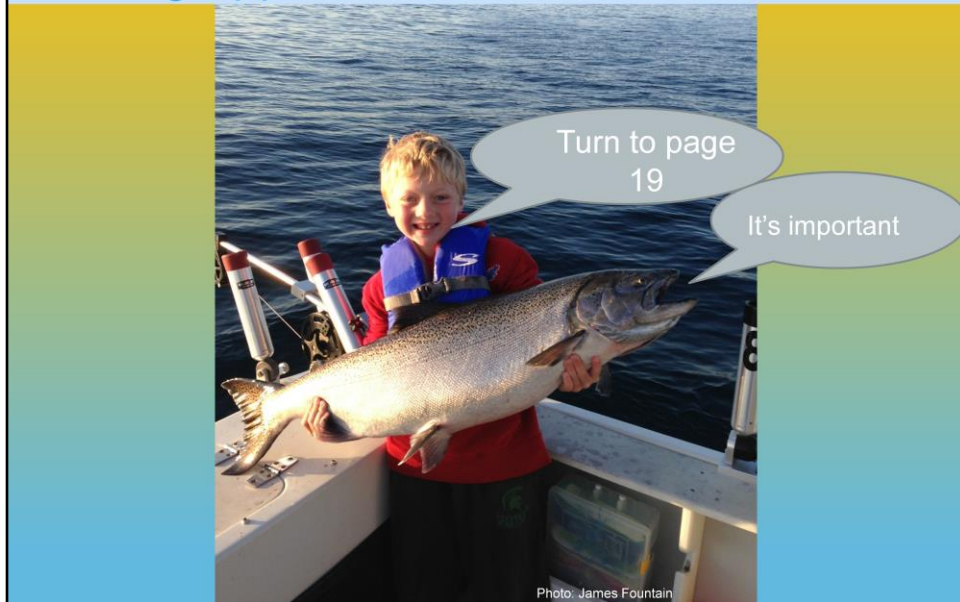
It also dispels the common thought that it takes longer for an operator to complete their run if applying salt at 25 mph.

Here is how:

At 35 MPH or faster our study proves that a high percentage of material ends up outside of the target area adding no benefit to clearing the road, which might require you to make a second pass to get the job done. If a bulk of your material lands on the shoulder or in the ditch, what you just did will be less effective, so now you will add more miles, use twice the fuel, put twice the wear on your equipment to try and accomplish what you may have been able to do in one trip at slower speeds.



## How to use the Deicing Application Rate Guidelines



This section will review the use of an application table. There will be 3 questions on the test that require the students to be able to use the application rate table.

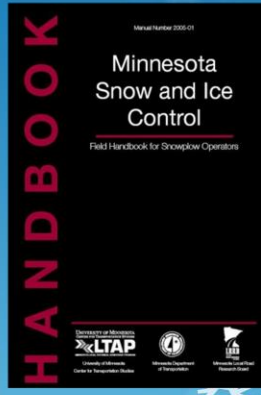
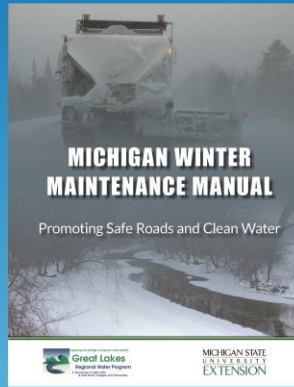


| Deicing Application Guidelines  |                   |                                |   |   |          |                         |
|---|-------------------|--------------------------------|---|---|----------|-------------------------|
| <div>19</div> <div>Deicing Application Rate Guidelines</div> <div>24' of pavement (typical two-lane road)</div> <div>These guidelines are a starting point<br/>Reduce or increase rates incrementally based on your experience.</div> |                   |                                |   |   |          |                         |
| Pavement Temp. (°F) and Trend (↑↓)  | Weather Condition | Maintenance Actions            | Lbs/two-lane mile                             |   |          |                         |
|   |                   |                                | Salt Prewetted/<br>Pretreated With Salt Brine | Salt Prewetted/<br>Pretreated With Other Blends | Dry Salt | Winter Sand (abrasives) |
| >30° ↑  | Snow              | Plow, treat intersections only | 80  | 70  | 100      | 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 recommended         |
|   | Frz. Rain         | Apply chemical                 | 150-200                                       | 130-180   | 180-240  | not recommended         |
| 25 - 30° ↑  | Snow              | Plow & apply chemical          | 120-160                                       | 100-140   | 150-200  | not recommended         |
|   | Frz. Rain         | Apply chemical                 | 150-200                                       | 130-180   | 180-240  | not recommended         |

Everyone should open their manuals to the application rate table before you continue with this section.

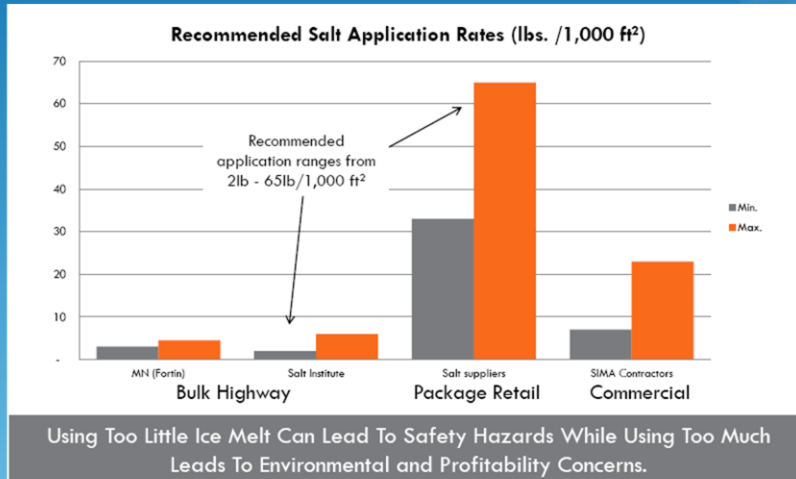
## This application rate table is found in the Michigan Winter Maintenance Manual:

- Was developed by a group of MN State, County, City, Private snow and Ice control experts in 2005
- Is a goal to strive for
- Is not proven, is an educated guess.



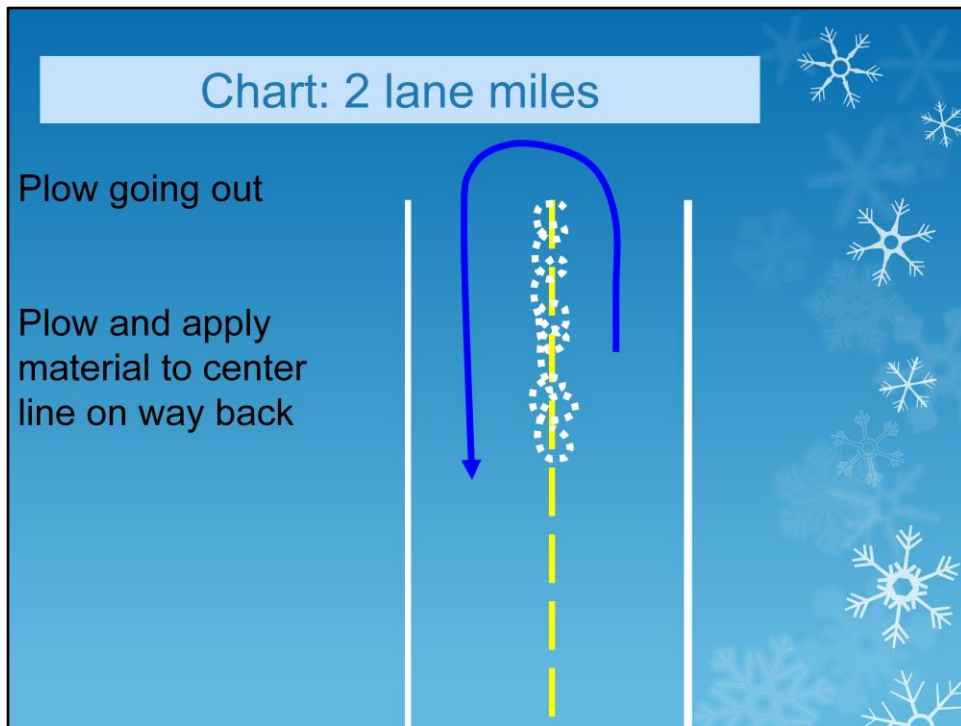
The application rate in the MI manual is copied from the MN Manual. To look at the MN manual go to [www.pca.state.mn.us/programs/roadsalt.html](http://www.pca.state.mn.us/programs/roadsalt.html) and you will see the picture of the black snow and ice book and you can print it or view it. You will have to scroll down a bit on the website to find the manual.

# Everyone has their own idea of the perfect application rate



From: Ice melt application for Profit Maximazation PPT – Russ Alger MI tech Univ, Niles Hysell, Morton Salt June 24, 2011

This chart illustrates the truth that everyone has their own idea of the perfect application rate. We encourage everyone to start where ever they are and work toward lowering their rates. It is best to make this a gradual process.



The chart is based on a 24 foot pavement.

This is the recommended plow and apply method. Plow one way and plow and apply on the return.

It is over simplified as many have more than 2 lanes and turn lanes, ramps and other complicating factors. This illustrates the idea of applying salt to the center of the road, not in the drive lane.



Example #1:

Look at application rate chart. See where pavement temp and dry salt intersect. That is the application rate.

| <div>Deicing Application Rate Guidelines</div> <div>24' of pavement (typical two-lane road)</div> <div>These guidelines are a starting point</div> <div>Reduce or increase rates incrementally based on your experience.</div> |                   |                                |   |   |          |                         |
|--|-------------------|--------------------------------|---|---|----------|-------------------------|
| Pavement Temp. (°F) and Trend (↑ ↓)  | Weather Condition | Maintenance Actions            | Lbs/two-lane mile                             |   |          |                         |
|  |                   |                                | Salt Prewetted/<br>Pretreated With Salt Brine | Salt Prewetted/<br>Pretreated With Other Blends | Dry Salt | Winter Sand (abrasives) |
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| 30° ↓  | Snow              | Plow & apply chemical          | 80-160  | 70-140  | 100-200  | not recommended         |
|  | Frz. Rain         | Apply chemical                 | 150-200                                       | 130-180   | 180-240  | not recommended         |
| 25 - 30° ↑   | Snow              | Plow & apply chemical          | 120-160                                       | 100-140   | 150-200  | not recommended         |
|  | Frz. Rain         | Apply chemical                 | 150-200                                       | 130-180   | 180-240  | not recommended         |

This is the application rate for this example



My route is 10 miles one direction  
My Application rate is 150-200 lbs/two lane mile



How much salt will I need?

200 lbs x 10 miles =  
2,000 lbs ( 1 ton)

To figure out salt needed: multiple the lane miles x application rate  
Remember the amount in the table is for a 2 lane mile.

It has just finished snowing and we have plowed

It is 19 ° and rising

We are using dry salt



What is our  
application rate?

Example #2:

Look up the pavement temp and dry salt and see where they intersect. This is the application rate. Use the chart in the manual.

| <div>Deicing Application Rate Guidelines</div> <div>24' of pavement (typical two-lane road)</div> <div>These guidelines are a starting point<br/>Reduce or increase rates incrementally based on your experience.</div> |                   |   |   |   |                 |                              |
|---|-------------------|---|---|---|-----------------|------------------------------|
| Pavement Temp. (°F) and Trend (↑ ↓)   | Weather Condition | Maintenance Actions                           | Lbs/two-lane mile                             |   |                 |                              |
|   |                   |   | Salt Prewetted/<br>Pretreated With Salt Brine | Salt Prewetted/<br>Pretreated With Other Blends | Dry Salt        | Winter Sand (abrasives)      |
| 25-30° ↓  | Snow              | Plow, apply chemicals                         | 120-160                                       | 100-140   | 150-200         | not recommended              |
|   | 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 and apply chemical                       | 200-280                                       | 175-250   | 250-350         | not recommended              |
|   | Frz. Rain         | Apply chemical                                | 240-320                                       | 210-280   | 300-400         | 400                          |
| 15-20° ↑  | Snow              | Plow & apply chemical                         | 200-280                                       | 175-250   | 250-350         | not recommended              |
|   | Frz. Rain         | Apply chemical                                | 240-320                                       | 210-280   | 300-400         | 400                          |
| 15-20° ↓  | Snow or Frz. Rain | Plow and apply chemical                       | 240-320                                       | 210-280   | 300-400         | 500 for frz. rain            |
| 0 to 15 ° ↓ ↑   | Snow              | Plow, treat with blends, sand hazardous areas | not recommended                               | 300-400   | not recommended | 500-750 spot treat as needed |
| <0 °  | Snow              | Plow, treat with blends, sand hazardous areas | not recommended                               | 400-600   | not recommended | 500-750 spot treat as needed |

The application rate is 250-350 pounds per 2 lane mile for this example

My route is 30 miles one direction  
My application rate is 250-350 lbs/two lane  
mile

How much salt will I  
need ?



$300\text{lbs} \times 30 \text{ miles} = 9,000 \text{ lbs ( 4.5 tons)}$

To figure out how much salt you need multiply the distance by the application rate.

It has just finished snowing and we have plowed

It is 10 ° and getting colder

We have rock salt treated with Calcium Chloride



What is our  
application rate ?

Photo: Brad Knight

Example #3:

In this example the students should find the application rate. A good question to ask them after they have found the application rate is what would the application rate have been if you used dry salt. They chart will say dry salt is not recommended for this temperature range. That is a good reminder to them.



| <div> <div>Deicing Application Rate Guidelines</div> <div>24' of pavement (typical two-lane road)</div> <div> <div>These guidelines are a starting point</div> <div>Reduce or increase rates incrementally based on your experience.</div> </div> </div> |                   |   |   |   |                 |                              |
|--|-------------------|---|---|---|-----------------|------------------------------|
| Pavement Temp. (°F) and Trend (↑ ↓)  | Weather Condition | Maintenance Actions                           | Lbs/two-lane mile                             |   |                 |                              |
|  |                   |   | Salt Prewetted/<br>Pretreated With Salt Brine | Salt Prewetted/<br>Pretreated With Other Blends | Dry Salt        | Winter Sand (abrasives)      |
| 25-30° ↓   | Snow              | Plow, apply chemicals                         | 120-160                                       | 100-140   | 150-200         | not recommended              |
|  | 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 and apply chemical                       | 200-280                                       | 175-250   | 250-350         | not recommended              |
|  | Frz. Rain         | Apply chemical                                | 240-320                                       | 210-280   | 300-400         | 400                          |
| 15-20° ↑   | Snow              | Plow & apply chemical                         | 200-280                                       | 175-250   | 250-350         | not recommended              |
|  | Frz. Rain         | Apply chemical                                | 240-320                                       | 210-280   | 300-400         | 400                          |
| 15-20° ↓   | Snow or Frz. Rain | Plow and apply chemical                       | 240-320                                       | 210-280   | 300-400         | 500 for frz. rain            |
| 0 to 15°<br>↓ ↑  | Snow              | Plow, treat with blends, sand hazardous areas | not recommended                               | 300-400   | not recommended | 500-750 spot treat as needed |
| <0°  | Snow              | Plow, treat with blends, sand hazardous areas | not recommended                               | 400-600   | not recommended | 500-750 spot treat as needed |

The application rate for this example is 300-400

The title of the column is salt prewet with other blends. This is the column for all liquids except straight salt brine.



My route is 50 miles one direction  
My Application rate is 300-400 lbs/two lane  
mile

How much salt  
will I need ?



400lbs x 50 miles =  
20,000 lbs (10 tons)

To calculate the amount of salt needed multiply the application rate by the lane miles.

After this third example see if everyone understands how to use the chart. If there is confusion just make up a few other examples for more practice.



Many organizations do not salt all of their routes. The examples we just practice assume that all of the route is salted.

If part of the route is salted the driver should know approximately how many miles of their route is salted and do the calculation with the salted lane miles not total lane miles.

## Develop and use your own chart work towards lower rates and safe roads



| Prewet Salt Chart | MN/DOT Prewet Salt Chart |                    |                              |            |             |                                    |
|-------------------|--------------------------|--------------------|------------------------------|------------|-------------|------------------------------------|
|                   | Pavement Temp            | Weather Conditions | Pounds Per Two (2) Lane Mile |            |             | Application Frequency and Location |
|                   |                          |                    | 100% Salt                    | 50% Salt   | Stock Pile  |                                    |
|                   |                          | Snow               | 150 – 300                    | 300 – 600  |             | As Needed                          |
|                   | 30° +                    | Freezing Rain      | 300                          | 300        |             | As Needed                          |
|                   | 25° to 30°               | Wet Snow           | 200 – 400                    | 600 – 800  |             | As Needed                          |
|                   |                          | Freezing Rain      | 400                          | 500        |             | Initial                            |
|                   |                          |                    |                              | 300        | 300         |                                    |
|                   | 25° to 30°               | Wet Snow           | 400 – 500                    | 800 – 900  |             | Initial                            |
|                   |                          |                    | 300                          | 400        |             | Repeat                             |
|                   |                          | Freezing Snow      | 400                          | 600        |             | Initial                            |
|                   |                          |                    | 400                          | 500        |             | Repeat                             |
|                   | 25° to 30°               | Dry Snow           | 400 – 500                    | 600        | 1200        | Sand Hazard Areas                  |
|                   |                          | Wet Snow           | 400 – 500                    | 900 – 1200 | 600 – 800   | Sand Hazard Areas                  |
|                   | Below 15°                | Dry Snow           |                              |            | 1200 – 1500 | Sand Hazard Areas                  |

All organizations should be guided by an application rate chart designed around pavement temperatures. You do not have to use the one in the manual, make your own and continue to improve it over time.

# Class Exercise

## Michigan Application Rate Worksheet

*Think of a familiar route that you salt or sand:*

1. Estimate the size of your route \_\_\_\_\_ miles
2. How much of this route do you normally use salt or sand? \_\_\_\_\_ miles
3. What do you most often apply?

Rock Salt      pretreated salt pile      pre-wetted salt (on truck)

Sand      Sand/Salt mix: \_\_\_\_\_ (what%)      Other \_\_\_\_\_

4. How much do you use in 1 pass? \_\_\_\_\_ pounds

### Take out your charts

5. At 22 degrees and getting colder, what is application rate? \_\_\_\_\_ pounds
6. How much material will you need for your route \_\_\_\_\_ pounds
7. How much material could you save, in one pass, if you used the chart?

Everyone take out their yellow class exercise:

Need pencil and calculator

Have audience think about their favorite winter maintenance route or area

You can talk the group through the first 4 questions then send them to the application rate table for the remaining questions.

This class exercise allows students to see how much salt they use vs what the chart recommends.

This also often shows the drivers that they do not know the length of their route or how much material they typically deliver. All good pieces of information that help improve the quality of maintenance.

# Integrating the facts gives us better results!

- Length of route
- Pavement Temperature
- Type of de-icer being used
- Application rate chart
- Calibration card

Know your route, base decisions on pavement temperature, understand the properties of the de-icers, develop an application rate chart for your organization and calibrate your equipment.

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