http://www.kalamazooriver.net/Corridor3/deq-water-stormwater-SWPPI_guidance.pdf

2. Road salt application and storage practices

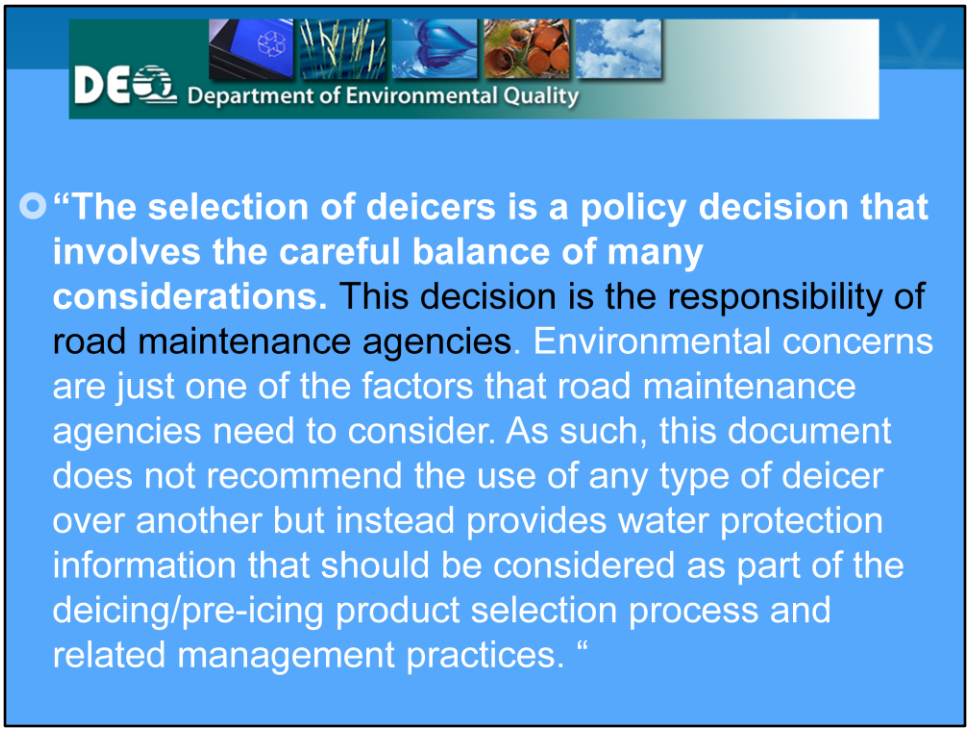
a) Application practices to consider:

i. Proximity to surface waters and other sensitive areas

ii. Frequency and amount of application should reflect site-specific characteristics

iii. Less environmentally harmful deicing alternatives near sensitive areas

This section will talk about some of the basic characteristics of de-icers and abrasives. Much information exists on a variety of de-icers although it is often confusing because information is frequently delivered by sales professionals. Although the information given by sales professionals may be accurate it is often one sided. Look for ways to understand how a variety of deicers work. This will allow you to make the best choices for your operation.

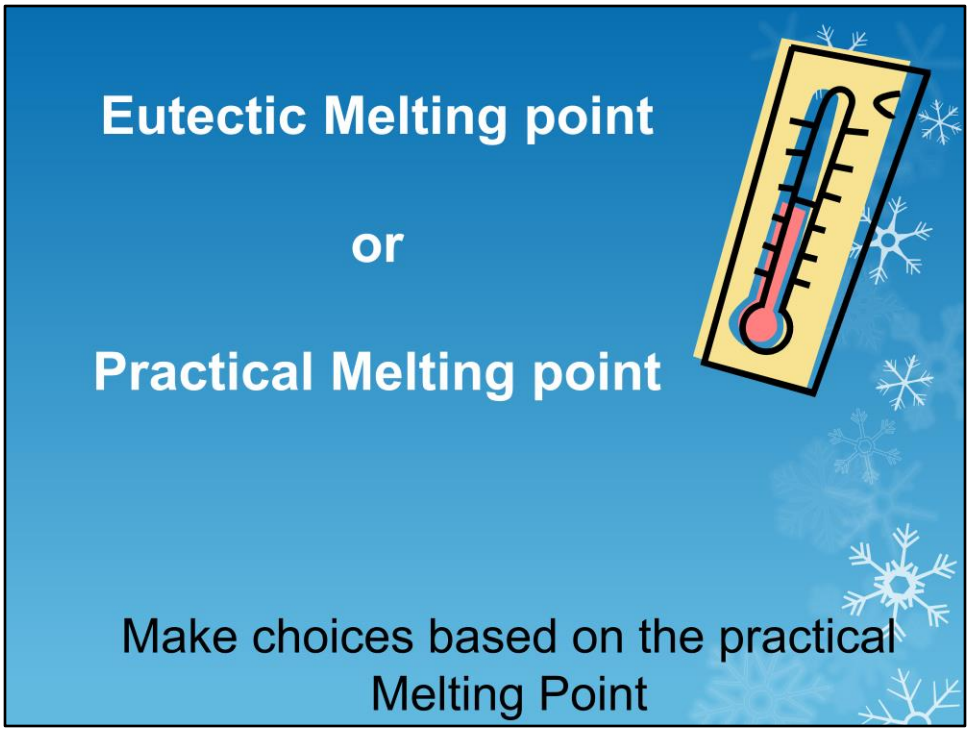


https://michigan.gov/documents/deq/deq-ess-faq-water-wb-deicers_255906_7.pdf

“The selection of deicers is a policy decision that involves the careful balance of many considerations. This decision is the responsibility of road maintenance agencies. Environmental concerns are just one of the factors that road maintenance agencies need to consider. As such, this document does not recommend the use of any type of deicer over another but instead provides water protection information that should be considered as part of the deicing/pre-icing product selection process and related management practices. “

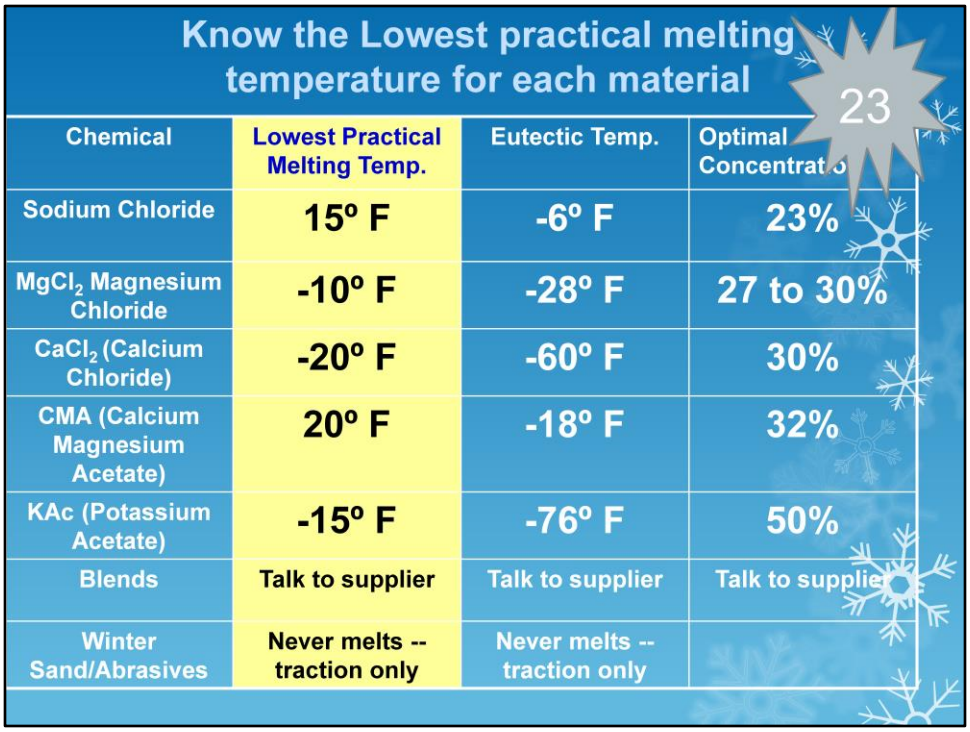
Video from Iowa DOT on the chemistry behind how salt works.

There may be other videos that would be appropriate here or even a series of slides or a talk that explains how NaCl breaks apart in the presence of H_2O. Shows the phase curve for a few de-icers based on pavement temps and concentration of solution. Explain how more isn't better. Use Anti-freeze in your truck example: 50 % anti-freeze + 50% water works best. By adding more anti-freeze it doesn't work better in fact it doesn't work as well.



Eutectic Melting point is the lowest temperature at which this product remains as a liquid or could melt snow or ice. It is not a good measure of when to apply it to a roadway. The practical temperature guidelines show when a product will work fast enough to be of any use.

Since there are no labeling laws on deicers, eutectic temperatures are often advertised with the products. It can be very misleading for those who think this is the temperature in which the product can work well.



This chart is taken from the “Minnesota Snow and Ice Control Field Handbook for Snow Plow Operators”

Sodium Chloride, Road Salt, NaCl

-Least expensive

-Does not attract water from air so it works slower

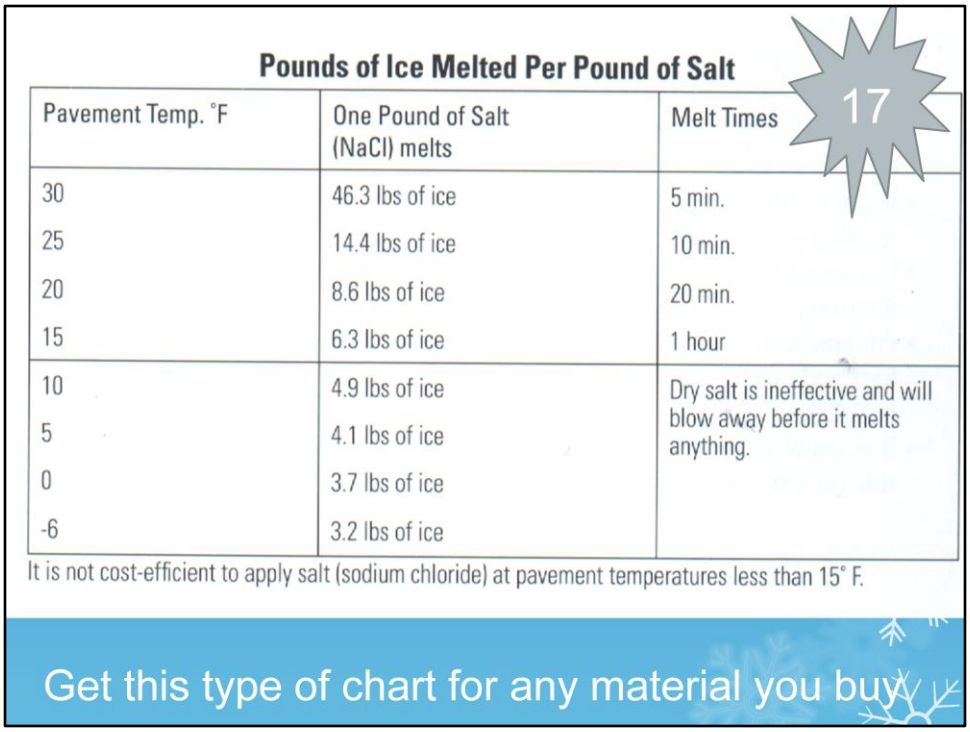
-Best at temps > 15° F

-No corrosion inhibitor

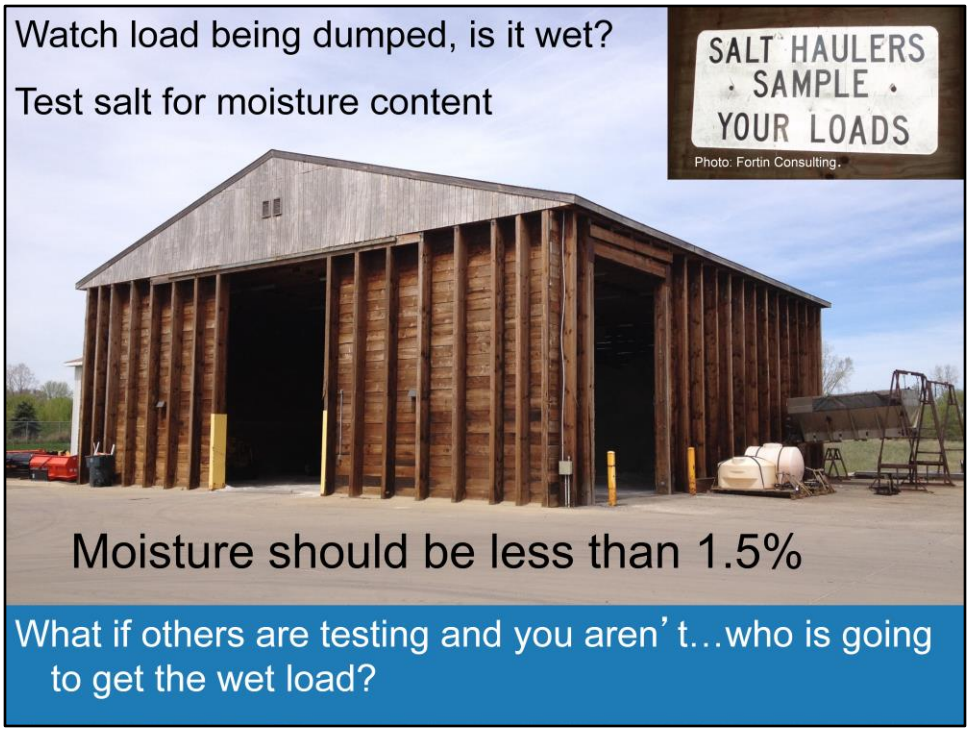
- Short term toxicity is lower than most

- Chloride persistent in water

For the test students should understand Rock Salt, Road Salt, Sodium Chloride and NaCl are all different names for the same product.



Use this to illustrate how pavement temperature influences ice melt capacity. This chart is taken from the “Minnesota Snow and Ice Control Field Handbook for Snow Plow Operators”



We want dry salt. Easier to work with, easier to store and allows us more flexibility when pretreating the stockpile. Not to mention we can save money by not paying for the water in the load.

Measure the moisture content of rock salt

26

You need a scale

You need 1 cup of salt (write truck # or invoice #)

Take from center of the pile

Weigh original product

Cook until dry but not "popping"

Weigh the dry product

Record the results

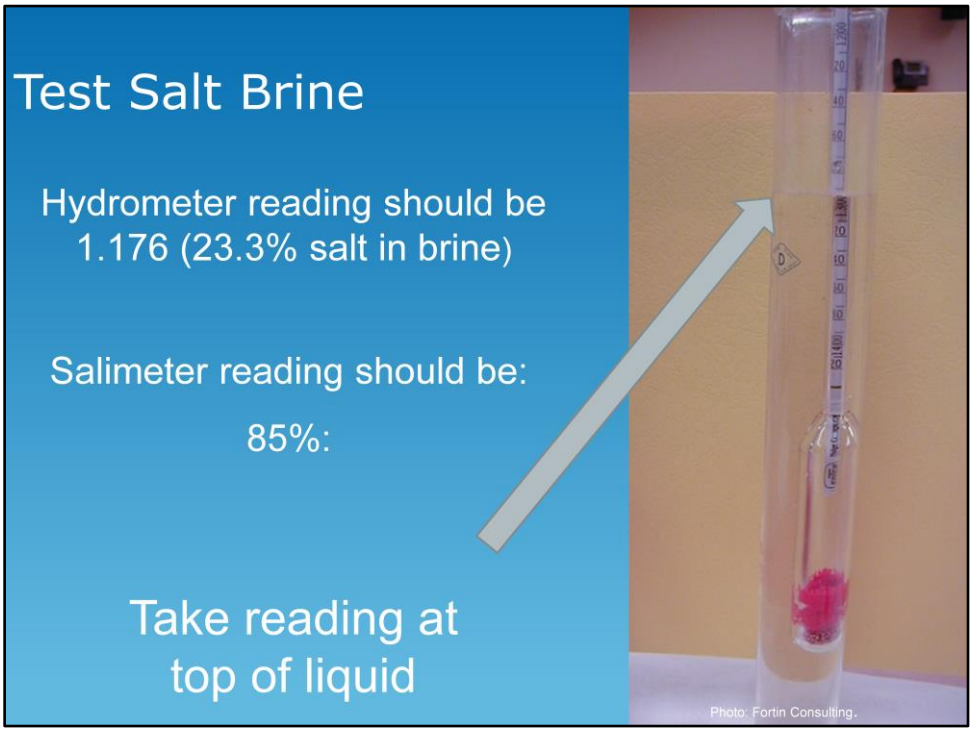
Photo: Fortin Consulting.

You can also cook the salt on the stove. Either way be sure to cook it gently so the salt doesn't pop out of the kettle or cup.

Brine = salt + water

- Works fast
- Doesn't bounce off road
- 15° practical
- -6 eutectic
- 23% optimal concentration

Use a hydrometer or salimeter to measure the density of your salt brine. A 32% mix works at the coldest temperature range. Making brine is very easy but don't forget to test the concentration or you could create problems for yourself.



A salimeter measures the percentage of salt that the water is carrying in solution (or dissolved into the water) at 60° F out of its total carrying capacity. Clear as mud hunh?

Water only has space for so much dissolved salt. When you change something like temperature you change the amount of salt that the water can carry. (Elevation can also make a difference like in Colorado)

Magnesium Chloride $MgCl_2$

- Better melter than rock salt at cold temperatures
- Attracts moisture
- Do not use on warm or humid winter days
- Can become greasy if over applied
- Can be stored outdoors
- Can be cautiously blended with salt brine

Photo: Forlin Consulting

Blending Mag Chloride into salt brine is possible. Talk to the manufacture for recommendations to reduce risk of settling in the tank or bad chemical reaction often only a small amount of mag is put into a brine mix.

Calcium Chloride $CaCl_2$

- Works at colder temps than road salt
- Attracts moisture
  - Good for cold and dry days
  - Not good for warm and humid days
- Can become greasy if over applied or if weather changes to warm and humid
- Can be blended with salt brine
- Can be stored outdoors
- Eutectic of -60°

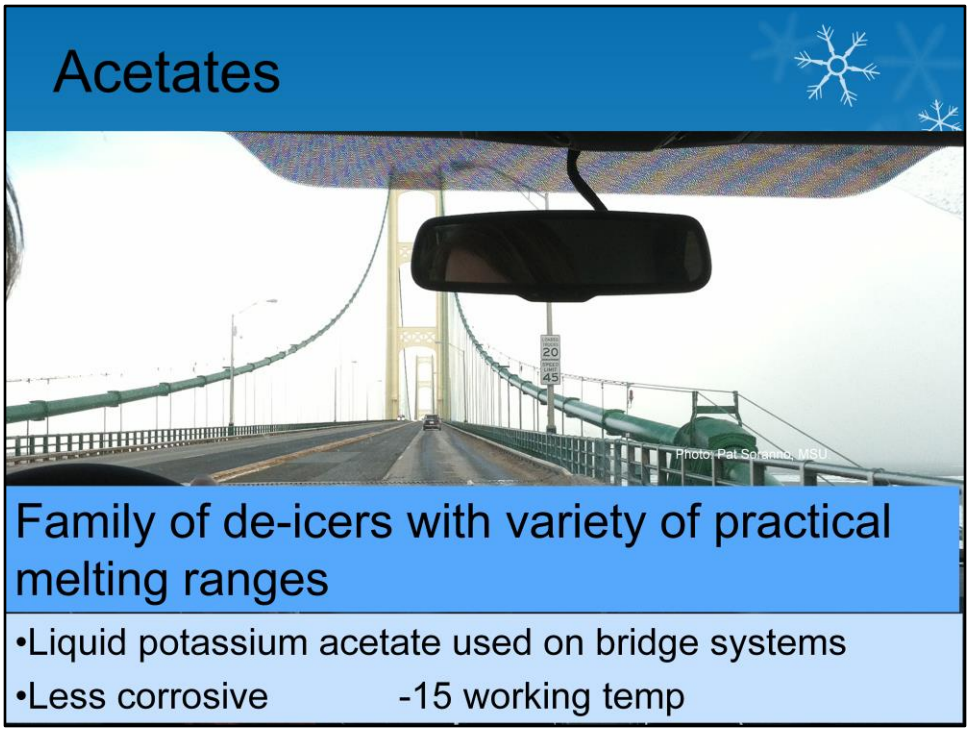
Photo: Michigan DOT

Calcium chloride is often blended into salt brine. However it is wise to talk to the manufacturer for advice on how to best use the product to avoid a bad chemical reaction or settling out of ingredients in the tank.

Treated Rock Salt

- Mag or Calcium applied at 4-6 gallons/ton
- Effective at lower application rates than straight salt
- Effective to colder temps than straight salt
- Goes to work faster than straight salt
- Can leach from pile - store carefully!

Treated salts are a great way to start using liquids. No new equipment is required, just load the truck, turn down the application rate and apply. Crews get to experience faster melting properties liquids provide without having to learn how to manage new equipment.
Proper storage is essential with liquid treated stockpiles as they are more likely to leach than dry stockpiles.



Acetates offer promise as the acetate portion is biodegradable. It still does create BOD problems. Depending on the type of acetate it has very different toxicity concerns. Refer the clearroads research on the toxicity of deicers. www.clearroads.org
Acetates are significantly more expensive to purchase than chlorides.

Any product used in high quantities will likely cause serious water quality problems. It is good to understand all of the components in your deicer both from a functionality standpoint and an environmental standpoint. If you are the user, you should make it a point to be an informed user.

Organic additives are helpful at reducing corrosion. How much organics are needed to reduce corrosion is a good discussion to have with your vendor. Often only a small amount is needed. Some products use other non “sugars” as a corrosion inhibitor.

There is added responsibility on your organization if you decide to manufacture products. You need to be on top of your game to ensure you have the right formula and you mix it properly. Quality assurance takes extra time but will be your key to limiting surprises in the field.

MDOT has guidance on how to select products. This may be useful to your organization

Maintenance Advisory

MA 2008-05

September 5, 2008

From Jon W. Reincke, Engineer of Operations

MDOT
Division of Operations
Maintenance
6333 Old Lansing Road
Lansing, MI 48917

For questions regarding this advisory, contact:

Dave Budd,
Maintenance Supervisor
269-337-3919
buddd@michigan.gov

jw:sb:tc

Liquid Deicing Chemical Purchase Guidance

The use of liquid chemicals for winter operations in Michigan has increased over the past few years. Using liquid chemicals for anti-icing and pre-wetting can make a winter operations program more effective and efficient. There are many de-icing chemicals available in Michigan and choosing a chemical that is effective, environmentally friendly and economical can be challenging. The following criteria have been created to assist contract agencies in selecting liquid chemicals for winter operations.

Any anti-icing/de-icing liquids used on MDOT Trunkline must meet one of the following three criteria.

1. Must be the Calcium Chloride and Agricultural Bi-Product (ABP) under contract with MDOT. Current Vendor, Great Lakes Chloride, Inc. – P.O. # 071B7200181.
   OR
2. Product is listed on Pacific Northwest Snowfighters (PNS) Approved Product List, (Categories 1 – 3) and is competitively priced with product listed in item #1.
   OR
3. Any other chloride based product that meets the requirements below and is competitively priced with product listed in item #1.

Criteria 3 products must be tested in accordance with the methods referred to in the current contract with Michigan DMB for ABP (Agricultural Bi-product). Test results from an independent laboratory shall be submitted. No products will be accepted that contain hazardous constituents in excess of the following established total concentration limits as listed in Table 1.

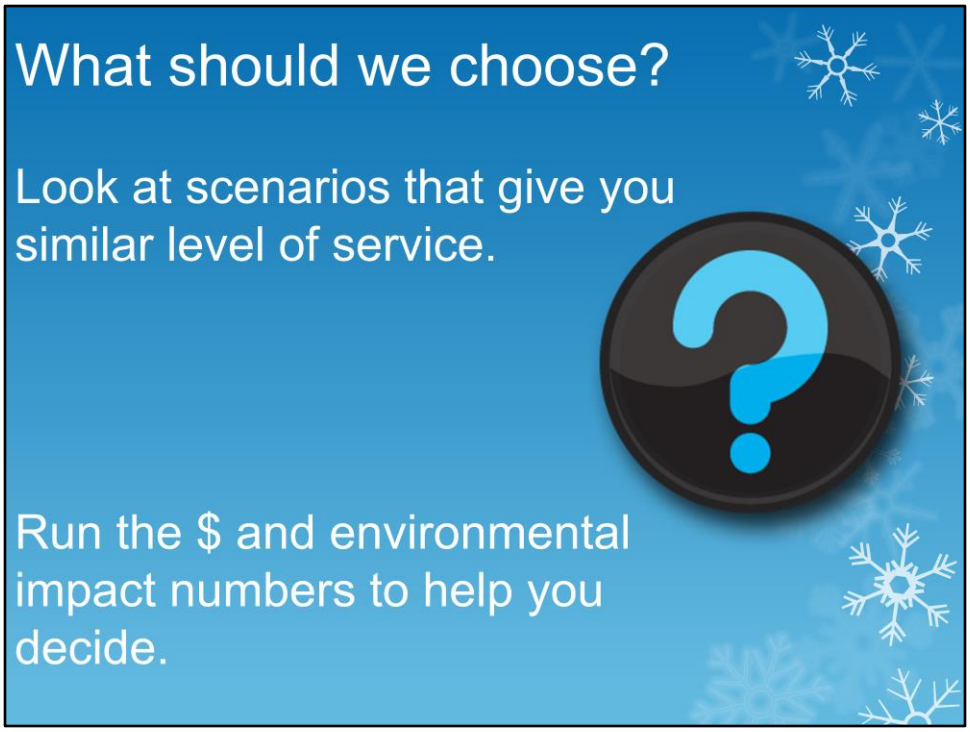
Table 1

Hazardous Constituent	*(ppm)	Hazardous Constituent	*(ppm)
Arsenic	5.00	Cyanide	0.20
Barium	10.0	Lead	1.00
Cadmium	0.20	Mercury	0.05
Chromium	0.50	Total Phosphorus	50.0
Copper	3.00	Selenium	5.00
Cyanide	0.20	Zinc	15.0

*Maximum Concentration Limit, parts per million (ppm)

Additionally, the pH of liquid chemical products shall be within the range of 6 to 9.

The product shall not contain greater than 1.0% (V/V) Total Settleable Solids and shall have ninety-nine percent (99.0%) of the Solids Passing through a Number 10 sieve after being stored at 0° F +/- 2° F for 168 hours. The product shall have a minimum storage life of one year, without degradation or addition of stabilizers or inhibitors. The product must not freeze at the lowest anticipated service temperature for the Region (i.e. to the Standard Specifications for Construction, subsection 906.07).

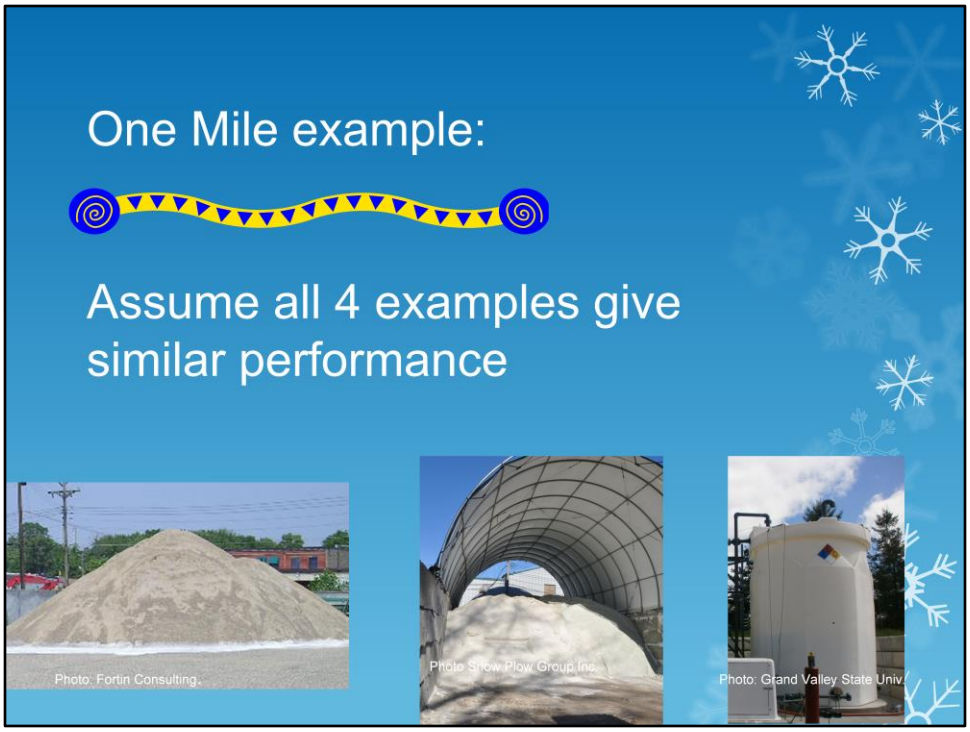


How do we choose the chemicals we apply? How do we choose the application rates? You probably already know a few different materials and different application rates that give you similar results. Compare their cost and environmental impacts and see if this influences your selection.

1 pound of salt
Pollutes 320 gallons of water

1 gallon of brine = 2.34 lbs of salt
Pollutes 728 gallons of water

1 gallon of brine goes much further than 2.34 pounds of salt



Calculations for the next few slides:
These are based on the federal chronic chloride standard of 230 mg/l

1 pound of salt pollutes 320 gallons of water

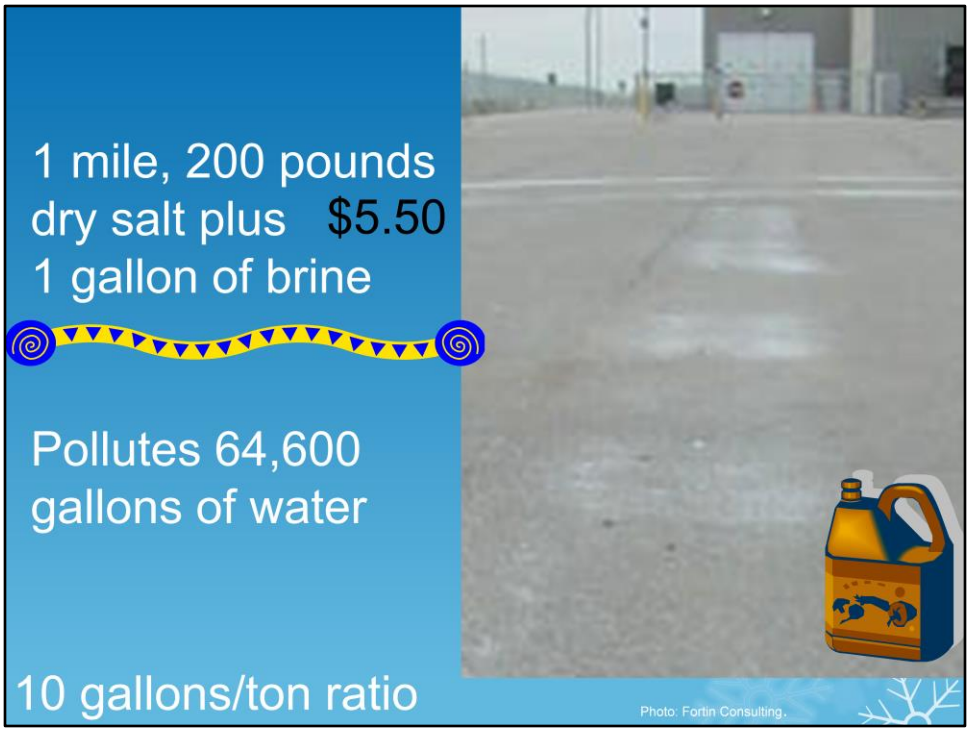
1 gallon of brine = 2.34 lbs of salt
1 gallon of brine pollutes 728 gallons of water

Minnesota Erosion Control Association did a study of the Lake superior drainage basin in MN. Surveying city, county and state roads in the basin. The 2009 recovery of winter sand was about 25%.

1000 pounds per mile with a 70% sand to 30% salt mix is one of many salt sand mix ratios and rates in use.

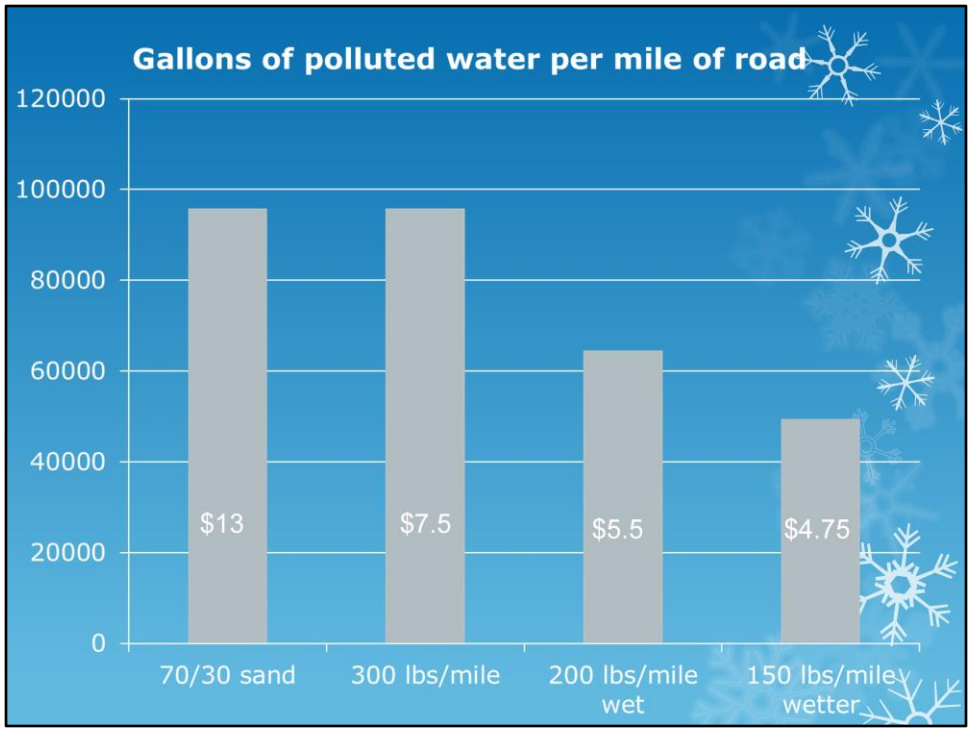
Costs assumes $16 ton for sand, $50 ton for salt

Spread pattern shown is 300 lbs per mile

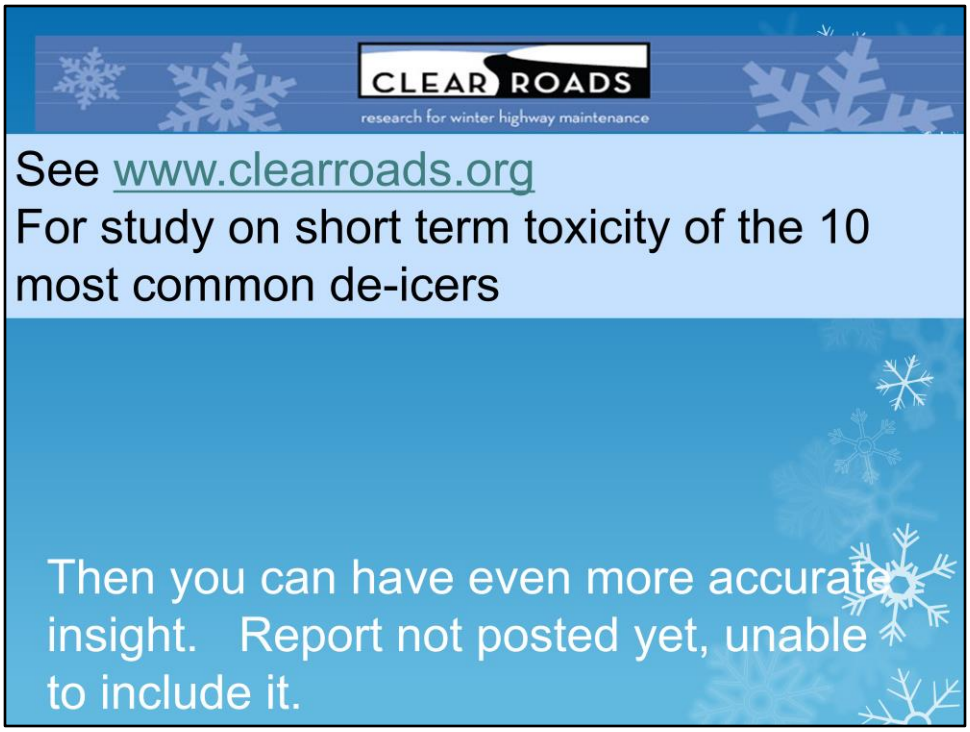


Assume 50 dollars for a ton of salt and 50 cent per gallon brine
Spread pattern shown is 200 pounds per mile.

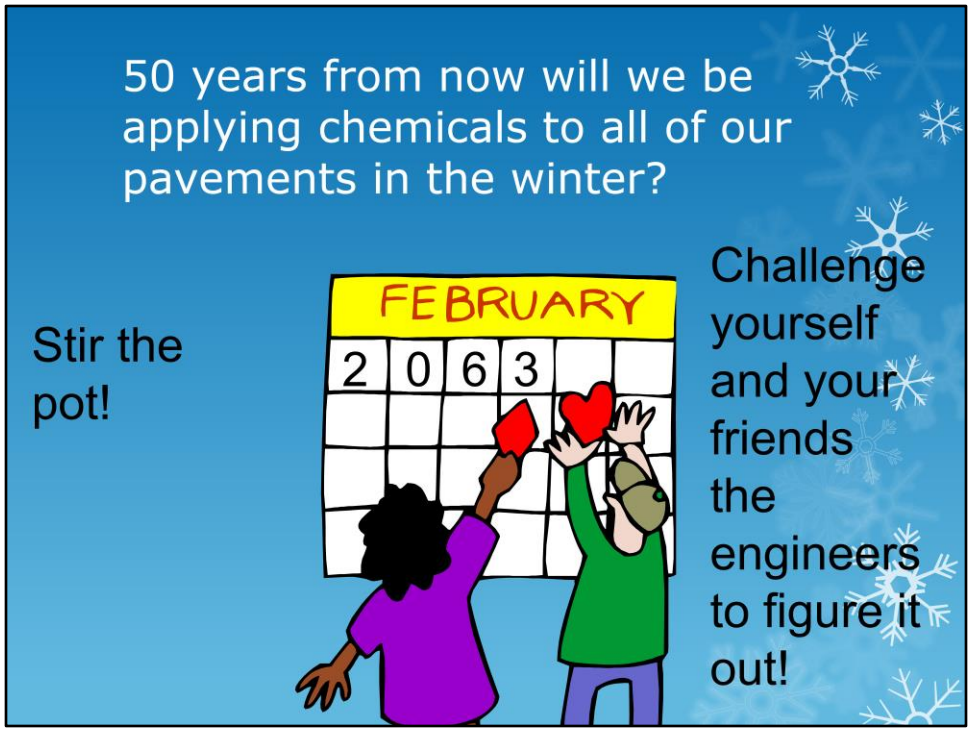
Assume 50 dollars per ton of salt and 50 cent per gallon brine
Spread pattern shown is 200 lbs/mile. Didn't have a spread pattern photo of 150 pounds per mile. If we get one we should replace this photo.



Polluted to the federal chloride standard of 230 mg/l

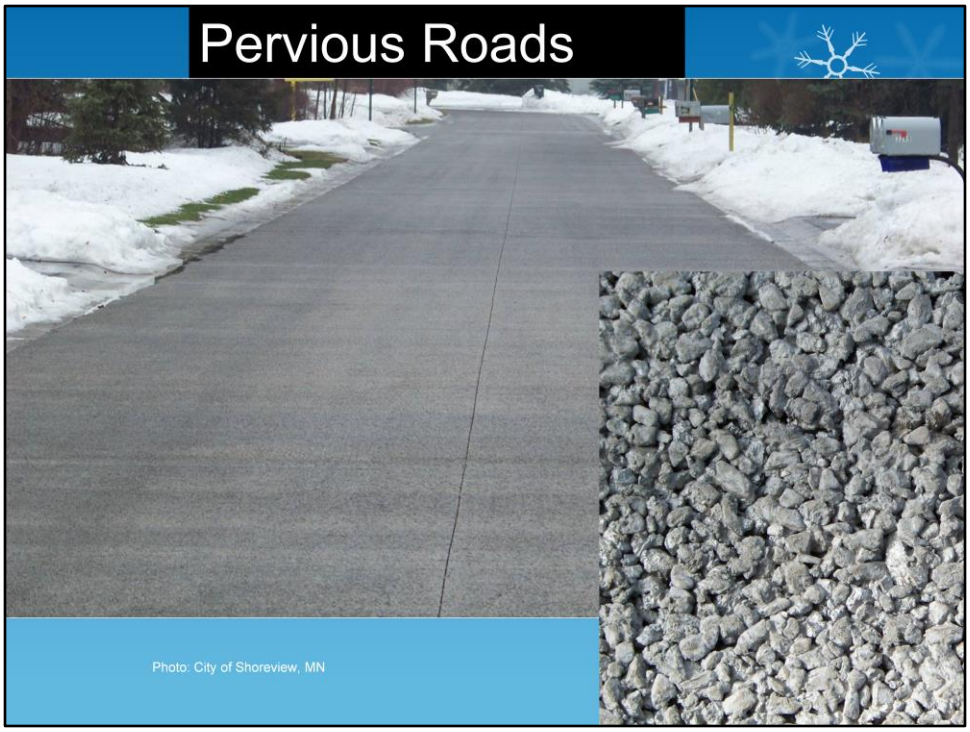


A new study is underway by the clearroads research group on the toxicity of deicers. The study is not yet completed but when it is completed it can be found on the clearroads website. www.clearroads.org. Look under research section.

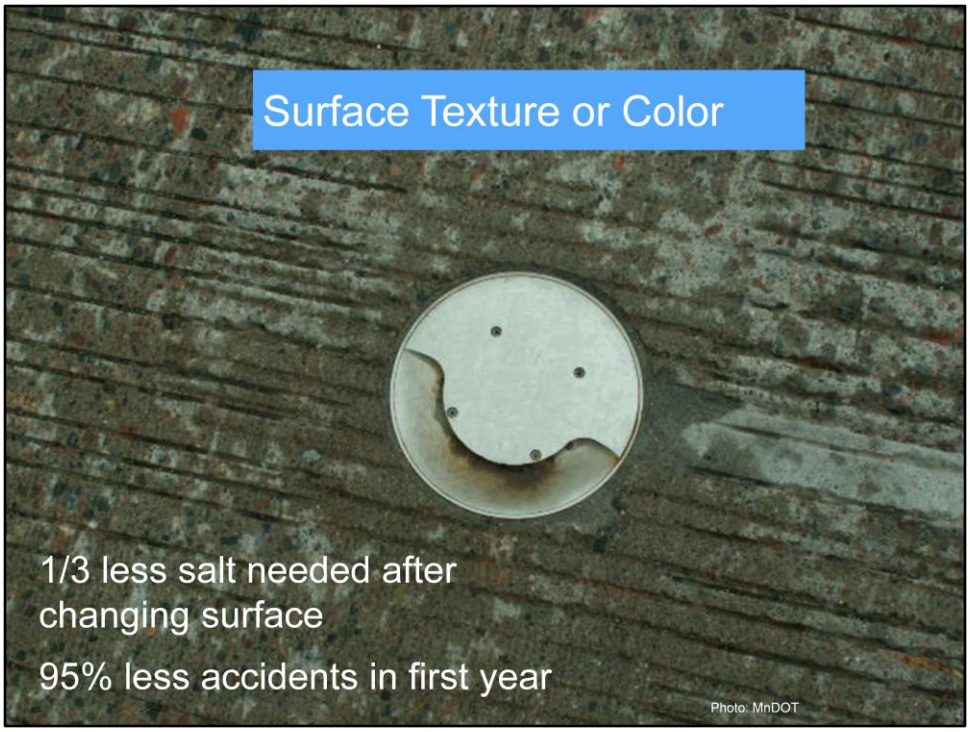


I do not believe our waters will survive 50 more years of salting. We can reduce our impact with the BMPs talked about in this training but ultimately we need to come up with a non-chemical solution (possibly a non-harmful chemical solution if there is such a thing?) to winter road maintenance. Salt accumulates so even if we reduce the use of it, it is still accumulating. What other directions can we explore?

No salt required on heated pavements

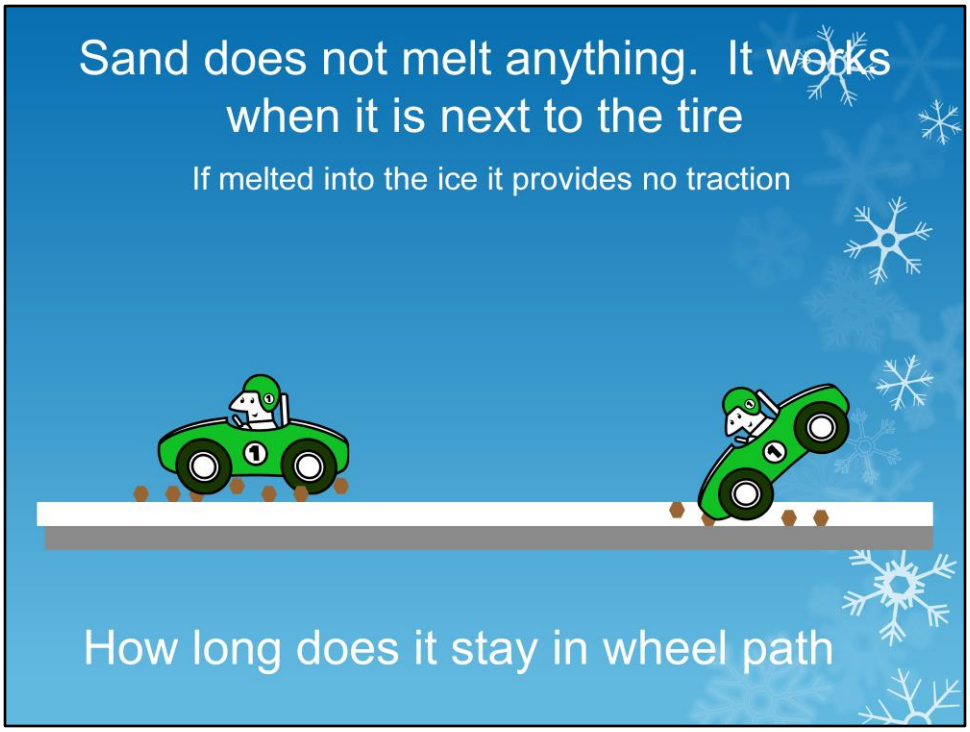


No salt required on permeable surfaces



Less salt possible if we have higher traction surfaces or colored surfaces that favor melting.

Keep your sand pile covered! We have already covered that but this is a good time to review that. Organization seem much more likely to cover their salt than their sand. Both need to be covered.



Sand must be on the surface of snow or ice to aid in traction. Once it is on the bare road surface it should be swept up. One a bare road surface, it can only lead to loss of traction.

Often we find that people are using enough salt in their salt/sand mixes to skip the sand altogether and just spread the salt.

You can try it for yourself by looking at the application rate table for dry salt and compare that to the amount of salt you apply per mile in your salt sand mix.

We only need to add a small amount of salt to keep sand from freezing. Challenge yourself to lower the salt mix in your sand pile.