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Snow and Ice Control

Understanding The Basics

VTrans

Vermont Agency of Transportation

Goals

- Know the available technology tools to help you succeed as a Snow Fighter
- Understand winter storms and weather conditions
- Understand how and when materials are applied
- Understand VTrans approach to snow and ice control
- Be familiar with the materials available, how they are generally used and how the costs compare
- Be aware of the environmental impacts of chlorides and how to minimize them

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Snow and Ice Control Plan

Handout

- Purpose and Need
- Level of Service – General Information
- Corridor Priorities
- Program efficiency
- Materials and Application Procedures
- Equipment
- Operations
- State and Federal Regulatory Oversight
- Best Management Practices, Tracking and Reporting

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R. W. I. S.

Road Weather Information System

Providing extensive weather information including:

- Air Temp
- Pavement Temperature / Condition
- Freeze Point of the Brine Solution or Level of Grip
- Wind Speed and Direction
- Relative Humidity
- Precipitation Type
- Visibility

R. W. I. S. LOCATIONS

Interstate Locations

I - 89	I – 91
Georgia	Derby
Milton	Sheffield
Williston	St. Johnsbury
Bolton	Newbury
Berlin	Thetford
Brookfield	Hartford
Bethel	Weathersfield
	Westminster
	Guilford

US and VT Routes

US 2 - Cabot

US 4 - Fair Haven

US 4 - Mendon

US 7 – Brandon

VT 279 - Bennington

VT 9 - Woodford

VT 78 - Alburgh

VT 103 - Mount Holly

VT 105 - Jay

VT 11/30 - Winhall

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RWIS plus Variable Message Sign
(Alburgh)

VAISALA / Navigator Vermont All

Map | Station Summary | Station Wall | Stations | Forecast | Alerts | Reports | Mobile

VTRANS - Rt 78 Alburg (Station not available on map)

Station Overview | Graph | Camera History | History Table

Current conditions 09.09.2015 12:47 PM

Level of grip **0.77**

Surface State **wet**

Surface Temp **100.4 °F**

Wind 09.09.2015 12:47 PM

N, NE, E, SE, S, SW, W, NW

Roadside camera 09.09.2015 12:48 PM

Traffic counting

	Timestamp	Average/5min Vehicle Speed (mph)	Average/5min Occupancy of road (%)	Traffic Volume
Rt 78 West Bound - Traffic	09.09.2015 12:40 PM	64.2	1	12
Rt 78 East Bound - Traffic	09.09.2015 12:40 PM	50.2	2	12

INFRARED THERMOMETERS

RoadWatch Infrared Thermometers

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INFRARED THERMOMETERS

- In-Vehicle device to measure surface temperature while driving at normal highway speeds
- Approximately 65 in use on Truck and Pickups
- Measures ONLY what it can see (Ice, Snow, Pavement)
- Check Accuracy with a pan of ice – Should read 32 Degrees
- Avoid placing too close to heat sources or blocking the view of the lens

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VERMONT WEATHER

- EACH WINTER STORM IS DIFFERENT….
- Scientists estimate that there are 66,000 different storm possibilities.
- Knowing the weather prior to, during and after a winter storm helps determine the best action and material to use

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APPLICATION OF MATERIALS AND PLOWING

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WHAT IS THE GOAL?

Our Goal is to provide
SAFE ROADS
at
SAFE SPEEDS

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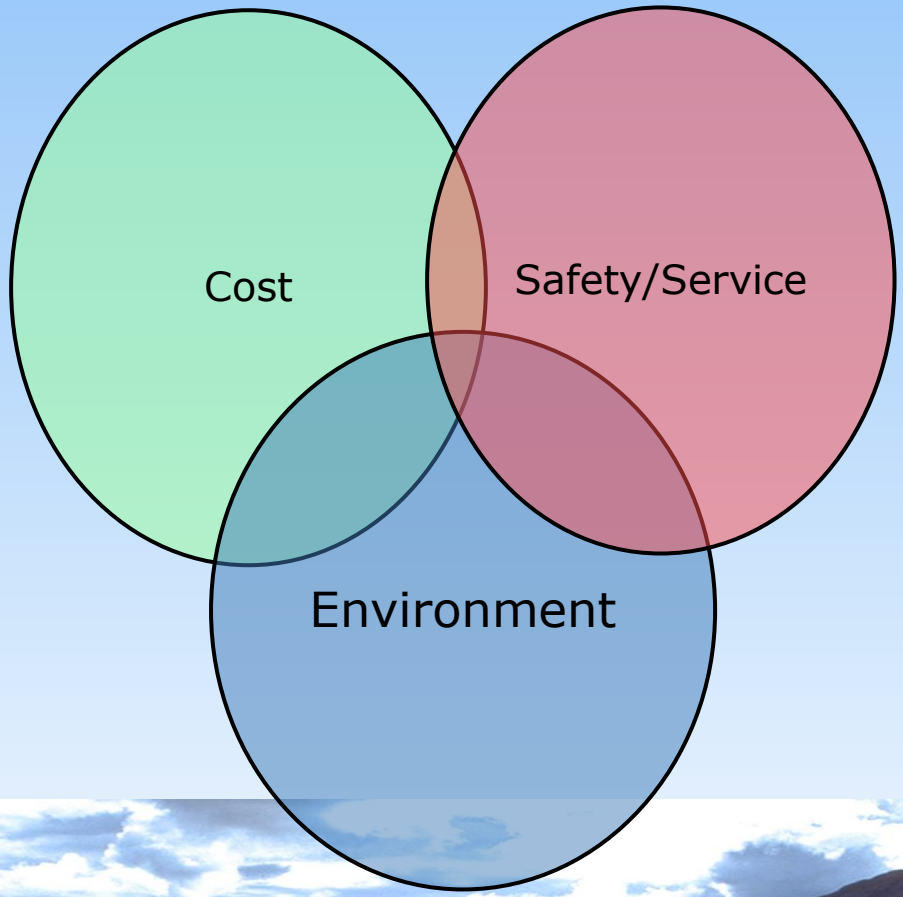
Its about Balance ….



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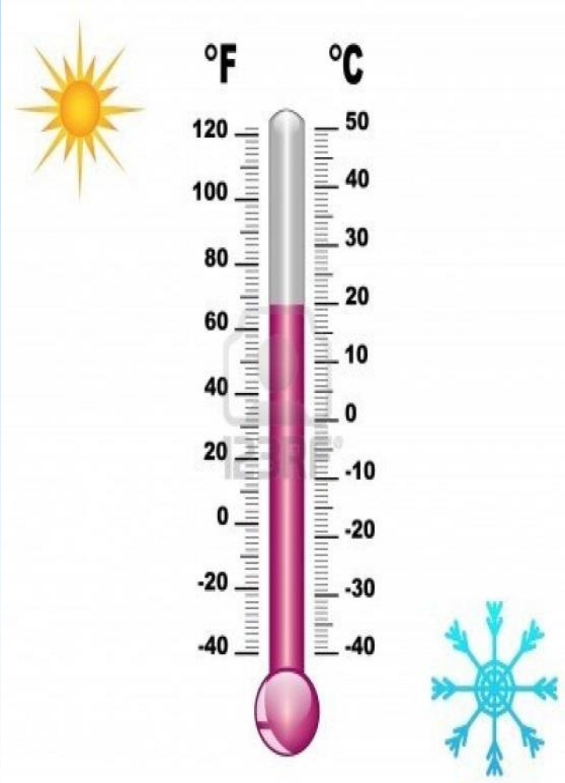
IMPORTANT …….

It is **PAVEMENT** Temperature that matters



NOT
AIR Temperature

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Maximum / Minimum Pavement Temperatures

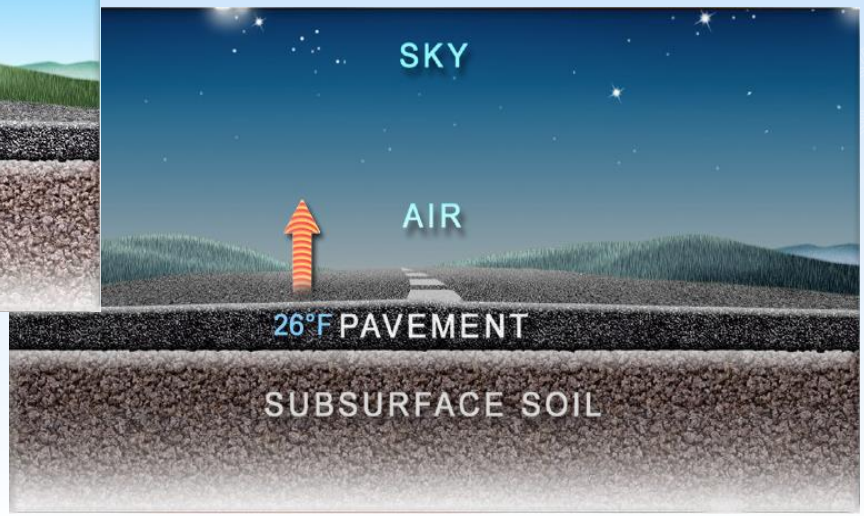
Question:

At what time of the day is the pavement typically at its Highest? Lowest?

Answer:

Highest: **Early Afternoon**.

Lowest: **Near Sunrise**.



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De-Icing vs. Anti-Icing

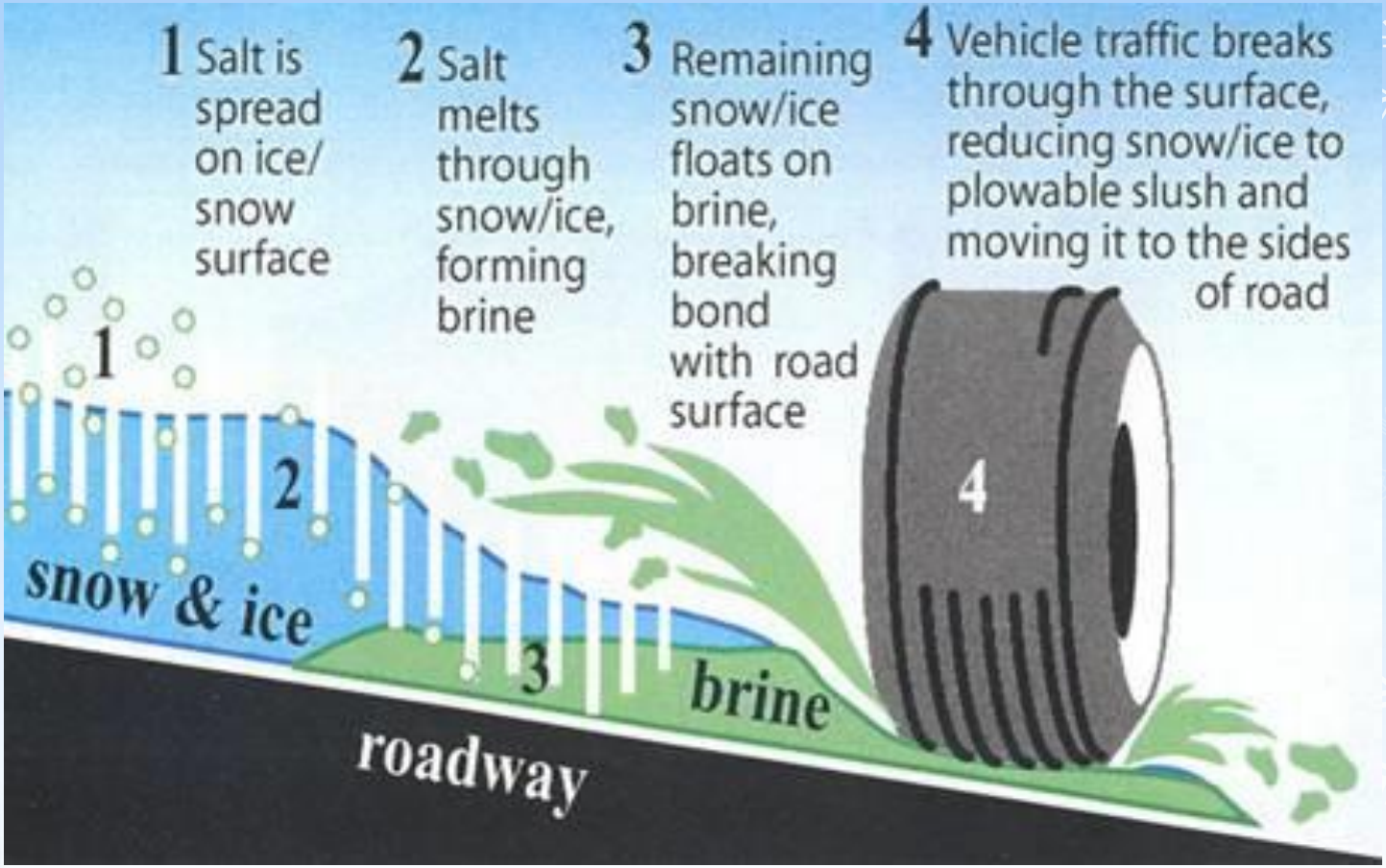
De-Icing

- High sand usage
- High material costs
- Snow "pack"
- High operational costs

Anti-Icing

- Strategic use of salt
- Leverages technology
- Bare pavement quicker after storms (Higher LOS)

Snow and Ice Control
De-Icing



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Factors in Deciding Snow and Ice Treatment

- **Present Pavement Temperature**
  - What is the trend of the pavement temp?
- **Current Road Condition**
  - Is snow/ice bonded to the highway surface?
- **Current Weather**
  - What is the trend of the weather?
- **Traffic Volume and Timing**
- **Resources Available**

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ANTI-ICING

The ice control practice of preventing the formation or development of bonded snow and ice by timely applications of Brine and other types of Anti-Icing Chemicals.

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Components for an Effective Anti-icing Program

- Must be applied to a bare and dry surface.
- Maintain a working brine layer.
- Use only what you need for materials.
- Collect accurate information to know what needs to be done and to track what was done.

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Anti-Icing Spray pattern and Coverage

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Communication

***Communication with your Supervisor is critical! ***

- Supervisor must communicate your route conditions.
- Suggest how you should approached it.
- You should communicate how successful that approach was.
- Continued communication throughout storm is essential. Conditions Change! Applications and strategies may change!
- When the storm ends your supervisor will update you on your clean up strategy.

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MATERIALS TO DO THE JOB

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Salt Brine

A solution of raw salt and water mixed in a brine maker, tested with a hydrometer to a **23.3%** solution of salt and water, which results into **2.5** pounds of salt per gallon of water.

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Salt Brine Properties

- Freeze Point: **-6 degrees F**
- Weight: **Approximately 10 Pounds / Gallon**
- Cost: Approximately **$.10 - $.15** (depending on blend percentage) per gallon Compared to Ice B' Gone at $1.24 per gallon

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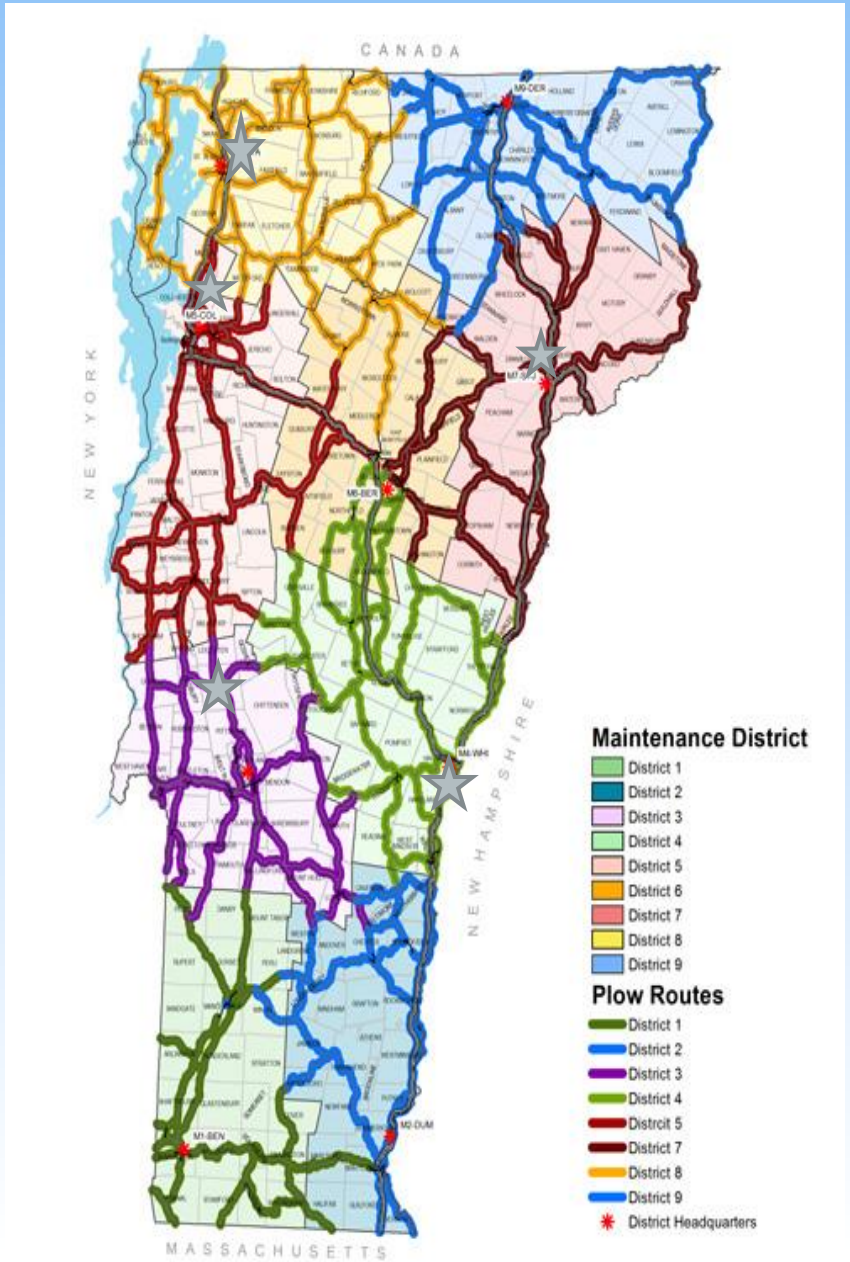
There are Currently 6 Brine Makers with in the State. More to be added with in the coming years.



1 - St. Albans

2 – Milton

3 – Brandon

4 – Windsor

5 – St. Johnsbury

6 – East Dorset

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Salt Brine Additives

VTrans blend Ice-B-Gone with Salt Brine from a ratio of 5 : 95 to 30 : 70 (IBG : SB)

These blends have proven to work well, at reasonable cost, and may also help reduce the corrosive effects of the chlorides.

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Salt Brine Applications

- **Pre-Treating**: Applied to roadway using Brine distribution equipment prior to the start of the storm.
  - **At rates of 50 gallons per lane mile**

- **Pre-Wetting**: Used in saddle tanks to pre-wet sold materials at the spinner.

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Pre-Treating

Q: Why do we Pre-Treat?

A: To help prevent the bond of snow and ice to the pavement.

- ✓ Gives upward of two hours lead time to respond.
- ✓ More liquid material stays on the pavement than dry material would.

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Pre-Treating Advantages

- **Consistent Application –** Salt is distributed evenly across the lanes
- **Efficient application –** **Very little material lost due to application process, so there is less waste.**
- **Treats Anticipated Frost Conditions**

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Pre-Treating ……

- **When do we pre-treat?**
  - ✓ **Roughly 6 hours before a storm.**
    - ❑ **Allow time for the material to dry**
    - ❑ **High traffic volumes can remove a significant amount of material if applied too soon.**

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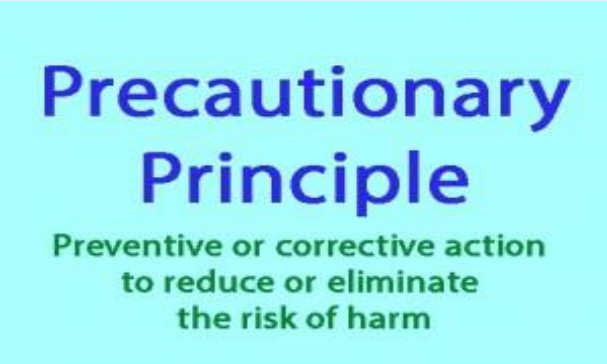
CAUTION CAUTION

Pre-Treating Precautions

- Should **NOT** be applied at temperatures **lower than 20** degrees Fahrenheit**.**
- Can **NOT** be used on **HARD PACK** (*can become slippery*) – **Generally Hard Pack is treated during De-Icing.**
- Do **NOT** spray in **oncoming or adjacent lanes** when traffic is present.



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HOW DO WE PRE-TREAT?

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Pre-Wetting

Definition: Applying liquid deicer to solid material at the spinner.

Q: Why do we Pre-Wet?

A: For all of the following reasons:

- ✓ Keep solid material on the pavement.
- ✓ Get the salt acting quicker. (The BRINE does the work)
- ✓ Melt snow and ice at lower working temperatures
- ✓ Melt more ice with less salt.

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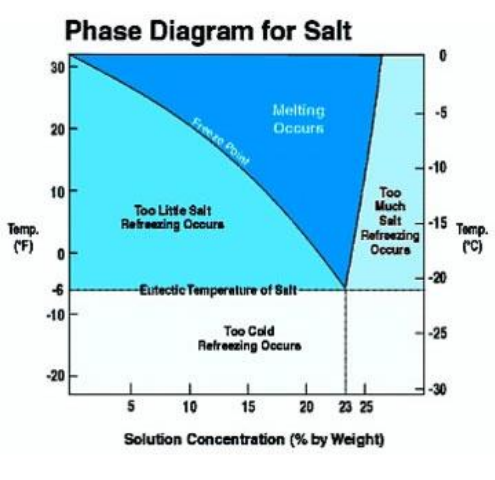
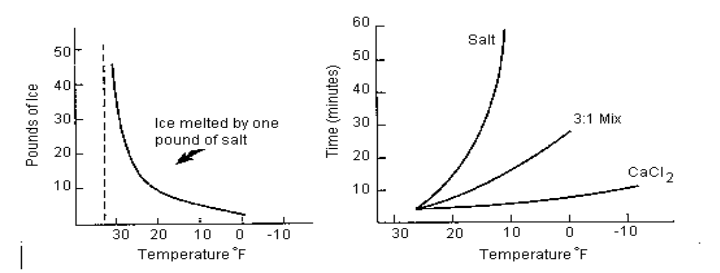
Pre-Wetting Salt with Salt Brine (NaC1)

- Salt needs moisture to work.
- Salt needs heat
- Needs help at certain temperatures

- Salt Brine Provides Moisture!
- Salt Brine is used when Temperature conditions meet requirements.
- Ice B Gone Salt Brine Blends "Jump Start" Salt in order to work FASTER





The graph on the left shows that salt melts more ice per pound at higher temperatures. The graph at right shows the comparative time for different compounds to melt 1/8" of glare ice.

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The Right Material…….

Salt (NaC1)

Melts Snow & ice and prevents bonding

(15 degrees +/- & up)

Sand

Provides Traction

(All Temps)

SALT BRINE

Consistent, early corridor treatment

(15 degrees +/- & up)

Ice-B-Gone

Lower working Temperatures

(-25 / +5 degrees and up)

…. For the Right Job!!!

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How Much salt is Working???

	Dry Application (No Pre-wet)	Pre-wet Application
Initial Application	500 lbs/lm	500 lbs/lm
Retained	46% = 230lbs	78% = 390lbs
5 cars @ 38mph	30% = 69lbs	93 % = 363lbs
Total remaining after 100 cars @ 38mph	15% = **10.5 lbs**	80% = **290 lbs**

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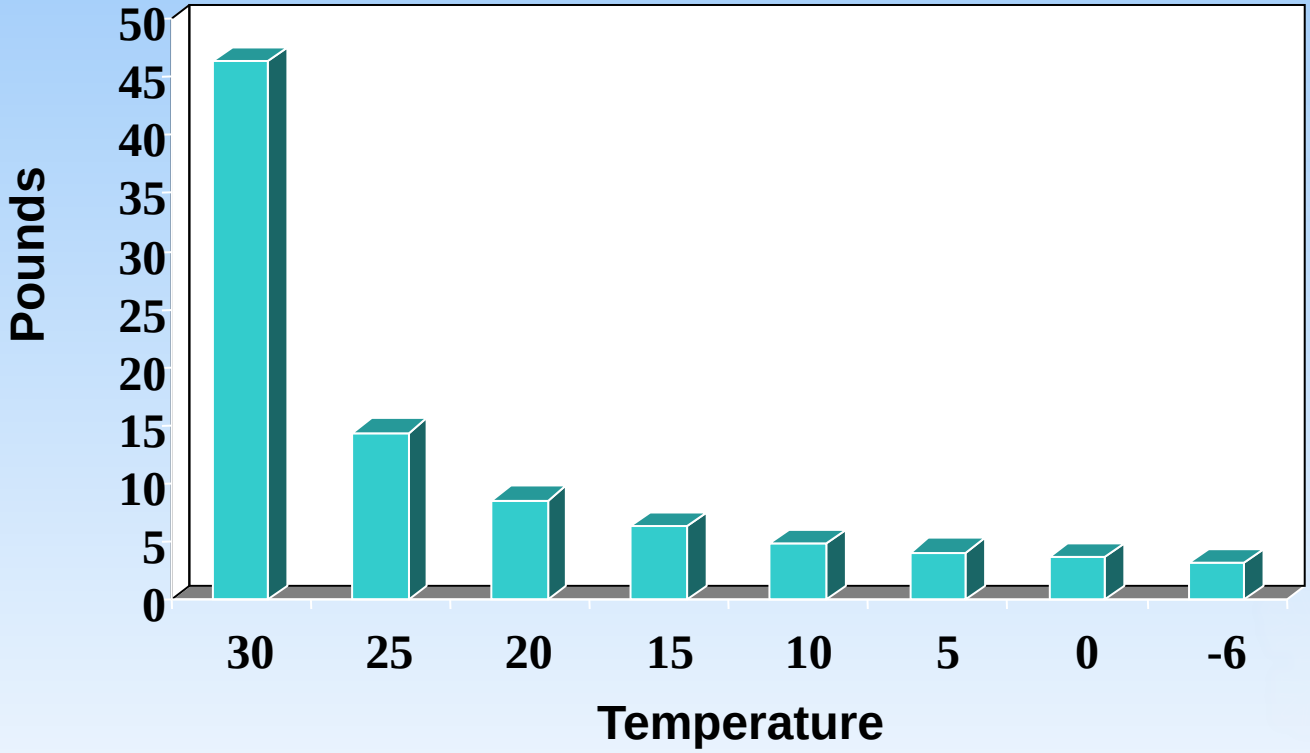
Pounds of Ice Melted per Pound of Salt



It takes over **5 times** more salt at 20 degrees than it does at 30 degrees to melt the same amount of ice!!!

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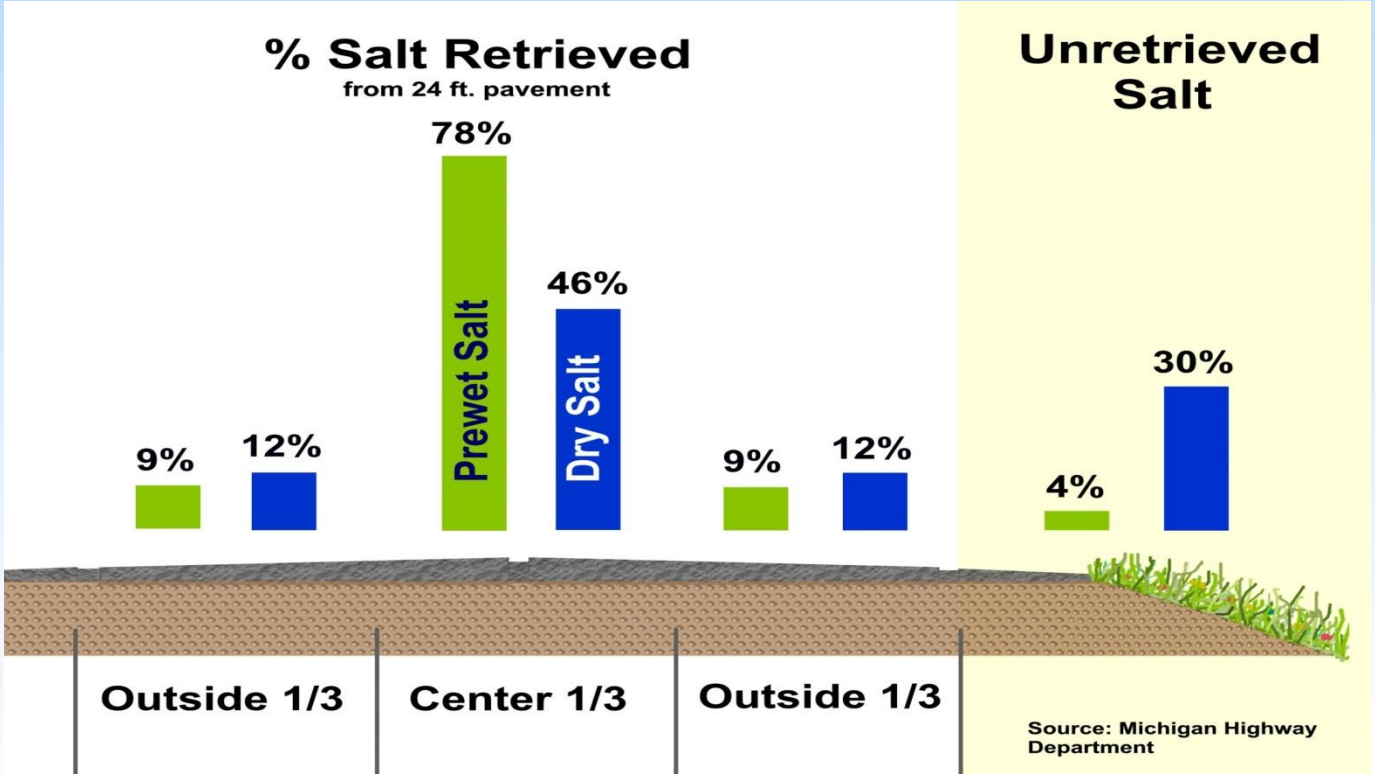
Bounce and Scatter ……

- Bounce and Scatter at Different Application Speeds
- Bounce and Scatter of Treated Salt vs. UnTreated Salt



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Bounce and Scatter …. Discoveries

- Speed is the biggest factor effecting Salt Bounce and Scatter (25 mph speeds retain the most salt in target zone by far)
  - Just because your truck can put salt out at 50 mph does not mean your should!!!!!
  - Salting at a slower speed keeps more salt on the roadway!!!!
- Treated Salt scatters less then untreated Salt.

❖ A balance between speed and application rate must be used to avoid this!!!!

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VTrans Salt Application
QUICK REFERNCE CHART

Communication with your Supervisor is the FIRST method of Salt Application. When communication is unavailable please refer to this Quick Reference Chart

VTrans Salt Application Quick-Reference Chart			
(**Double these rates for centerline applications**)			
Pavement Temp. Range	Application Rate (#/LM)	Pre-wet Material	Comments
Above 32°	0 to 100	Salt Brine or Blend	A little salt goes a long way when temperatures are near freezing
25° to 32°	100 to 200	Salt Brine or Blend	Salt is very effective here. Pre-wetting with a blend will allow lower application rates.
20° to 25°	200 to 300	Salt Brine, Ice-B-Gone, or Blend	Salt effectiveness is dropping off in this range. A Blend or straight IBG will help.
15° to 20°	300 to 400	Ice-B-Gone or Blend	Pre-wetting is especially important. Your liquids will provide the extra boost needed.
15° or Below	Snow is usually dry and blowing in this range. If no ice or pack exists, plow only. DO NOT APPLY		If necessary, Spot treat icy patches with abrasives. If glazing occurs on high-volume, high-speed, P1 corridors, sand will not last and higher salt applications, with Ice-B-Gone pre-wetting, will be necessary.
General Notes:			
(1) Application rates should be on the lower end when temperatures are on the higher side of the range or remaining steady. Falling temperatures, and temperatures on the lower side of the range, will require applications on the higher side, and possibly in the next range if dropping rapidly.			
(2) High-volume, Priority 1 corridors will often require an additional 50#/LM			
(3) In any of the ranges, if the snow is dry and blowing off of the roadway, avoid application.			
(4) Pre-wetting under wet storm conditions is not required. In cases where the only pre-wetting liquid available is a high-performance chemical (i.e. Ice-B-Gone), it is better to save those products for the drier and colder conditions.			

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Sand…. Still in our tool Box

Sand is used When:

- Pure salt will not work fast enough (i.e. accident scenes or other situations that require immediate traction)
- Pavement temperatures are too low.
- Steep hills or curves require additional traction
- Problem areas on lower-speed roads are wet heading into dropping temperatures at night.

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Disadvantages of Winter Sand

- Build up and drainage problems
- Siltation of waterways
- Air quality issues
- Benefit is temporary
- Little / No melting properties
- Skidding hazard on dry pavement
- High cost of storage & handling

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ALWAYS REMEMBER…

- We are only **PREVENTING THE BOND** of the ice to the pavement **NOT** burning off all of the snow and ice

- **PLOWING**, not melting, is the **PRIMARY TOOL** for removing snow and ice from travel lanes

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Safe Material Spreading Practices

- Watch Speed to be Sure Material is being place where desired
- Match speed to Pavement Surface and Traffic Condition
- Watch Revs to be Sure Hydraulics can Function Properly
- Be aware of Potential Material Spreading – Public Vehicle Conflicts
- Verify that Material is being Dispensed

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THE EFFECTS OF ROAD SALT IN THE ENVIRONMENT

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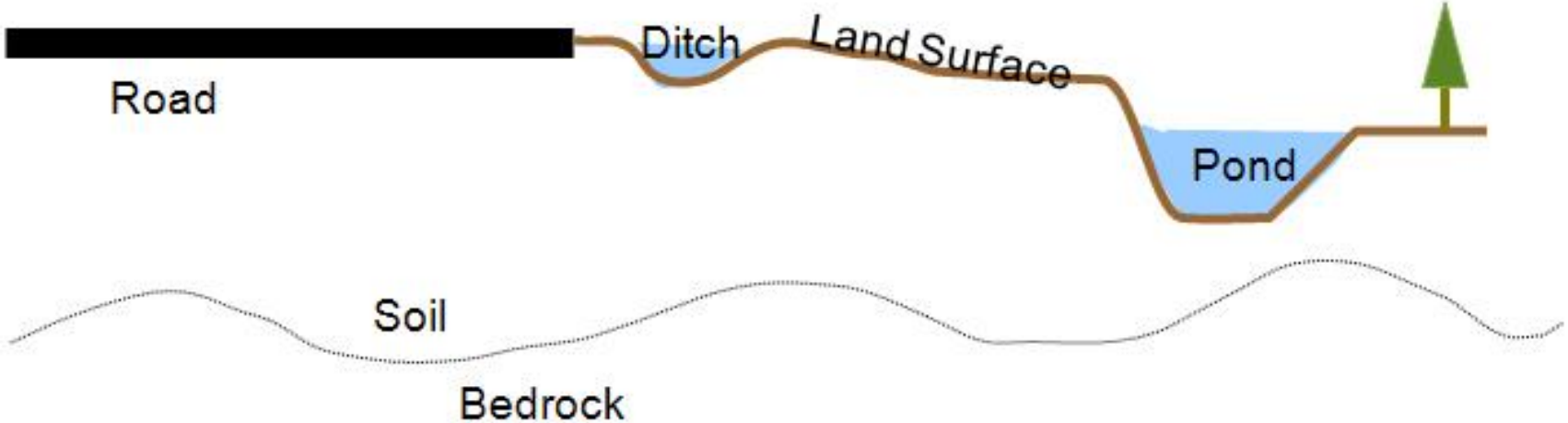
ENVIRONMENTAL RECEPTORS



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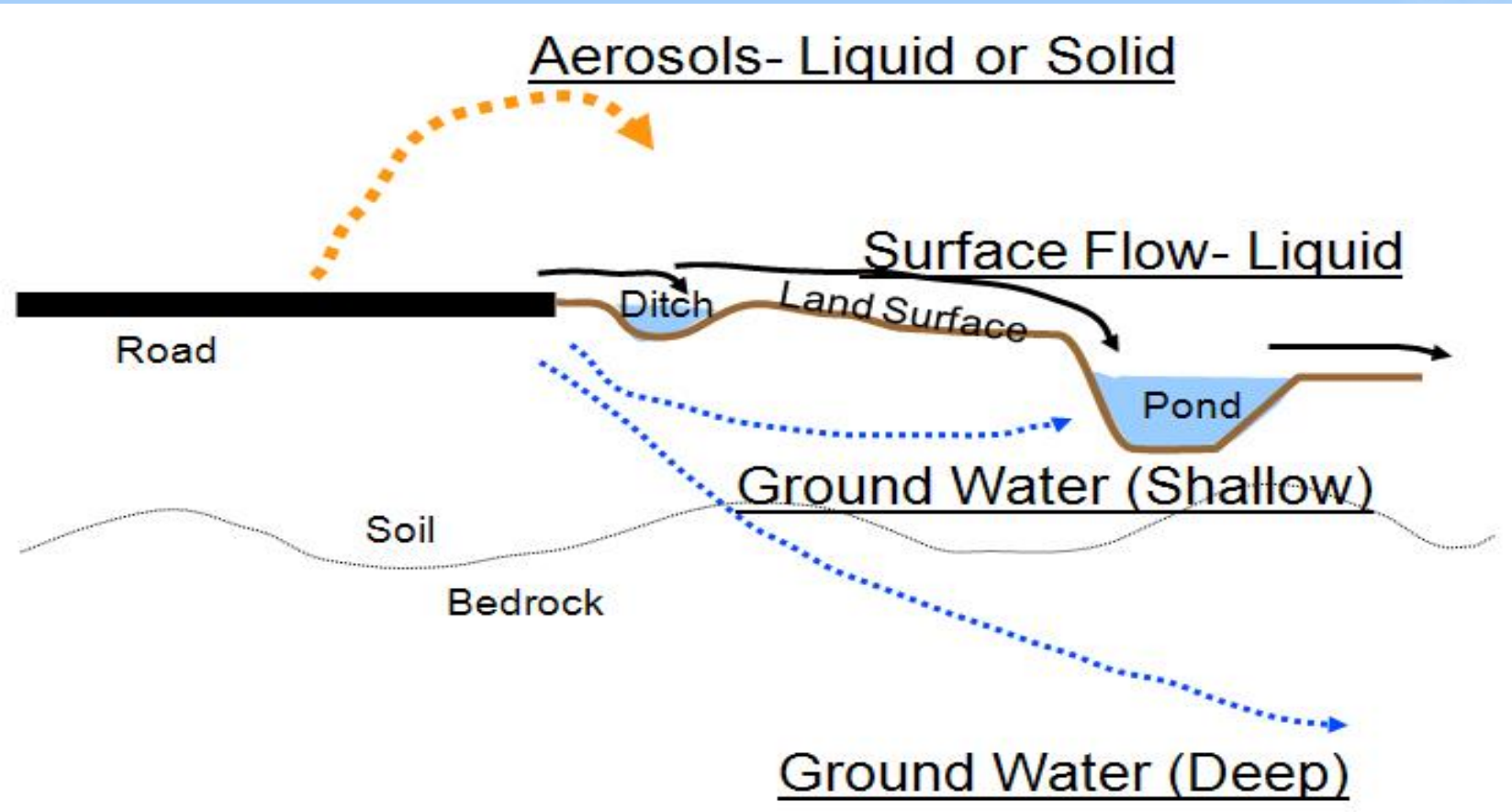
ROAD SALT – PATHWAYS TO ENVIRONMENTAL RECEPTORS



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ROAD SALT AND WATER QUALITY

- **SHORT TERM**
  - Elevated spikes of Na and Cl in surface and ground waters (seasonal)
  - Seasonal impacts to shallow water supply wells
- **LONG TERM**
  - Increased salinity of streams, ponds, vernal pools, wetlands and groundwater (1600’ wide)
  - Soil chemistry change through ion exchange (release of Ca and Mg then H (Acidification)
  - Soil “stores” salt and releases it over time
- **TRENDS**
  - Increased concentration of Na and Cl in surface waters
  - High salt in surface water limited to near roads and storage areas
  - Salt in groundwater can extend well beyond

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ROAD SALT AND Ecosystem Quality

- **SHORT TERM**
  - Increased attraction of salt-loving species (road-kill)
  - Foliar burning
  - Loss of salt sensitive species (plant and animal)
- **LONG TERM**
  - Decrease in surface water diversity (Toxic thresholds exceeded for sensitive species)
  - Dominance by salt-tolerant invasive species.
  - Vernal pool decline
- **TRENDS**
  - Decrease in surface water diversity
  - Increase in invasive species (plants)
  - Ecological footprint ~ 1600 feet wide
  - Loss of high quality ground water

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THINGS TO AVOID!!!

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SUMMARY AND CONCLUSIONS

Road Salt Affects Water Quality and Ecosystems

- ***Transient Effects- Larger Magnitude, Shorter Duration***
- ***Chronic Effects- Lower Magnitude, Longer Duration***

•Reversibility

- ***Transient Effects are mostly reversible***
- ***Chronic Effects- May be reversible on the scale of years to decades***

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SUMMARY AND CONCLUSIONS

- **Trends**
  - *Increase in Chloride in surface waters & groundwater*
  - *Cation exchange leading to nutrient depletion and acidification of water*
  - *Loss of biodiversity*
  - *Increased prevalence of invasive species*

VTrans is aware of and developing appropriate strategies to address these trends.

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QUESTIONS?????

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