



Snow and Ice Control Methods and Materials

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Salt Institute

- Why road salt is a critical tool for achieving desired levels of service
- Purpose of using road salt (it may not be what you think!)
- Overview of recommended practices for road salt use
- The low hanging fruit among recommended practices – what you can implement with little to no up-front costs
- What salt usage reduction might you see with each recommended practice you implement
- Infrastructure issues and road salt usage

Overview

After the talk, attendees should be able to:

- Identify recommended practices that they can introduce in their agency for the coming winter, with minimal cost and operational disruption
- Quantify the salt reductions they would expect to see if those recommended practices are successfully implemented
- Detail the potential challenges and pitfalls of implementing their chosen recommended practices and have ideas about how to address those challenges

When We Are Done...

- Safety
- Mobility

Why Winter Maintenance?

- Each winter, 116,000 injury crashes, 1,300 deaths in winter related accidents
- We know that effective winter maintenance program reduces:
 - Crashes by 88%
 - Injuries by 85%
 - Accident costs by 85%
- People expect a safe transportation system



The Safety Angle



- When roads in an area are closed by winter weather, commerce is hit hard
- For example, in Illinois, a one day shut down of the transportation system due to a snow storm results in a \$400 million estimated loss to the economy
- We simply cannot afford those sorts of losses

The Economic Angle

December 2008
Series of Storms
City Ground to a Halt

What About Seattle?



Why So Bad?

"If we were using salt, you'd see patches of bare road because salt is very effective," Wiggins said. "We decided not to utilize salt because it's not a healthy addition to Puget Sound."

A Saltwater Body...



- The purpose of salt in winter maintenance is to **break the bond** between snow (or ice) and pavement
- It is **NOT** to melt the snow or ice
- We get rid of the snow or ice with a plow, we make that removal easier with road salt to **break the bond**
- Typical road salt application melts a few thousandths of an inch of snow/ice...
- “Chemical plowing” is **inefficient, wasteful, hugely expensive, and poor environmental stewardship**

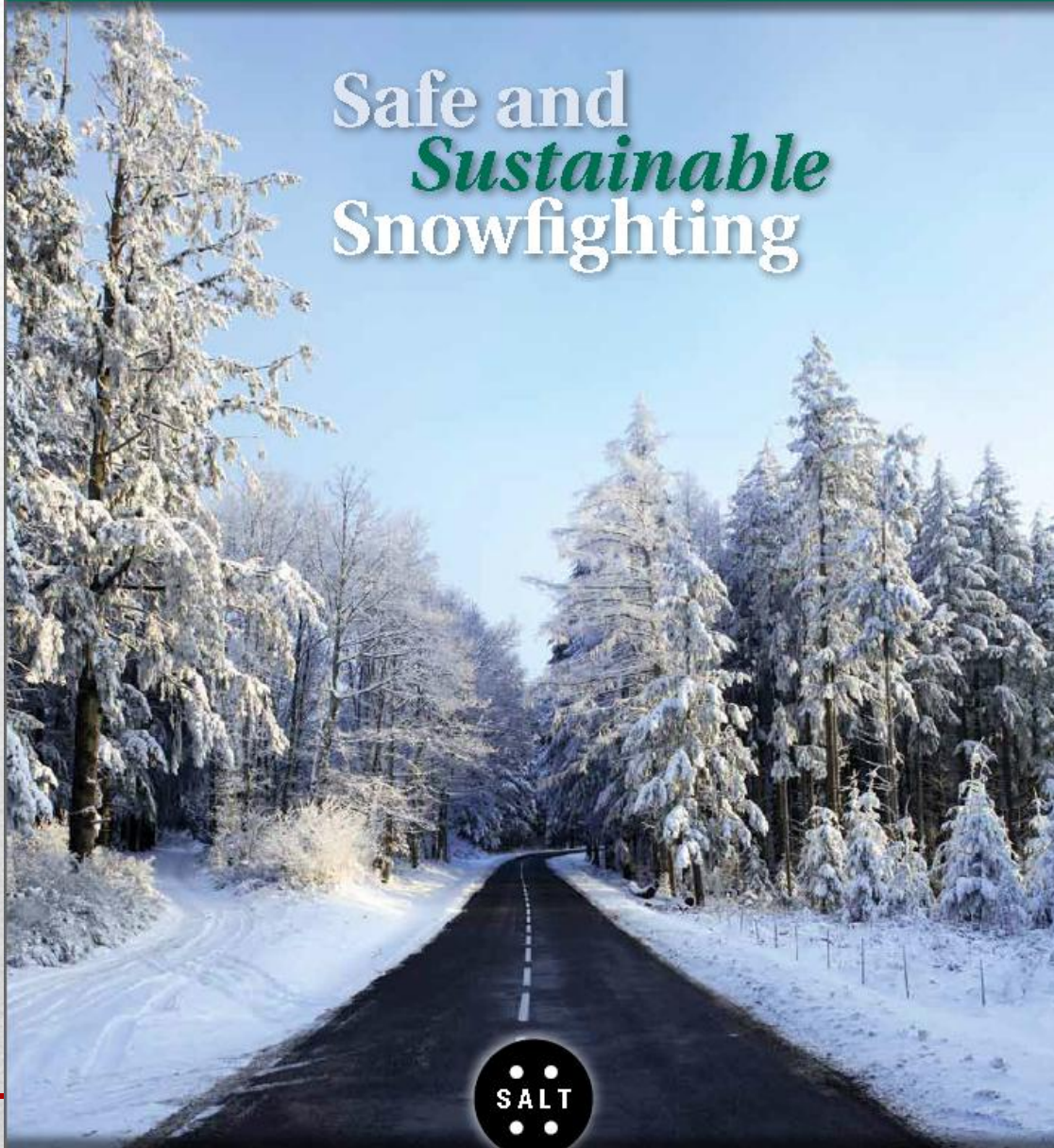
So How Does Salt Help Us?

- Want our changes **to be sustainable**, but also **be seen to be sustainable**
- Can do this by using a checklist/award program...
- Handout shows the many areas by which we can measure sustainability

Creating A Context

A W A R D A P P L I C A T I O N

Safe and *Sustainable* Snowfighting



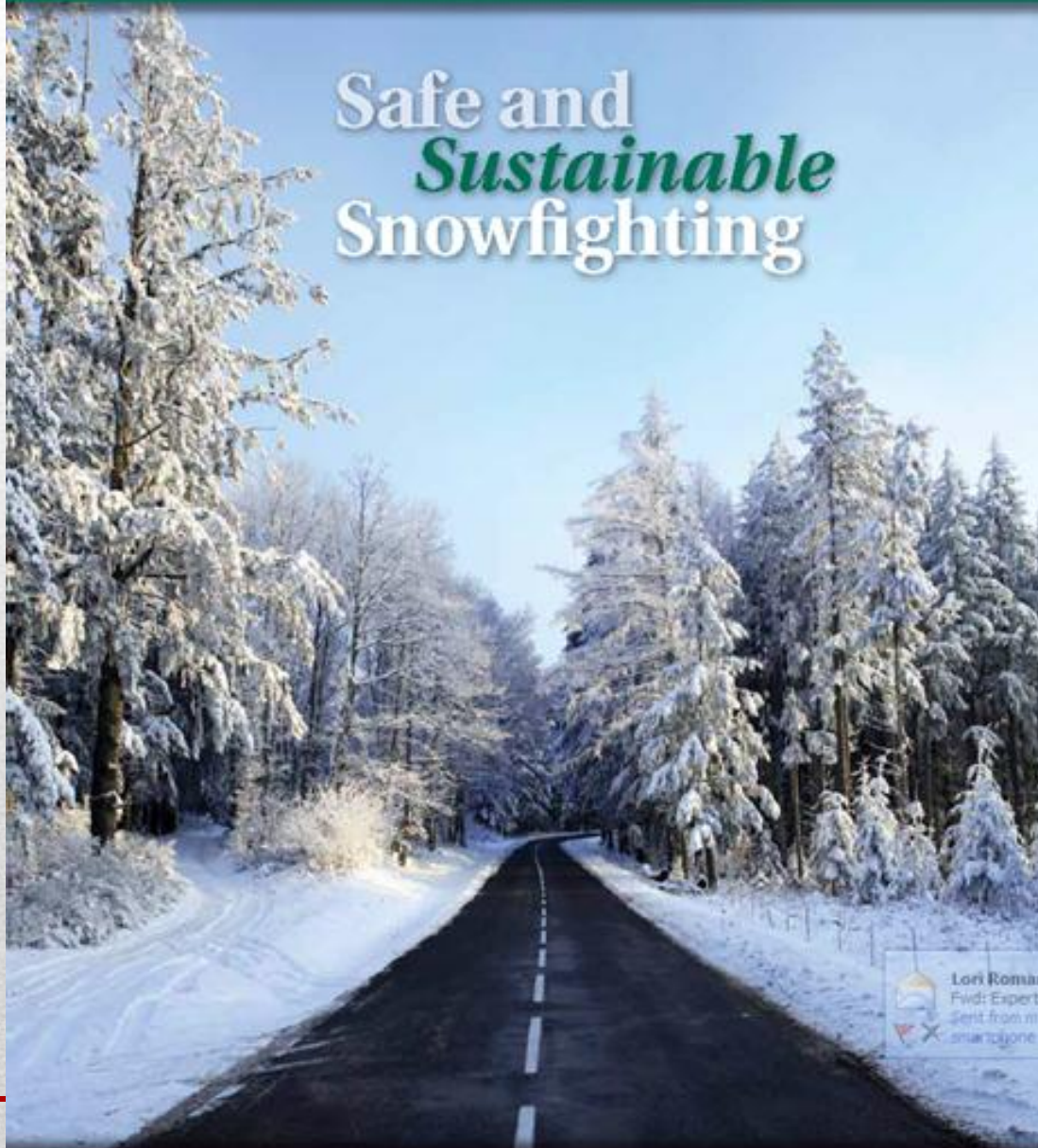
S A L T I N S T I T U T E

Levels of Safety and Service	Yes	No	Score
Are all roads within an agency's area of responsibility assigned a level of safety and service?			
Are the different levels of safety and service clearly identified?			
Can agency personnel easily determine whether and when a given stretch of road has achieved its desired level of safety and service?			
Has the community served by the agency been involved in the process of determining levels of safety and service for roads serviced by the agency?			
Does a plan exist to evaluate levels of safety and service on agency roads on a regular basis?			
Is the level of safety and service of a given road segment determined by including factors such as AADT, peak hour traffic, access for emergency services, school hours and bus routes, and other similar factors?			
Have road segments that are in particularly environmentally sensitive areas been clearly identified, and assigned a level of safety and service accordingly?			
In the last two years, has your agency been free from lawsuits resulting from personal injury or property damage as it relates to improper winter maintenance?			
Maximum Total Points for Level of Safety and Service	8		
Your Agency's Score for Level of Safety and Service			

Materials Usage	Yes	No	Score
Does the agency have a method to specify application rates as a function of pavement temperature, route cycle time, and storm type?			
Does the agency have the capability to pre-wet all solid applications? On the truck (2 points) or in the facility (1 point)?			
Does the agency have the capability to apply liquids before and during a storm?			
Does the agency limit the use of abrasives or abrasive-salt mixtures to those conditions in which straight salt usage is not appropriate?			
Does your agency utilize the deicing tool (NCHRP577) in selecting the most economical and effective deicing products.			
Maximum Total Points for Materials Usage	6		
Your Agency's Score for Materials Usage			

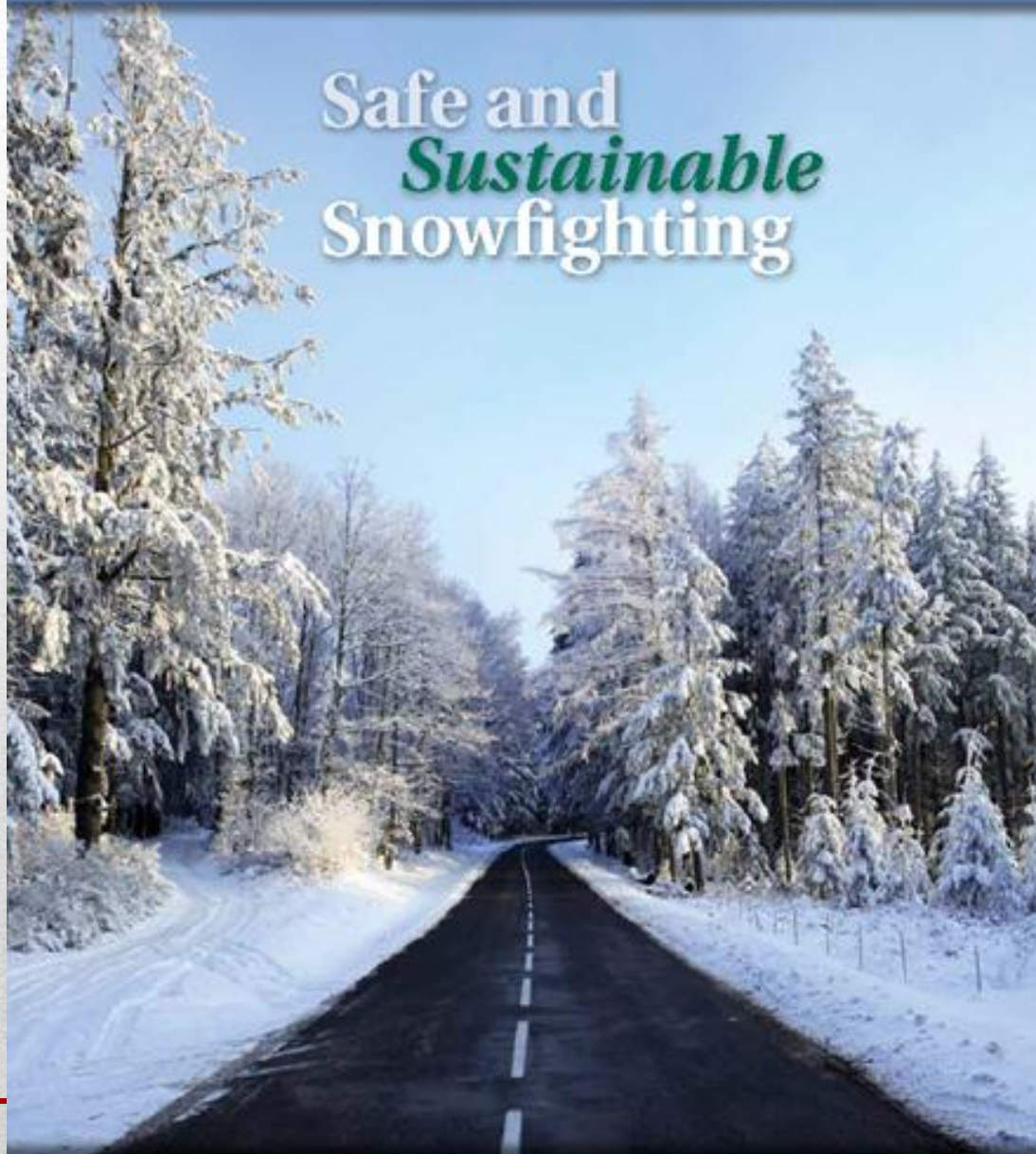
Equipment Selection and Operations	Yes	No	Score
Are all material delivery systems calibrated regularly? Annually (1 point) or monthly (2 points)?			
Do all agency vehicles have surface temperature measuring equipment attached?			
Is all winter maintenance equipment specified and purchased on the basis of life-cycle costs?			
Does delivery equipment have the capability to record where material was placed on the road, and at what rate it was placed?			
Is the equipment fleet managed using a pro-active maintenance system?			
Is it standard practice in equipment operations to use the most fuel efficient vehicle capable of efficiently conducting a specified task?			
Do fuel efficiency, vibration reduction, minimizing of pavement damage, and wear resistance all get incorporated into cutting edge selection for snow plow blades?			
Are various pieces of equipment (e.g. snow plows, material delivery systems) easily exchanged between vehicles (i.e. in less than 10 minutes)?			
Maximum Total Points for Equipment Selection and Operations	9		
Your Agency's Score for Equipment Selection and Operations			

Safe and *Sustainable* Snowfighting



Lori Roman
Fwd: Experts
Sent from my
smartphone

Safe and *Sustainable* Snowfighting



- There are no national standards for snow and ice
- If there were, they would be fundamentally unsustainable (because they would not respect local needs etc.)
- The suggestions are general information only – there is no one size fits all, so consider these as options and go from there.

Some More Context

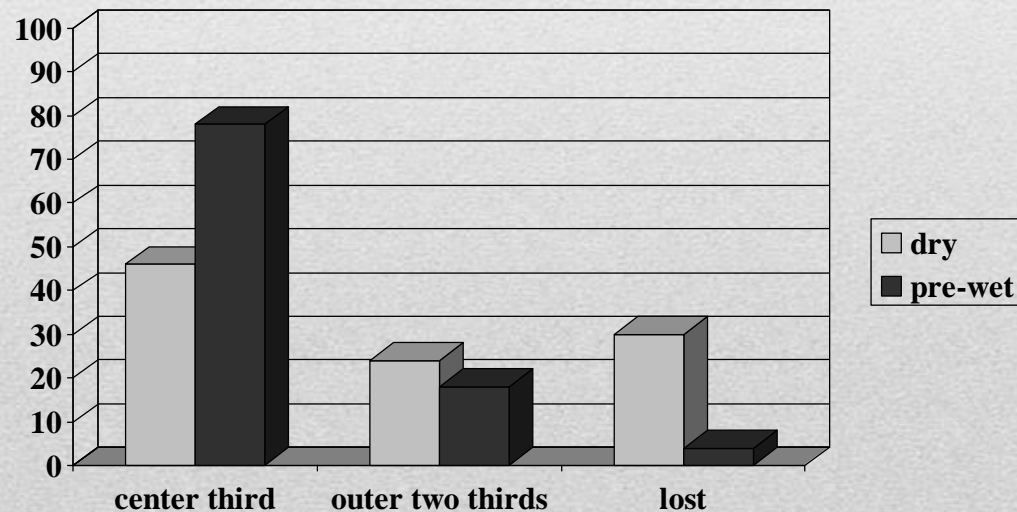
- Pre-wetting
- Anti-icing
- Variable application rates
- Calibration
- Measurement
- Accountability
- Liquids
- Don't use when too cold
- A good forecast
- Base all actions on levels of service

Some Potential Recommended Practices

- Mix the salt with a liquid brine
- Ideally at the back of the truck
- Rates of about 5-10 gallons per ton
- Reduce bounce and scatter
- Stop 30% going into the ditch right away
- Or, to put it another way, get the same result with 30% less salt applied
- The very first step

**Potential Savings?
30%**

Pre-wetting



- Need to have liquids
- Need to have equipment on truck
- If you cannot get these, at least get your stockpile treated with liquids
- Need to have your equipment calibrated, so you can turn down the application rate by 30%
- Again, number 1 step and can be implemented even without the liquid and pre-wetting equipment

Pre-wetting Issues

- Instead of breaking the snow pack off the road, we prevent it ever sticking there in the first place
- How? Apply materials (typically in liquid form, but can use pre-wet solids) before it starts to snow
- Then reapply (smaller quantities of) materials during the storm to continue bond prevention
- Over a whole storm, use about 25% of the salt compared with a re-active approach

**Potential Savings?
75%**

Anti-Icing

Chicago Area Waterways Chloride F



- Need liquids and the means to deliver them
- Need good forecasts, and of course sometimes those are wrong
- Need to persevere even when things do go wrong (will your boss back you?)
- Because it is more pro-active, it means more judgement in the whole process – every storm is different...

Anti-Icing Issues

**Potential Savings?
50%**

- When the pavement is colder, you need more salt to prevent or break the bond – when it is warmer, you need less
- When the winter precipitation is wet or heavy (blizzard or freezing rain) you need more salt than for a typical four inch snow storm
- When your cycle time is three hours, you need more salt than when it is two hours

Variable Application Rates (VAR)

Salt Application Rate Guidelines							
<i>Prewetted salt @ 12' wide lane (assume 2-hr route)</i>							
<i>Surface Temperature (° Fahrenheit)</i>		32-30	29-27	26-24	23-21	20-18	17-15
lbs of salt to be applied per lane mile	Heavy Frost, Mist, Light Snow	50	75	95	120	140	170
	Drizzle, Medium Snow 1/2" per hour	75	100	120	145	165	200
	Light Rain, Heavy Snow 1" per hour	100	140	182	250	300	350
<i>Prewetted salt @ 12' wide lane (assume 3-hr route)</i>							
<i>Surface Temperature (° Fahrenheit)</i>		32-30	29-27	26-24	23-21	20-18	17-15
lbs of salt to be applied per lane mile	Heavy Frost, Mist, Light Snow	75	115	145	180	210	255
	Drizzle, Medium Snow 1/2" per hour	115	150	180	220	250	300
	Light Rain, Heavy Snow 1" per hour	150	210	275	375	450	525

- What should those rates be?
- How do I ensure that is the rate that is actually used?
- Is my equipment calibrated?
- “I used to do two trips around my route with one truck load, but now with these changing rates, that just is not the case any more...”
- Note, technology is not the barrier here!

VAR Issues

**Potential Savings?
50%+**

- You cannot control how much material you use if you cannot measure it
- You cannot measure it if you do not calibrate your equipment
- Even so-called automatically calibrating equipment can be wrong by surprising levels
- Should be part of annual winter preparation

Calibration

Chicago Area Waterways Chloride Reduction Initiative



- A tedious and boring job
- There are plenty of other things to do
- The findings may be disturbing...
- Two useful videos:
 - <https://www.youtube.com/watch?v=ilsHIuJW-9M>
 - <https://www.youtube.com/watch?v=kzTIOG3MxNw>

Calibration Issues

Potential Savings?
10 - 30%

- You need to keep the best possible track of your material usage
- This, by the way, is a basic business cost control measure...
- On a route by route, storm by storm, winter by winter basis
- Use some form of winter storm index
- “if you do not measure you cannot manage”

Measurement

Chicago Area Waterways Chloride Reduction Initiative



- How will you do it (or everybody loves paperwork...)?
- Data storage (the Iowa DOT experience)
- How will you use the data?
- Will it change how you operate?
 - Hint – if it doesn't you are not doing it right...

Measurement Issues

**Potential Savings?
10 - 50%**

- If you have all the above techniques in place
- And your folks know how much material they should be putting down, and where they should put it
- But they don't and instead they do things the way they always have
- What will you do...?



Accountability

- It will in some cases mean conflict
- There may be issues with work rules
- Need well defined plans to help workers get on the right track

Accountability Issues

**Potential Savings?
75%**

- Get a protective layer of brine onto the pavement as quickly as possible
- Key part of anti-icing
- Also part of a frost prevention program

Liquids



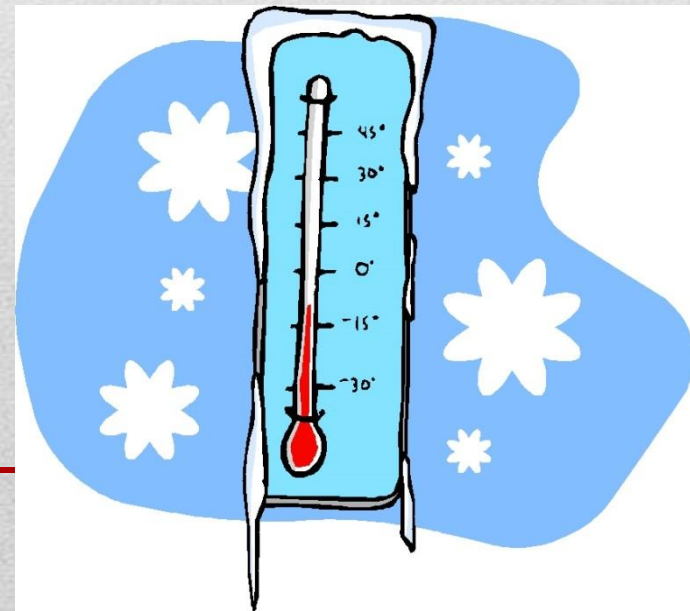
- Will need new facilities (to store, dispense, and if using salt brine, to make the brine)
- Will need new equipment on trucks
- Will need new strategies for when to use and when not to use
 - Checklists for this are available and should be part of your adoption process

Liquid Issues

Potential Savings?
50%

- Salt becomes less effective as the **pavement** temperature reduces
- For most Mid-western storms not an issue – **pavement** temperatures do not normally get this cold during storms, but...
- When **pavement** temperature gets below about 15° F it might be wise to not use road salt until the pavement is going to warm up (e.g. as the sun gets on it)

When It Gets Really Cold



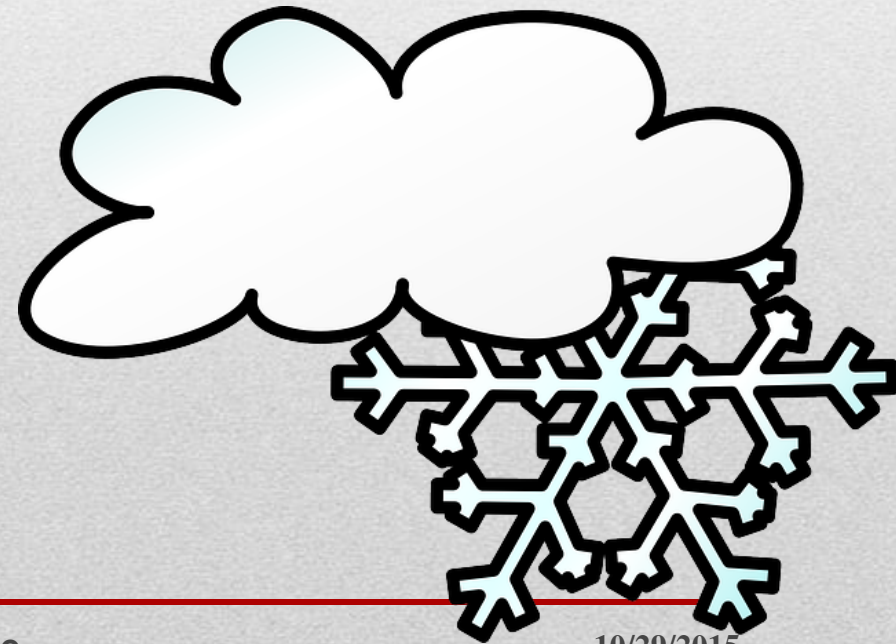
- Need to track pavement temperature (not something in normal weather forecasts or at NWS and other web sites)
- What do you do when you cannot use salt?
 - Plow and take other measures to temporarily increase friction
- Remember this is a rare occurrence, but if you are not aware of this issue, you can waste a lot of salt at low temperatures

Cold Issues

Potential Savings?
75%

- Forecasts that are specific to your needs help to optimize your operations
- Especially important for pro-active approaches like anti-icing
- Need specialized information like pavement temperature, storm start and end times, variations in precipitation types that typical forecasts do not have

Forecasts



- To get the “special stuff” you will need to pay (a Value Added Meteorological Service” or VAMS)
- Even with a paid forecast, it will be wrong some of the time
- So you still need to “hedge your bets” when it comes to the forecast, especially on things like starting precipitation type

Forecast Issues

**Potential Savings?
30%**

- Need well defined levels of service
- Different road types (e.g. residential v. collector) need different levels of service, because they are used differently
- The level of service defines what you will (and by implication, what you will not) do in your operations



Levels of Service

- This is a political decision, often specified in policy documents, so operations may not have the final say here, but...
- Once defined, the levels must be adhered to otherwise you risk creating an expectation that you should not be offering



Levels of Service Issues

- The whole point of winter operations is to provide a safe transportation system that provides mobility to the public and thus to commerce
- In that context, there are many tools we can use to obtain our level of service goals in a Safe and Sustainable manner

Conclusions
