

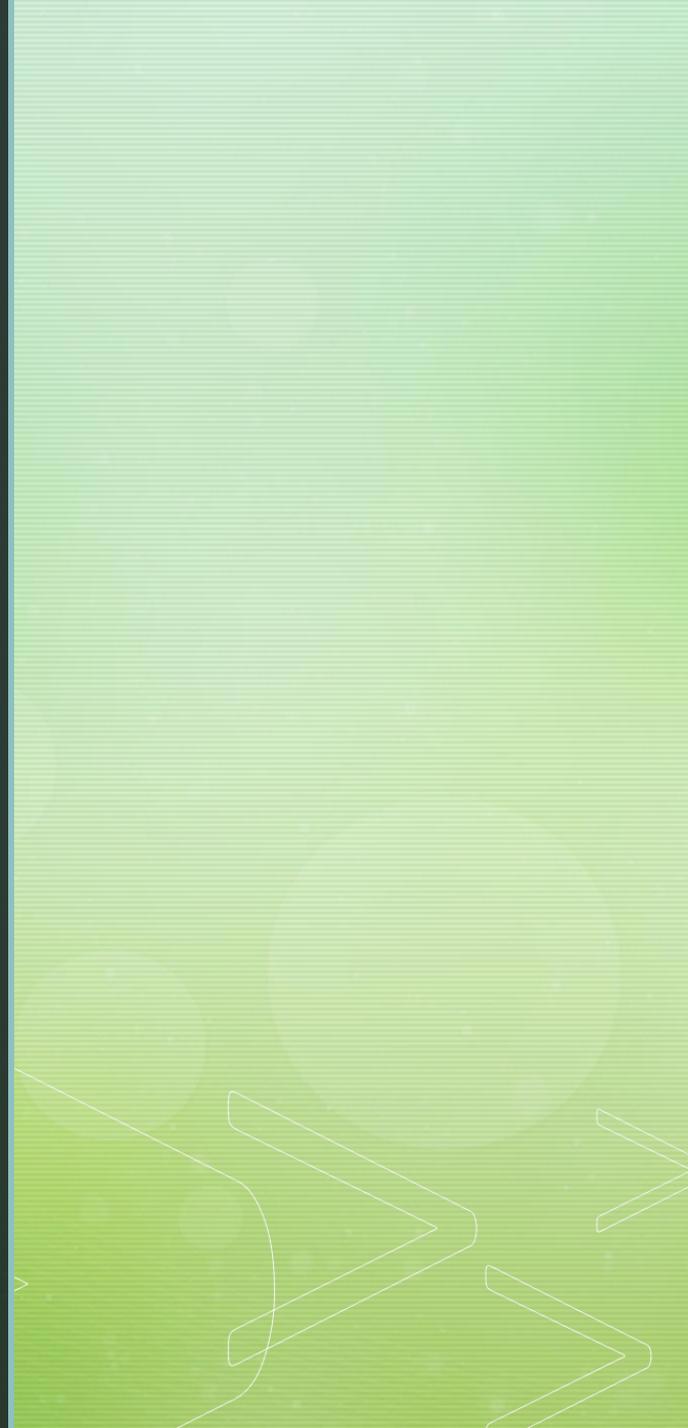


Wilf Nixon

Salt Institute

▶

# Excellent Practices in Winter Maintenance Operations



## Why “Excellent” instead of “Best?”

- What is “best” for one agency may not be “best” for all agencies
- But choosing among a variety of “excellent” practices just makes sense
- And, OK, there is a legal aspect to this!

## Salt Storage

- The EMPs are fairly well known already (cf. Salt Institute Safe and Sustainable Storage Handbook)
- The key approach is to protect your salt from the elements while it is in storage
- This reduces wastage, and avoids run-off issues



- Safety
- Accessibility
- Legality
- Tidiness
- Economics
- Drainage

# SALTED

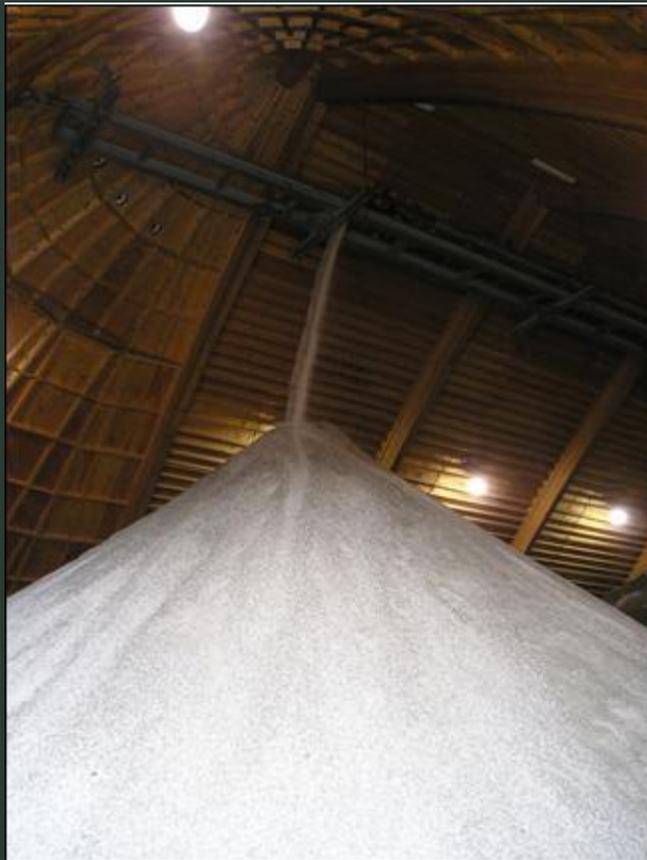


## Newer Issues

- Shared Facilities
- Yard and storage building layouts
- Need for liquid storage
- Unique storage facilities
- Regional Storage (emergency storage)

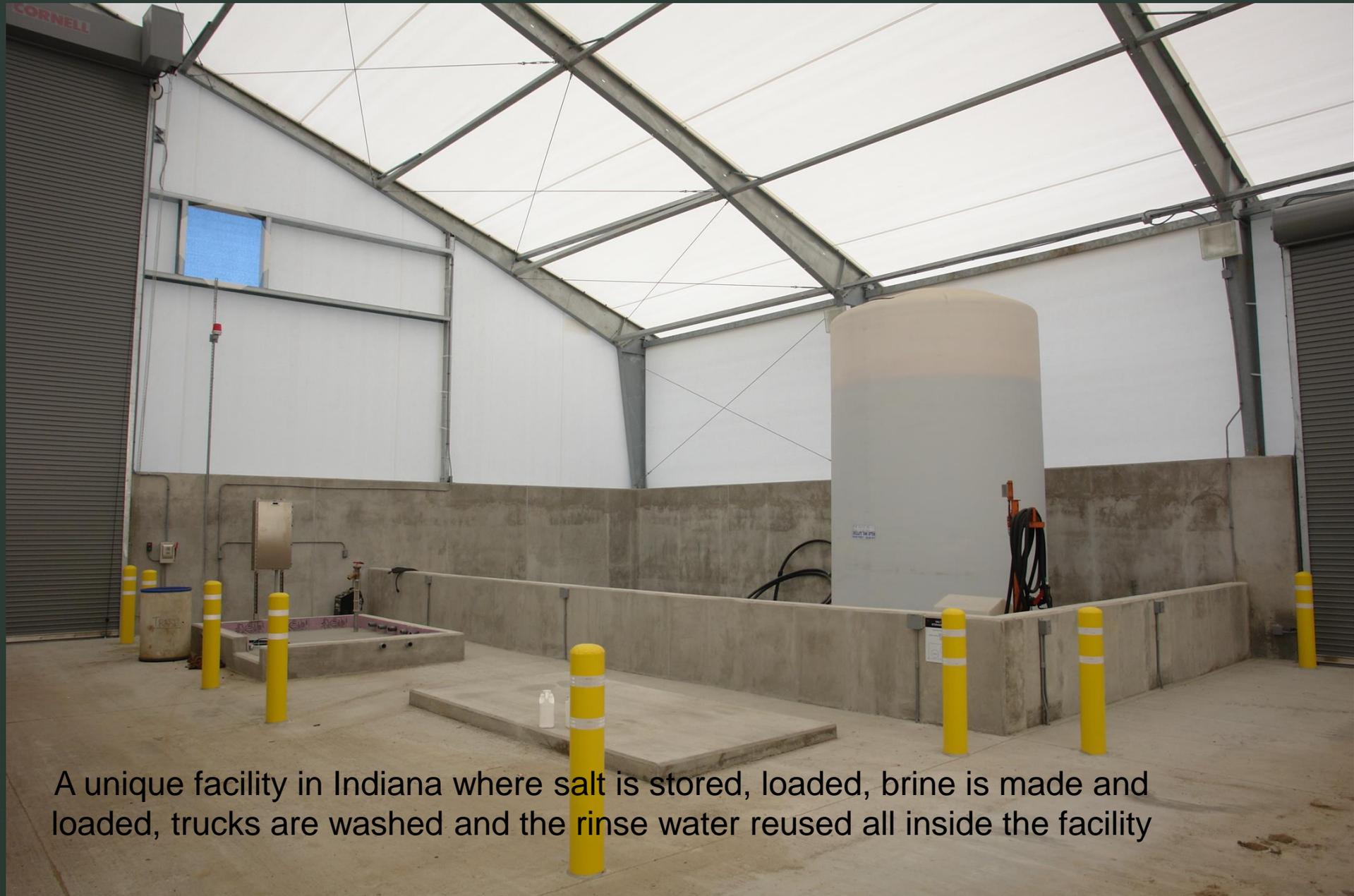


One of the best examples of a shared site, with a great yard layout and the facility is optimized with multi access points, conveyor loading, treating material while loading, brine making and liquid storage.



A regional storage facility in Iowa that stores emergency supplies of material





A unique facility in Indiana where salt is stored, loaded, brine is made and loaded, trucks are washed and the rinse water reused all inside the facility



# Application EMPs

- Again, most information is well known
- Eleven different areas identified
  - Calibration
  - Measurement
  - Accountability
  - Level of Service
  - Training
  - Variable Application Rates
  - Forecasts
  - Cold Temperature Usage
  - Liquid Usage
  - Pre-wetting
  - Anti-icing



## Which Should You Do?

- Fundamental Five are basic and should be implemented by all
- The next six require some investment of resources, but may all give rise to substantial cost reductions
  - Payback periods of 1 to 3 winter seasons
- All will result in a more sustainable winter maintenance operation

# The Fundamental Five

- These really are the basics
- Every agency can do these, at minimal cost
- But it requires change, and change is not easy
- So, “at minimal cost” is not really true – there are real, non-fiscal, costs associated with change...

# Calibration

▶ You have to know how much you are putting on the road

Experience has shown that “factory calibrated” isn’t...

The Stevens Point experience

This works extremely well if both operators and mechanics are involved in the calibration process

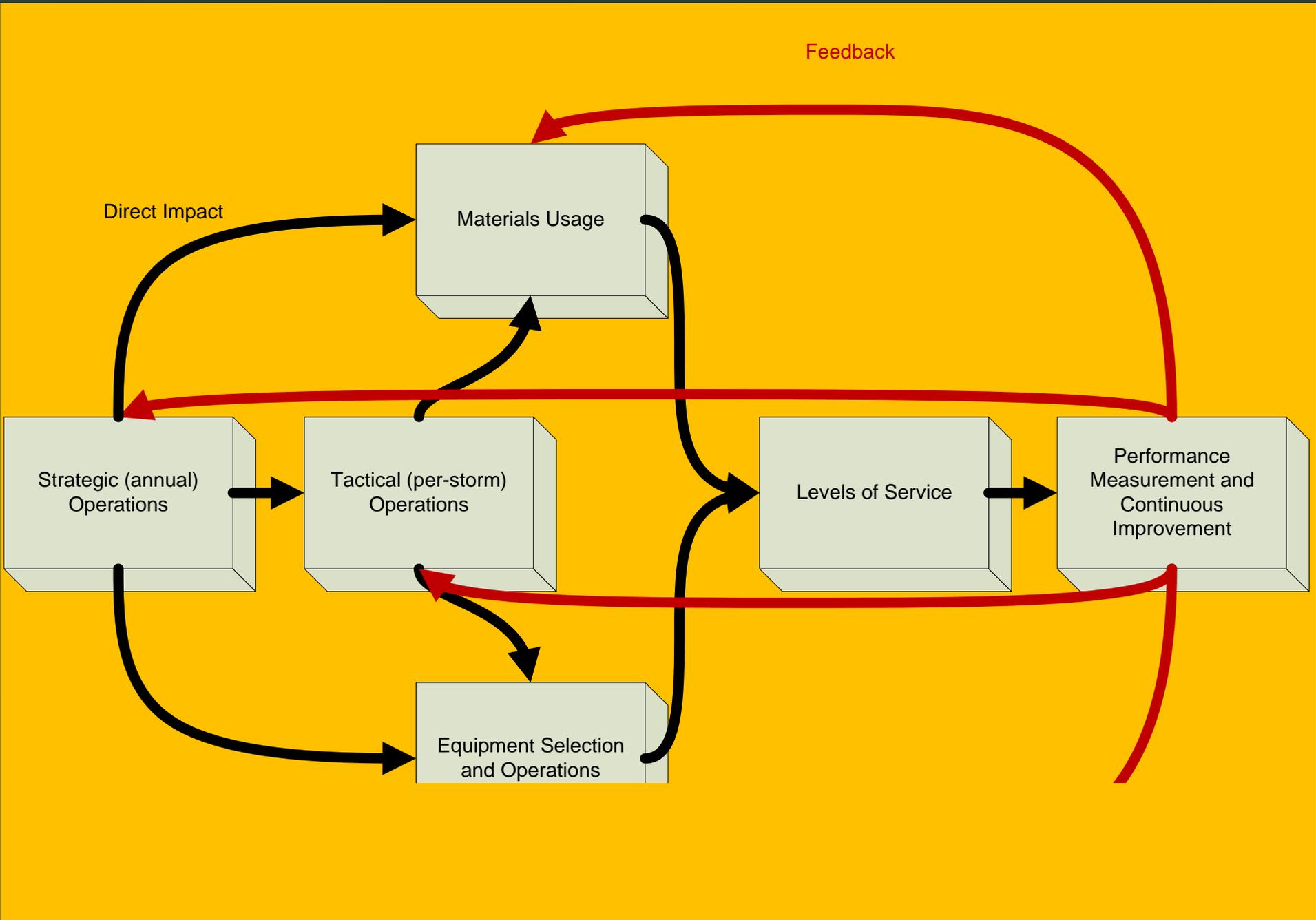


# Measurement

- “If you don’t measure it, you cannot manage it”
- What will you track?
  - How much salt used per lane mile, per event?
  - Based on different event types?
  - Location/route based?
- How will you track it?
  - What sensors should you use?

## Accountability

- It is an important step to have a plan to manage your salt use in winter maintenance operations, but...
- That plan is meaningless if you do not “close the loop” by ensuring all your personnel are using the plan
- You have to get them on board to specifics of the plan
- “If you do things the way you have always done them, you will get the results you have always got.”



## The Center Point

- Level of service drives all our decisions
- Or, it should!
- In short, level of service is the equivalent of the old saying: If you don't know where you are going, you will end up somewhere else!
- So, do you know where you are going?

## Levels of Service

- Different roads receive different levels of effort
- Often some sort of manual sets the goal for a given road type
- Road types often differentiated in terms of Average Daily Traffic (ADT)
- Priority Levels Assigned

# How Clean is Clean Enough?



# The Level of Service and Societal Factors

- We have to provide the “right” level of service
- This is different for different communities
- An interstate should have a different level than a county road
- Base this on ADT and other factors (school bus routes, emergency routes, etc.)
- But, consider this as one circle (of several) that we need to make sure our winter maintenance falls within
- The “diameter of the circle” reflects the requirements of our community

## Accountability and Level of Service

- You may have well defined levels of service, but are they what you really deliver?
- Most often, we over-deliver on levels of service
- To avoid those pesky complaints and phone calls
- Levels of Service are primarily a political decision, which means the politicians have to be on board with what they approve for those levels of service...

# Training

- This is how you make everything happen
- All your personnel need to be trained in the practices you wish to have followed
- You need methods to document not only that your folk have been trained but to show that the training has been effective...
  - Which means, yes, some form of knowledge testing
- If your training has not changed, your practices will not change...

## The Second Six

- These practices allow you to significantly reduce the material that you use, while still achieving your required levels of service
- But, they all require some equipment and tools that you may not currently have
- We will identify what the costs are (in general terms) and what reductions in material applications you can achieve with these approaches

# Variable Application Rates

- The amount of salt you need to put on the road depends on three factors
  - What the pavement temperature is
  - What your cycle time is
  - How much moisture there is in the storm that you are dealing with
- We all know that every storm is different, so why would we think that we should do the same thing (especially with regard to quantity of materials) for every storm
- Will need spreaders that can vary their application rate, and that are calibrated for the range of rates to be used
- Can reduce total material usage over a season by up to 50%

### Salt Application Rate Guidelines

#### Prewetted salt @ 12' side lane (assume 2-hr route)

Surface Temperature	(Fahrenheit)	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 ½" per hour	75	100	120	145	165	200
	Light Rain, Heavy Snow 1" per hour	100	140	182	250	300	350

#### Prewetted salt @ 12' wide lane (assume 3-hr route)

Surface Temperature	(Fahrenheit)	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 ½" per hour	115	150	180	220	250	300
	Light Rain, Heavy Snow 1" per hour	150	210	275	375	450	525

# Forecasts

- If you know what is coming your way weatherwise, you can prepare much more effectively for it
- But, the typical weather forecast does not cover a key parameter that we need
- Pavement temperature
- So, you may need to contract with a VAMS (Value Added Meteorological Service)
- May be possible to pool resources on this



# Cold Temperatures



- As the pavement temperature drops, salt takes longer to go into solution
- When it is very cold, the salt may be swept off the road before it does its job
- “Below 15, salt shouldn’t be seen”
- Primarily an operational change

**Pounds of Ice Melted Per Pound of Salt**

Pavement Temp. °F	One Pound of Salt (NaCl) melts	Melt Times
30	46.3 lbs of ice	5 min.
25	14.4 lbs of ice	10 min.
20	8.8 lbs of ice	20 min.
15	6.3 lbs of ice	1 hour
10	4.9 lbs of ice	Dry salt is ineffective and will blow away before it melts anything.
5	4.1 lbs of ice	
0	3.7 lbs of ice	
-8	3.2 lbs of ice	

It is not cost-efficient to apply salt (sodium chloride) at a pavement temperatures less than 15°F

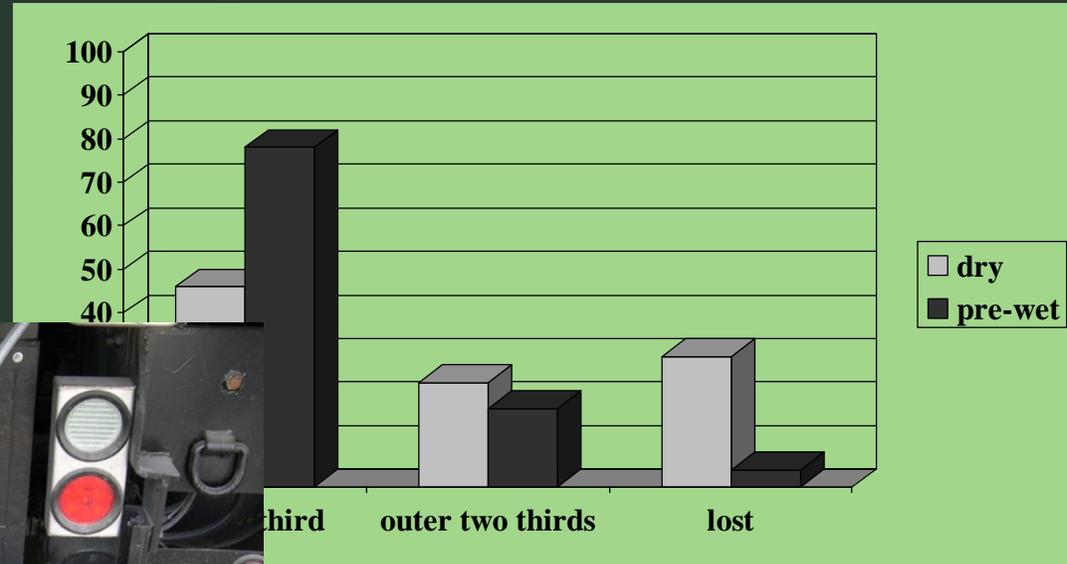
# Liquid Usage

- Experience has shown us, multiple times, that the use of salt brine in a variety of ways can result in much more efficient material usage overall
  - How much? – by as much as 50% overall
- There are a number of ways we can use salt brine
  - Direct liquid application
  - Pre-wetting
  - Anti-icing
- Need the ability to make the brine (brine maker), store the brine, apply the brine, and transfer the brine onto the trucks

# Pre-Wetting

- Lots of experience here shows that adding 5-10 gallons of brine per ton of salt on the truck allows us to reduce application rates by 30% and get the same effectiveness
- To do this, we need the liquid, and the on-truck systems to store the brine and to apply it to the solid
- Typical pay back periods are from less than one winter to maybe two winters
- But, you have to reduce your application rates to see savings!

# Pre-Wet the Material...



# Anti-Icing

- This a full storm strategy (not just “using liquids”)
- You apply material (most often liquids) before the storm
- You keep applying material (at greatly reduced rates) during the storm
- You prevent the snow and ice from freezing to the pavement, which makes it much easier to remove than if it has frozen to the pavement and you have to break the bond
- Studies suggest you can reduce your total storm material usage by 75% using this method
- Needs good forecasts, pre-treatment capability, liquids, and practice

## Conclusions

- For storage, it is all about protecting your salt from the environment
- For operations, you should definitely be doing the "Fundamental Five" – if you are not, what are the barriers to doing them?
- The "Second Six" are a progression an agency can (and should) make over time – you do not eat the elephant in one bite
- How much an agency saves will depend on their starting point – so a great first step is to document where you are right now in terms of these practices