



Measuring the Impact of Training on the Use of Chlorides in Winter Maintenance

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- How do we know when we have made a difference?
- How do we normalize for the variability of a winter season or a winter storm?
- Results from an Illinois DOT district
- Implications of the results

Map of the Talk

- New training developed for Illinois DOT supervisors and front line maintenance workers
- Addressing issues of chloride usage – how do we make sure we use the correct amount, no more and no less?
- If the training works, we should see a reduction in the use of salt when comparing pre-training usage with post-training usage
- Except, every storm is different and every winter is different

Making a Difference?

- Need a method to take the storm and the winter variation out of the mix so we can just look at the benefit (or otherwise) of the change we have made (in this case, the new training)
- Traditionally this is done by use of an index to measure winter severity

How Can We Normalize

- A number of these indices are available, but not all have the same goals
- In this case, the goal is to measure how difficult a given storm was from the viewpoint of achieving the level of service goals for winter maintenance activities
- So two things were required:
 - How severe was a given storm?
 - How can we roll up all the storms in a winter to determine how severe a given winter was?

Winter Severity Indices

- Different folks will have different ideas!
- But, might be a few themes upon which most can agree...
 - Pavement temperature (colder is harder)
 - Storm type (heavy snow and freezing rain are the two worst types)
 - Wind speed (above about 15 mph drifting becomes a major problem)
 - Pre-storm events can influence (e.g. does it start with rain or snow?)
 - Post-storm, increasing wind speeds and decreasing pavement temperatures are bad news

What Factors Make a Storm Bad?

Dealing With Storm Severity

$$SSI = \left[\frac{1}{b} * [(ST * Ti * Wi) + Bi + Tp + Wp - a] \right]^{0.5}$$

Storm Type (ST)	Freezing rain	Light Snow	Medium Snow	Heavy Snow
	0.72	0.35	0.52	1
Storm Temp. (Ti)	Warm (33F+)	Mid(25-32F)	Cold (15-25 F)	
	0.25	0.4	1	
Wind Conditions in Storm (Wi)	Light (<15 mph)	Strong (> 15 mph)		
	1	1.2		
Early Storm Behavior (Bi)	Starts as Snow	Starts as Rain		
	0	0.1		
Post Storm Temp. (Tp)	Same	Warming	Cooling	
	0	-0.087	0.15	
Post Storm Wind Conditions Wp)	Light	Strong		
	0	0.25		



Fiscal Year	Winter Season	Tons of Rock Salt Used
10	2009-10	536,900
11	2010-11	562,400
12	2011-12	235,200
13	2012-13	456,500
14	2013-14	802,341

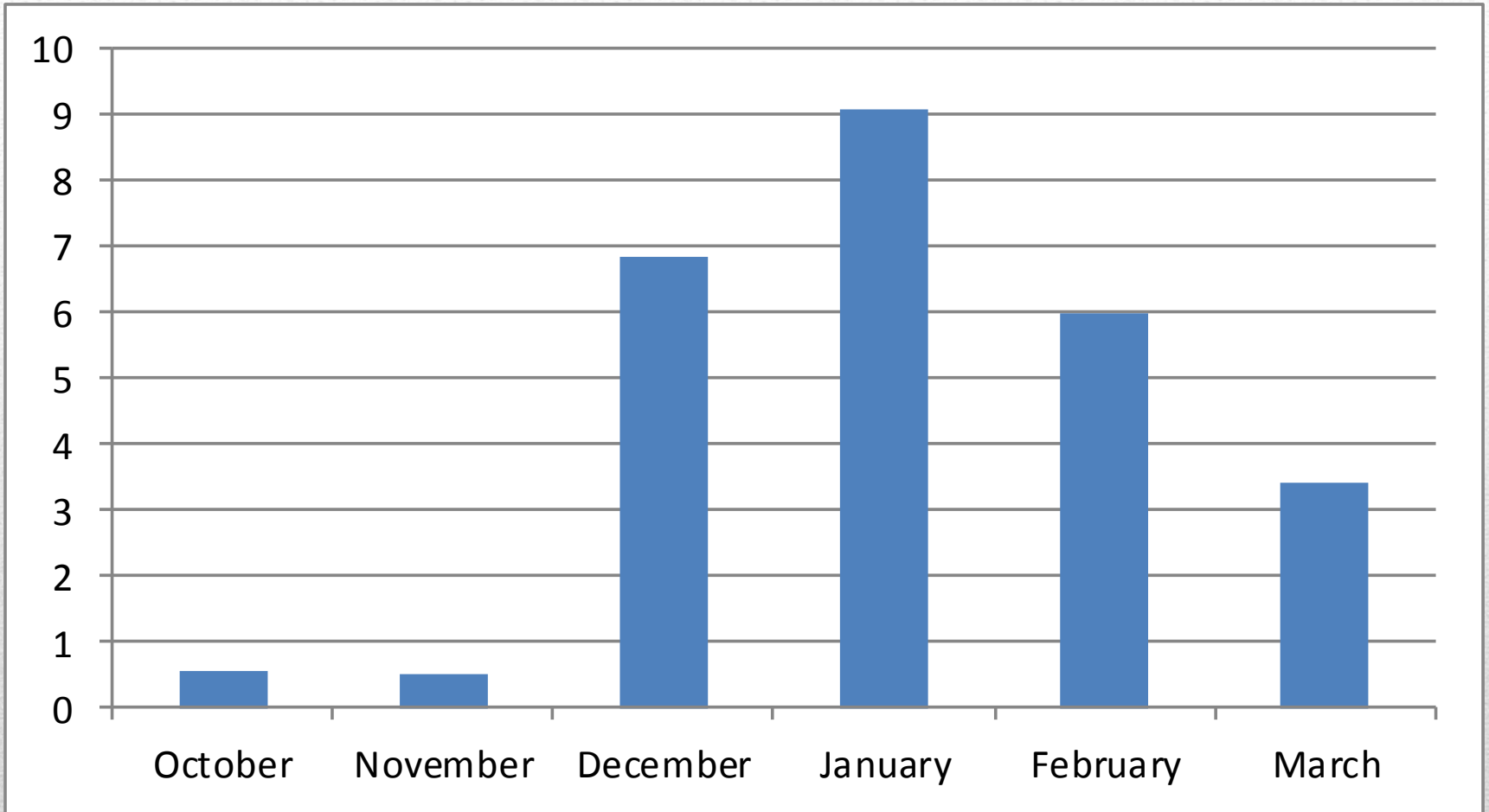
Note: 2012-13 used a lot less salt than 2013-14

Question: Which year was the salt used more wisely?

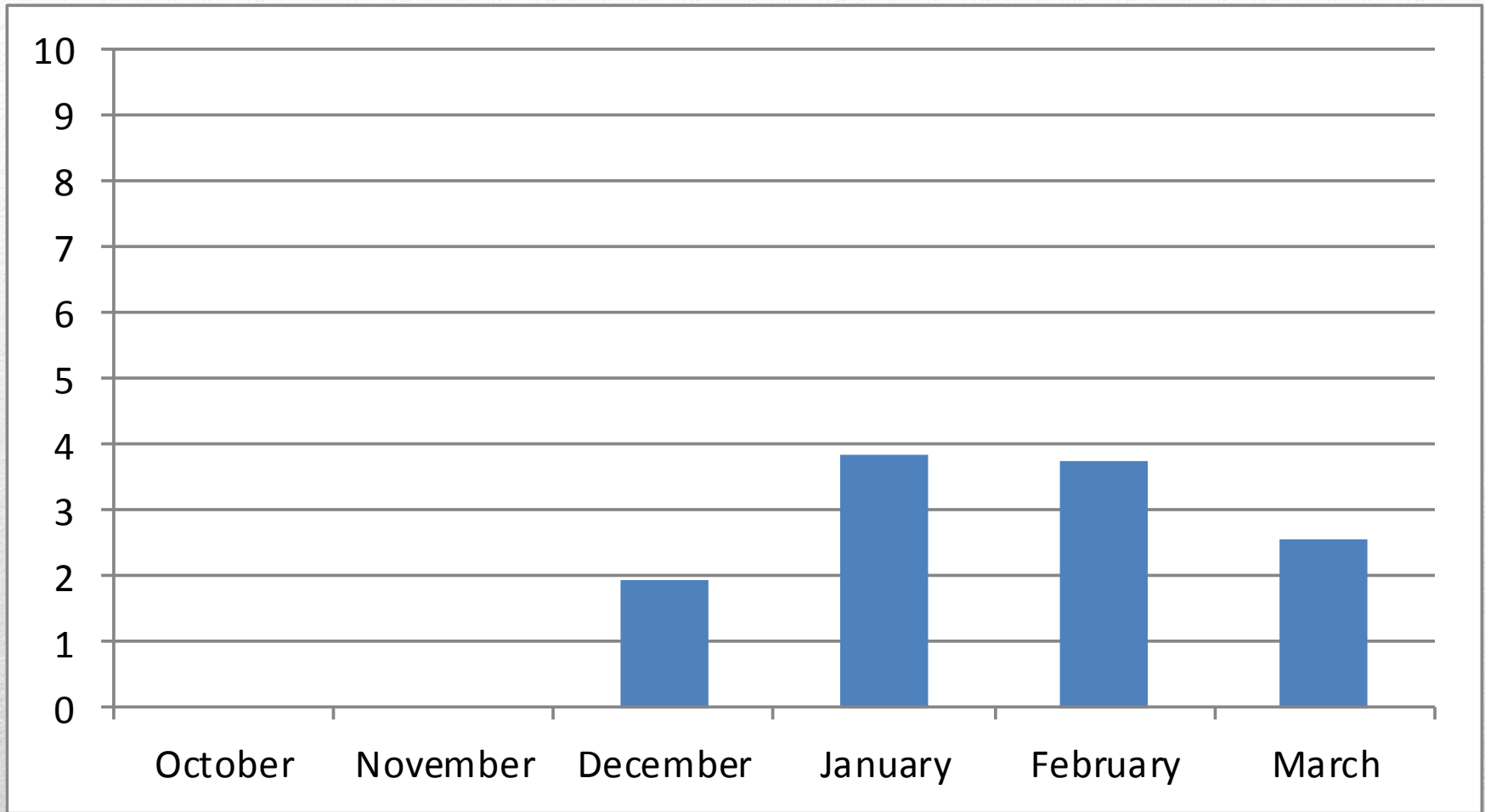
Why We Need This

- Compare storm to storm
- Add up all the storms in a month, and compare month to month
- Add up all the months in a winter and compare winter to winter
- Look at Moline District of Illinois DOT (because we had the data...)

How to Use the Index

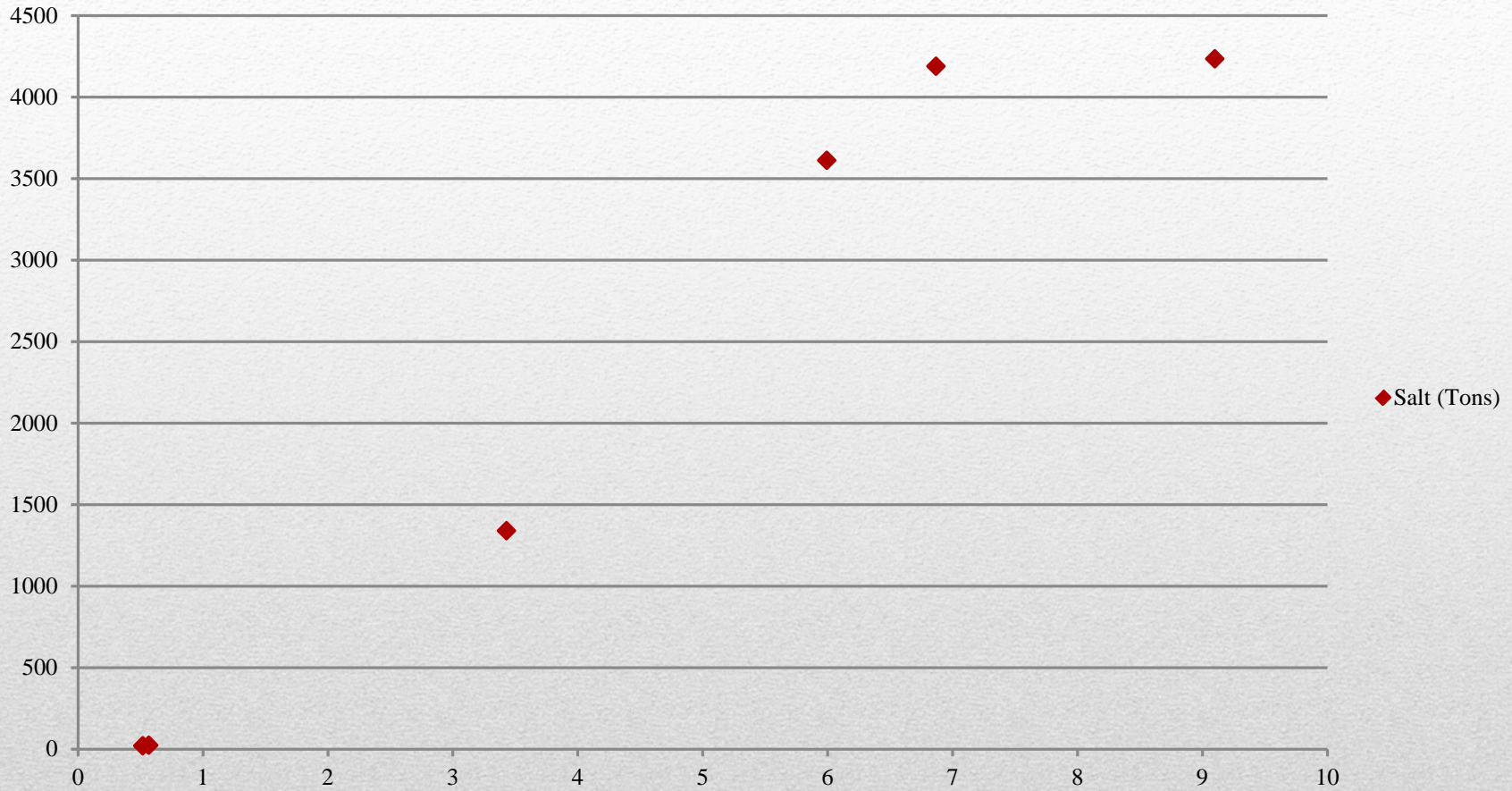


The 2013-14 Winter



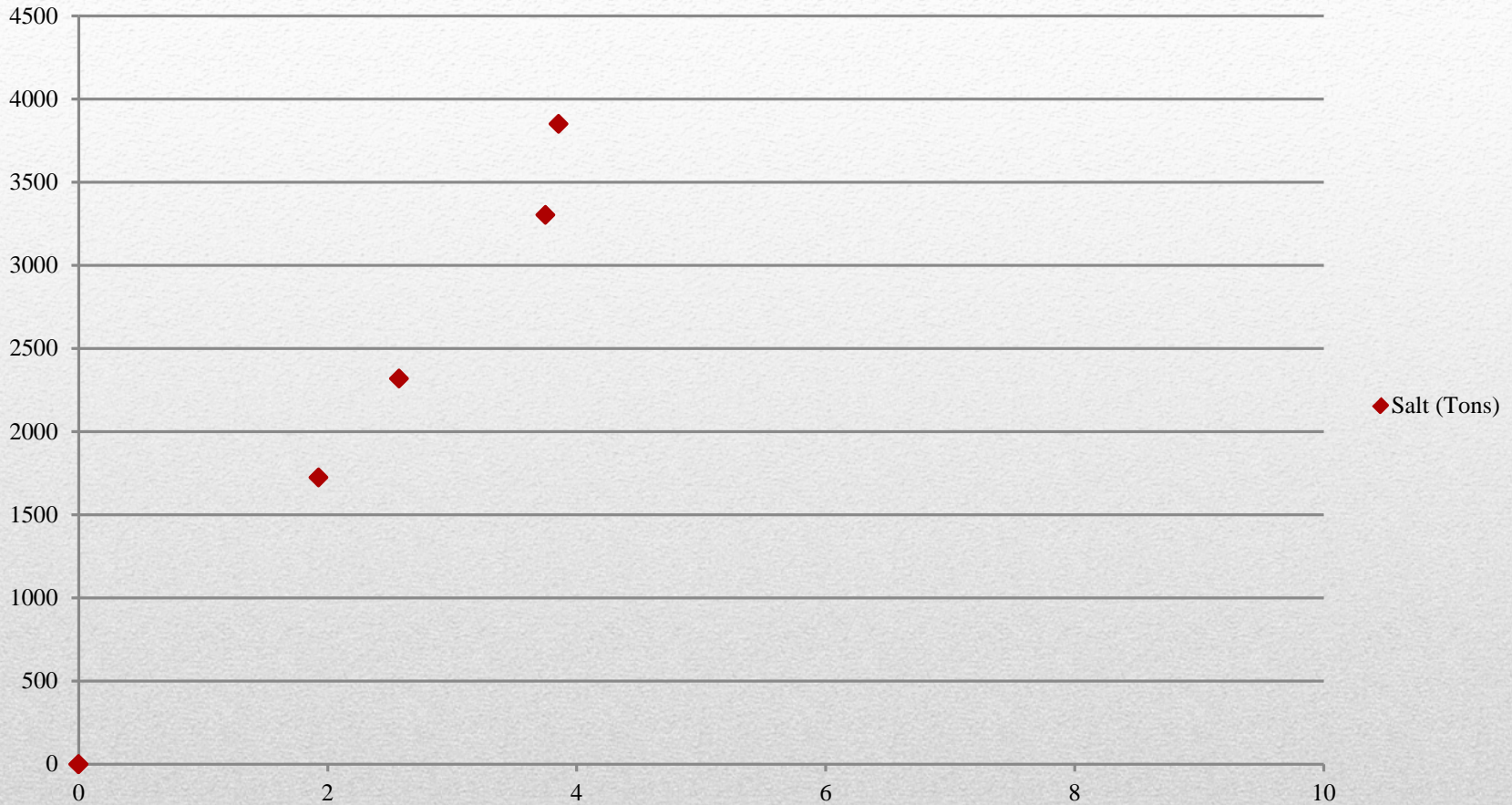
The 2012-13 Winter

Salt (Tons)



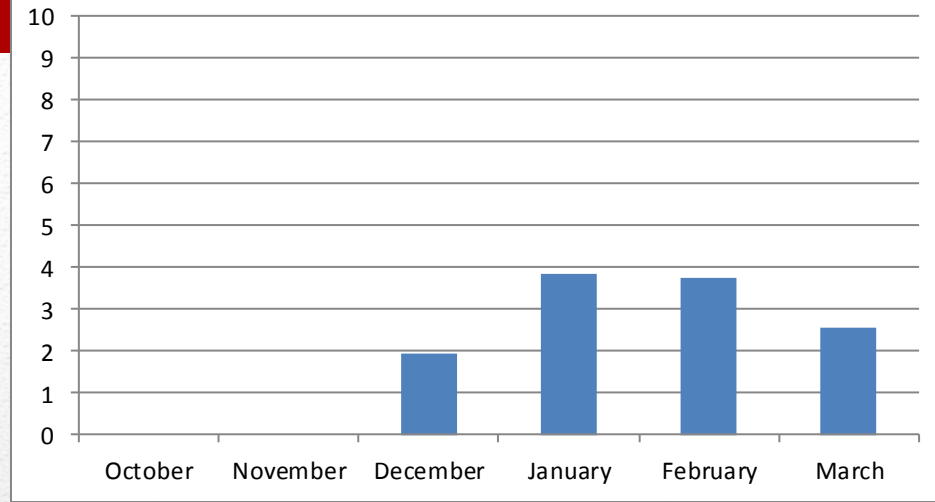
Salt Use 2013-14

Salt (Tons)

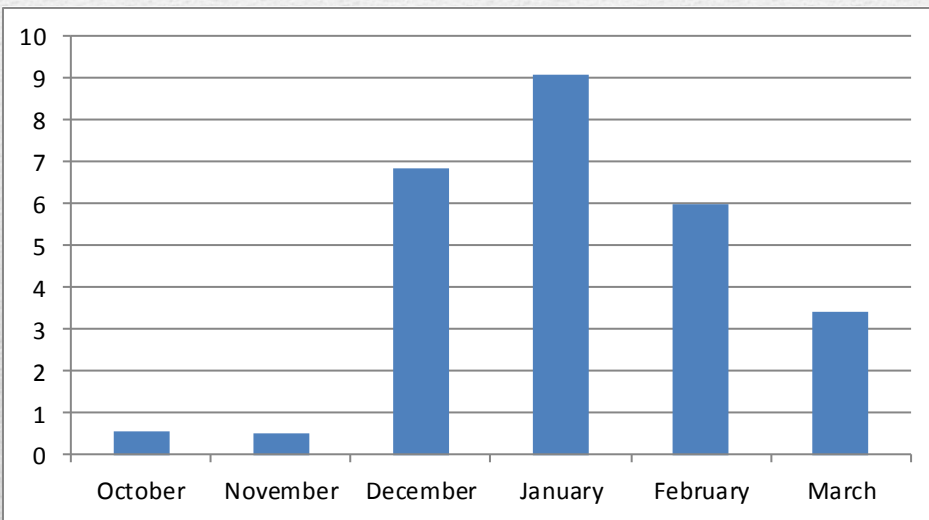


Salt Use 2012-13

Moline 2013-14
Total Salt Used = 13,420 Tons
Tons/Index Point = 499



Moline 2012-13
Total Salt Used = 11,200 Tons
Tons/Index Point = 848



Both Together

- Salt use in general follows the index – higher index, more salt used – but...
- The maximum amount used in a month was similar between the two winters
- The total amount used each winter was similar (although some 20% higher in the more severe winter)
- The normalized quantity (tons per winter index point) was lower in the more severe winter than in the less severe winter – about 40% lower (or wiser)

What Have We Learned?

- Be cautious – we cannot ascribe all the improvement to training, because the training did not happen between the two winters!
- What did happen?
- Perhaps salt availability limited usage in 2013-14.
- Perhaps in 2012-13 salt was over-applied.
- Given only two years data for one location we cannot say, but we do have a tool that allows us to start to look at these and related questions.

What Does it Mean?

Questions?