

### Who is Paul Johnson ?

- Operations Manager, County of Wellington
- 28 years with the County
- Studied liquids for 28 years
- Past President of the Ontario Good Roads Association
- Past-chair of Ontario Road Salt Management Group
- Chair of Training Sub-committee of ORSMG
- Member of EC Multi-Stakeholders Working Group on Salt Management
- Member of Winter Maintenance Sub Committee APWA

### What am I going to talk about

- How we started with liquids
- What we learned
- Mistakes we made
- Results we have seen
- Equipment changes

### Where is Wellington County?

Ontario

Wellington County  
400 sq miles

### So let's begin

- 40 years ago sand and salt were the only game
- Sand was and still is used to promote traction. *It has no melting abilities on it's own.*
- Salt is added to stockpiles to keep piles from freezing.
- But sand use led to air and water quality issues.

A black and white photograph showing a snowplow operator and another person on a truck in a snowy environment. The truck appears to be a piece of winter maintenance equipment.

### Salt

- Initial use was to keep sand piles from freezing.
- Salt in sand helped the mixture perform.
- Straight salt works well above -9°C or 15°F

A photograph showing a large, rounded pile of snow or sand, likely a stockpile, under a dark sky.

**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	8.6 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	
-6	3.2 lbs of ice	

Application Rate  
Conclusions

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

17

**How we started using liquids**

**In 1975**

- Convinced liquids would help
- Steel tanks with steel lines
- Calcium chloride

**Results**

- Sand and salt worked better but
- Tanks and lines lasted only 2 winters so in 1978
- We went to CTS “Calcium Treated Sand”

**How did that work?**

- Liquid Calcium chloride was added at about 20 liters or 5 gallons /ton plus
- 10 % salt but
- We lost half the calcium out the door from leaching and it cost 4 time cost of sand with 5 % salt

**Plus**

- We had to put up 2 piles of sand
- One with just 5 % salt and one with CTS
  - Because we provided sand to our smaller municipalities and CTS would defrost a gravel road

**Experimented**

- I studied the cost of sand and salt versus CTS
- By
  - Comparing application rates, frequency of applications and time to achieve desired level of service

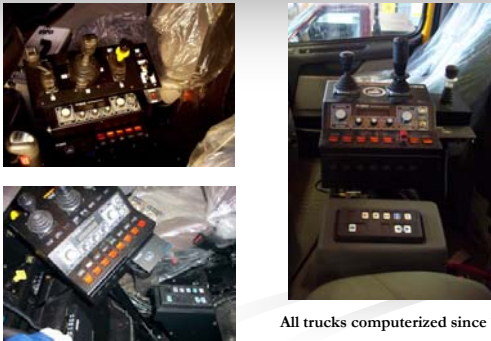
### Results

- Clearly showed
  - CTS was not economical
  - We needed onboard tanks with on demand application of liquids
  - So in 1992 we added computerized controls for liquids and solids and using Calcium Chloride.

### Went for these Manual Controls



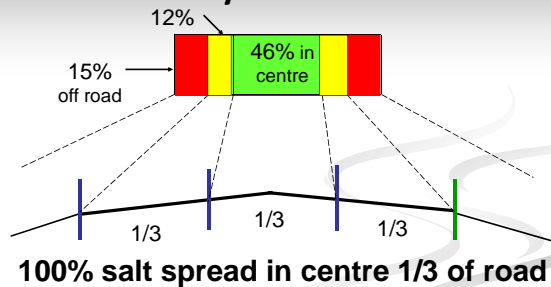
### Computerized Controls



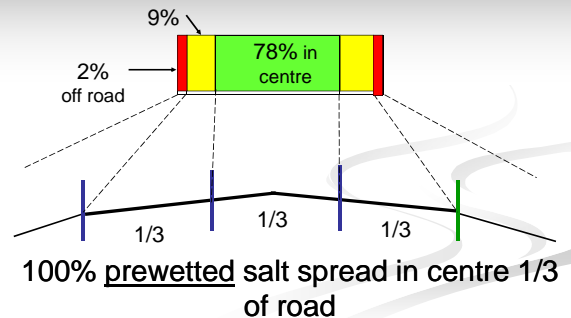
All trucks computerized since 1994

- What we didn't know in 1975 was how much sand and or salt would stay on the road when it was pre-wet. Years later experiments from Michigan confirmed what we suspected.

### Typical scatter pattern of dry road salt



### Typical Scatter Pattern of Pre-wet road salt



**I have 4 maintenance areas with 2 works garages each.**

**In 1997 I switched one of our 8 works garages to Magnesium Chloride plus an agricultural base product.**

### The experiment

- At the one garage I had
  - 3,000 of sand with 5% salt in the dome
  - 3,000 of sand with liquid and no salt outside
  - 2,000 gallons of mag and agricultural product
  - 500 tons white salt
  - 500 tons pre-mixed salt (liquid added and put into stock pile.
  - Same foreman for this and sister garage
  - Staff switch garages every 2 weeks



### The results

- Sand in the dome was never used that winter
- All the sand outside was used
- Liquid was added as necessary as temperatures dropped
- The garage with regular sand and salt and no liquids
  - Used 55 % more sand and 25 % more salt then the other garage
  - Roads took longer to reach same level of service

### What next?

- The next year both garages - same products
- Following year all 8
- Started pre-mixing sand because
  - liquid storage inadequate
  - only 50 % of fleet had pre-wet capability
  - Easier to add liquid into stockpile then store it for pre-wetting

- Since 1997 we have tried 10 different products
- Over the last 6 years we have settle on a Mag and corn based produce.

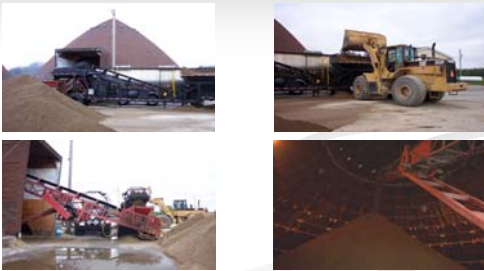
### Then what?

- In 2002 we started pre-mixing salt
- Added much larger tanks and two 2,000 gallon anti-icing trucks
- 75 % of fleet was now pre-wet capable

### However there were disadvantages to pre-mixing

- Hard to co-ordinate material (sand/salt), stacker, pug mill, loader, and liquid without rain.
- Usually one fill, part fills not economical
- Typically salt is a “just in time” product, not stockpiled **New “Thawrox”**
- Leaching can occur

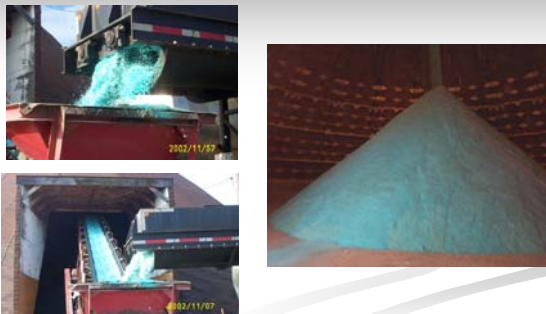
### Pre-mixing Sand 2002



### Pre-mixing Salt 2002



### Pre-mixing Salt 2002



### So what about pre-wetting?

*The application of a liquid deicer just before the sand and/or salt hits the road.*

#### Advantages

- More liquid can be added than in stockpile
- Increase or decrease liquid application as temp. change
- 25 % savings in salt used
- Up to 60 % saving in sand used



### The Disadvantages

- Computerized/liquid controls costly
- Onboard liquid tanks and pumps
- Site storage of liquids
- More costly in short term but will pay for themselves during the life of the truck
- Additional training required for:
  - Liquids
  - Controllers

### Our 3 in 1 Units




### 3 in 1 Unit



### Why use Infra Red Thermometers?

They show relative road temperature at different physical locations :

- \*Such as culverts, top of hills, valleys, shaded areas, bridge approached versus bridge deck etc



### Pre-wetting Equipment



### In 2001 we started Anti-icing

*a concept in which a liquid, or a pre-wetted salt, is spread directly onto the pavement before the storm begins.*

#### Advantages

- Prevents bonding of snow and /or ice to road  
*(Studies have shown it costs 5 times more to break the bond than to prevent the bond.)*
- Faster cleanup
- Applied in better weather
- Doesn't get plowed off
- Equipment is fairly easy to make

### Disadvantages

- Need better weather forecasting
- Cannot be used for gravel roads
- Larger liquid storage tanks

### Liquid Storage

- We had 8 of these 2,000 gallon tanks one at each of our 8 work yards.
- We now have 100,000 gallons storage capacity



### Our first big tank 13,000 gallons



### Same tank today with containment



Old 2,000 gal tank (yellow) and new 10,000 gal tank (white)



### Pre-wetting and Anti-icing Units



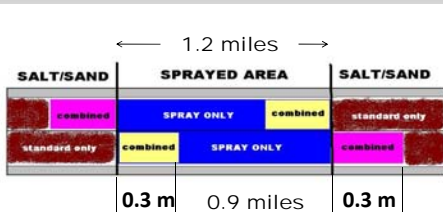
### Our Anti-icing test sites

- 8 test sites, one per maintenance garage
- Each 2 km or 1.2 miles long
- Positioned on flat, straight roads, with shallow ditches
- Half the length along open fields other half adjacent to tree line
- On roads with different N-S and E-W direction
- Applied only liquids

### 8 Test Sites throughout the County



### Test Site



4 different combinations: salt only, salt on top of liquid, straight liquid, liquid on top of salt.

### Results

- Salt only- worked well but bonding occurred in lower temperatures
- Salt on top of liquid- liquid prevented bonding, salt prolonged dilution
- Straight liquid- liquid prevented bonding but eventually diluted
- Liquid on top of salt- salt started melting action to break bond, liquid sped up melting and broke bond .



Anti- Icing

### Anti-icing







### What have we learned about Anti-icing?

- It is not for every road
- More is not better
- Different road types (surface treated versus new asphalt versus concrete) different application rates
- Time of day, specific lanes different results
- Start slow
- Get lots of info on what liquid can do and can't do

### Now what about De-icing?

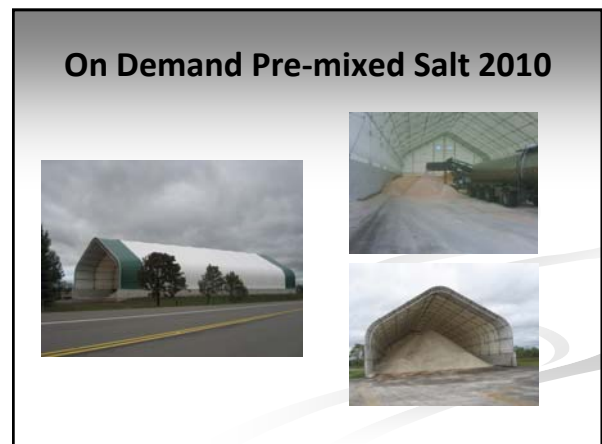
*an operation where a deicer is applied to an accumulation of snow, ice, or frost that is bonded to the pavement surface.*

**Advantages of liquids verses solids**

- Works much faster than straight salt
- Residual liquid becomes an anti-icing operation
- Improved level of services

**Disadvantages**

- Re-active rather than pro-active





### On Demand Pre-mixed Salt?

- Basic rock salt, encapsulated with a high-performance liquid
- A deicer with increased performance and environmental friendliness

### Compare the methods - Evolution

Truck Bed Pre-Wet	Stockpile Injection	Saddle Tank Pre-Wet	Pre-mixed Salt
Typical coverage 15-20%	Typical coverage 15-35%	Typical coverage 40-60%	Typical coverage 95-100%

### Let's get something straight!!

LIQUIDS are :

- the most misunderstood
- the most underutilized

and,

- the most misused tool available to you to fight winter !

### What have we learned ?

- Once wetted with Liquid :
  - Salt works faster
  - Increases penetration
  - Less blow-off
  - Less bounce and scatter
  - Increased level of service
  - Environmental Savings

### Some Facts about LIQUIDS ?

- Liquids are already in solution
  - They act more quickly – a strength
  - They dilute more quickly – a weakness
- Never use with rain (except for pre-wetting)
- Never put on top of compact (unless you are using a very hot product)
- More is not better, especially early in the season

### Corrosion Concerns

Because liquids are already in solution:

- corrosion quicker than solid chemicals. (if using a liquid that is corrosive)
- Major and valid concerns about equipment and infrastructure damage (depends on the liquid)
- Some concerns seem to be more perception than reality (misunderstanding)

### Chemical Sickness

- Know what you are applying
- Equipment is calibrated
- Let the temperature drop before you make that first application
- Be especially careful after long dry spells
- Reduce application rates early in the winter
  - Half rate for first application

### Conclusions on Liquids

- Liquids are not for melting snow and ice
  - use them to prevent and/or break the bond instead
- Road surface temperature not air temperature
- We need liquids under the snow – anti-icing gets them there faster
- If we are going to anti-ice, know the limitations as well as the benefits

### More Conclusions

- Use liquids that mix well and stay mixed
- Effective temperature more important than Eutectic.
- The more Viscous the better
- Exothermic liquids better than Endothermic
- Have liquid specific training

### Calibrating Spreaders

- Ensure accurate discharge of material
- Recalibrate at least annually and periodically as required
- Gate setting is tied to calibration
- Ensure gate setting is matched to material being applied

<http://www.saltinstitute.org/snowfighting/6-calib.html>

<http://www.ogra.org>


### Washing Equipment

- Wash vehicles at the completion of every storm event
  - Wash vehicles indoors
- All wash water should be properly managed
- Use oil/grit separator
  - Clean routinely



### Training

- On what?
  - liquids
  - equipment
  - weather



**Thank You!**

### Any Questions?



Paul Johnson, Operations Manager, County of Wellington  
[paulj@wellington.ca](mailto:paulj@wellington.ca) 1-800-663-0750 ext 2230