Deicing Chemicals - State of Practice

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Methods of Operation

- Traditional Methods
  - Plow and antiskid
- Anti-icing
- Deicing
- Pre-wetting

Anti-icing

- The control practice of preventing the formation or development of bonded snow or ice to the pavement surface by timely applications of a chemical freezing-point depressant.

Anti-icing

- Pro-active
- Largely uses liquid products
- Can use pre-wetted solid chemicals

Deicing

- Traditional snow and ice control practice is to wait until and inch or more of snow accumulates before beginning to plow and treat the highway with chemical or abrasives.

Deicing

- Subsequently it requires large quantities of chemical to work its way through the pack to reach the pavement interface and destroy the ice to pavement bond.

Pre-wetting

- The addition of a liquid chemical to an abrasive or solid chemical before it is applied to the road.
- Increases the deicer performance and longevity on the roadway surface.
- Embeds the particle in the snow and ice floor by melting in and freezing.

Benefits

- Reduce the use of abrasives
- Lower accident rates
- Better performance
- Increase winter mobility
- Reduce chemical usage
- Reduce maintenance labor cost
- Fewer winter pass closures

Benefits

- Pre-wetting
  - Enhances the penetration of chemical
  - Gets the chemical reaction going quicker
  - Jump starts the ice melting
  - More salt stays on the highway
    - 96% verses 70%

Benefits

- Abrasive Cost
  - Abrasives require seven more times material to treat a section of roadway than chemical products.
  - PM 10 areas
  - Flushing drains
  - Clearing pipes
  - Sediment loading in waterways (EPA)
  - The final cost of using abrasives including cleanup and environmental impact is typically over three times the original cost of the abrasive.

Strategies

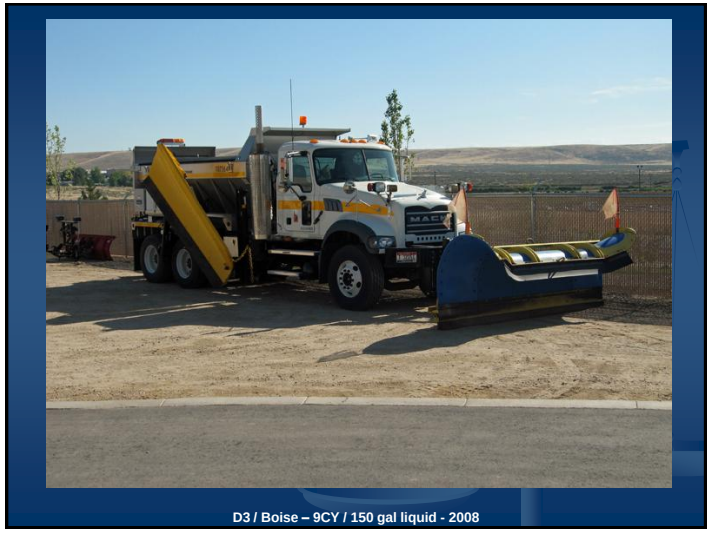
- New Equipment
  - Spray verses Stream
    - Stream offers less issues with plugging
    - Multi-lane spray
  - Pre-wet
    - Spinner more complex with various injection ports for liquid chemical.


D3 / Boise – Three lane de-icing unit – 2500 gal - 2001


D6 / Rigby – 9CY / 150 gal liquid - RDS Body - 2005


D3 / Boise - 8CY / 150 gal liquid – 2008

D3 / Boise - 5CY / 100 gal liquid - 2002



D3 / Boise – 9CY / 150 gal liquid - 2008

Strategies

- New Operational Methods – Proactive
- Road Weather Information System (RWIS)
  - Forecasting (http://511.idaho.gov/)
- Maintenance Decision Support System (MDSS)

Strategies

- New Management Techniques
  - Train your workforce
    - FHWA – "Manual of Practice for an Effective Anti-icing Program - A guide for Highway Winter Maintenance Personnel"
    - AASHTO Interactive CD Training Programs
    - Hire professionals for a training program
    - Attend Winter Maintenance Conferences
    - Talk to your neighbors

Strategies

- New Chemical Products
  - Pacific Northwest Snowfighters www.wsdot.wa.gov/partners/pns
  - Many products are available Chlorides, acetates, and carbohydrate
  - Corrosion Inhibited
  - PNS approved products drastically reduce threats to the environment.
  - Liquids are tested for coefficient of friction

Lets talk Chemicals

- Use them to prevent or break the bond between snow/ice and the pavement.
- Use the right amount, in the right form, in the right place, at the right time.
- Consider the following when deciding how much chemical to apply
  - Temperature
  - Dilution potential
  - Cycle time

Temperature

- As the temperature decreases then need for more chemical increases.
- Time of chemical reaction slows down with lower temperatures.
- With lower temperatures the dilution rate is slowed.
- Surface temperature is more important than air temperature.

Dilution Potential

- The higher the moisture presence, the quicker the chemical application dilutes.
- Different precipitations events have various amounts of available liquid.
  - Sleet, freezing rain, wet snow verses dry snow.
- Thus these types of events will require more chemical.

Cycle Time

- Time between chemical applications to a given point on the highway system.
- Short cycle on a high priority route, longer cycle on lower priority routes.
- The longer the cycle time, the more the chemical application will dilute out on the road.
- Longer routes require higher application rates.

General Guideline

- Lower temperatures, wetter precipitation, and longer cycle times all require more chemical to avoid refreeze.
- Don't use liquids with rain or on top of compact snow.
- Don't use liquids or pre-wet solids if this will create a wet road in a drifting snow.
- Don't put down dry chemicals on a dry road. Use a pre-wet chemical.

What do you want for a chemical

- Freeze point depressant
- Melt snow/ice in reasonable time frame
- Penetrate to the snow/pavement interface
- Will not damage infrastructure
- Protect the traveling publics vehicles
- Non-toxic to humans, animals and vegetation
- Available in large quantities
- Cheap

Picking your chemical

Picking your chemical

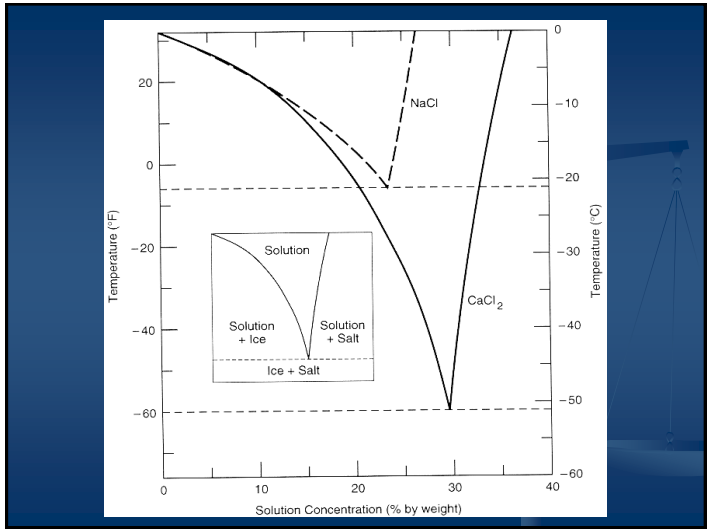
- What are your temperature requirement?
- What do you need the chemical to do?
- What are your constraints?
- Differentiate between different chemicals.
- Performance characteristics
- What is the chemicals freeze point depression.

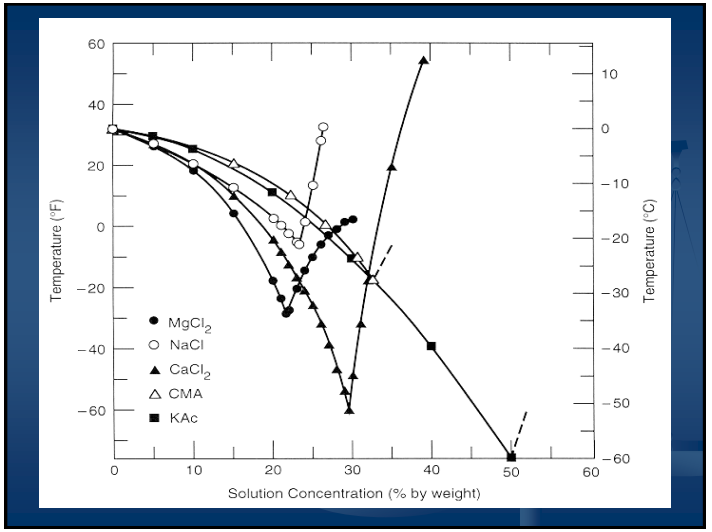
What is a freeze point depressant?

- The mixture of water and chemical must have a lower freezing point than water.
- The free water would rather bond with the ions in the chemical than with other water molecules.

Phase Diagram

- A graphical diagram that shows a chemicals physical characteristics at a given temperature and concentration.
- Can be represented for a single or multiple component chemical system.
- We are primarily interested in two phases, liquid and solid.

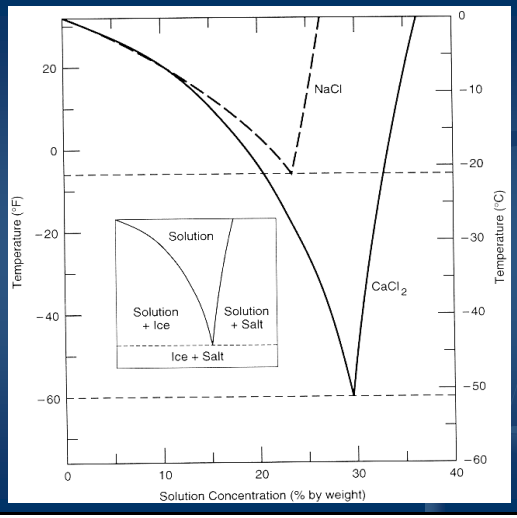




Chemical	Eutectic temperature °F	Eutectic concentration %
Calcium Chloride ($CaCl_2$)	-60	29.8
Sodium Chloride (NaCl)	-5.8	23.3
Magnesium Chloride ($MgCl_2$)	-28	21.6
Calcium Magnesium Acetate (CMA)	-17.5	32.5

Eutectic Point Information

- Eutectic Point tells you if the chemical is suitable for you climate.
- Inhibitors and carbohydrates can lower EP.
- Need to know two more point from the curve.
  - Half the concentration from the Eutectic Point.
  - Tells us the lowest temperature we should use the chemical.
  - Quarter point from the half point gives provides temperature where refreeze is being approached.



Points of Interest

- Half point for salt is 18 ºF
- Half point for Magnesium chloride is 2 ºF
- Half point for calcium chloride is -15 ºF
- Which chemical should you choose?

Picking your chemical

- Consider all the points that you need for a region.
- Different regions may have different requirements.
- Score the chemical accordingly giving more weight to the more critical factors and less weight to the lesser factors.

Manufacturing your own salt brine

Brining

- Weight to weight mixture of salt and water not weight to volume.
- Verify finished concentration with a hydrometer for specific gravity or salinity.
- Install a documented QC plan.
- Can be easily adapted for adding corrosion inhibitors.
- Carbohydrates can increase the longevity of the chemical on the roadway.

Questions??????