Blending: The Alchemy of Salt Brine in Deicing

Expectations
- Blends
- Equipment
- Our Experiences
- Results
- Lab Testing
- Questions/Discussion

MCHENRY COUNTY DIVISION OF TRANSPORTATION (MCDOT) DEVELOPED A METHOD TO BLEND LIQUID DE-ICING CHEMICALS TOGETHER PRECISELY.

MCDOT APPLIES LIQUIDS DIRECTLY TO THE SALT ON BOARD EACH TRUCK (PRE-WETTING) AND DIRECTLY TO THE PAVEMENT PRIOR TO EACH EVENT (ANTI-ICING) AS SHOWN BELOW.

COMBINATION VEHICLE

Blending
- Add tools to your arsenal
- Improved residual value
- Lower working temperatures

PRE-WETTING ANTI-ICING
THE BLENDING SYSTEM COMBINES THE THREE CHEMICALS IN PRECISE AMOUNTS

LIQUID CHEMICALS USED BY MCDOT/WDM

- SALT BRINE
  - Very low cost
  - Dries quickly
  - Effective at pavement temperatures above 20° F
  - Readily available

- CALCIUM CHLORIDE
  - Fairly low cost
  - Very effective at low temperatures
  - Exothermic

- DE-ICE 55 (GEO-MELT)
  - Non-Chloride Inhibitor
  - Effective at low temperatures
  - Good residual effect

WHEN COMBINING CHEMICALS THERE ARE FACTORS YOU MUST CONSIDER

   • HOW DO THE CHEMICALS REACT
   • WHAT % OF EACH CHEMICAL CAN BE MIXED TOGETHER
   • HOW DO YOU ACCOMPLISH PRECISION BLENDING

OUR FIRST CONCEPT DRAWING

OUR FIRST PROTOTYPE MANIFOLD

MANIFOLD BLENDING SYSTEM 2004

AFTER MANY REVISIONS
TODAY’S SYSTEM IN PLACE

2005 BLENDING STATION RECONFIGURATION AFTER IT’S INITIAL SUCCESS

HOW DOES IT WORK?

SUCTION MANIFOLD

PRESSURE MANIFOLD

MIXING BOARD

VALVES ARE COLORED CODED AND LABELED

2 INCH FILL STATIONS

100 GALLON TANKS CAN BE FILLED IN 45 SECONDS
BRINE PRODUCTION

SUPER MIX

Components
- Salt Brine 85%
- Calcium Chloride 5%
- De-Ice 5%

ANTI-ICING PICTURES

PRO-ACTIVE TREATMENT PRIOR TO AN EVENT

You can Prevent This!

SUPER MIX PERFORMANCE

PRE-WET APPLICATIONS
FEBRUARY 4TH AND 5TH 2005
RESIDUAL EFFECT

COSTS - MCDOT

- This is what we figured on our usage per 100:
  - 85% Salt Brine = 85 x .05 = $4.25
  - 10% De-Ice 55 = 10 x 2.06 = $20.60
  - 5% Calcium Chloride = 5 x .43 = $2.15
  - The grand total per 100 = $27.00
  - .27 per gallon

2005-2006 SEASON TOTALS

- 44 CALLOUTS TO DATE
- 8,035.65 TONS OF SALT APPLIED
- 109,212 GALLONS APPLIED
- 55,961 PRE-WET
- 6.96 GALLONS PER TON APPLIED
- 53,251 ANTI-ICING
- 92,830.20 GALLONS OF BRINE
- 10,921.20 GALLONS OF GEO-MELT
- 5,460.60 GALLONS OF CALCIUM
- TOTAL $ SPENT ON LIQUIDS = $29,487.24

Mark in his “earlier years”

WDM’s Concept Drawing

West Des Moines - “A – Team”
Technical Adviser!

Getting Started!

WDM's System

- Computerized Blending
- Can store or “blend on demand”
- Capability to blend 3 products
- Extensive filtering of liquids
- Extensive employee input
- MDSS Compatible
### Liquid Storage Capacity

- 20,000 gallons – Salt Brine
- 12,000 gallons – Super Mix
- 9,000 gallons – Calcium Chloride
- 9,000 gallons – GeoMelt
- 5,000 gallons – Inhibited Chloride
- 15,000 gallons – Extra Storage

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### Computerized Blending

#### Calculation for Making CaCl₂-Brine-Geomelt Blends

<table>
<thead>
<tr>
<th>CaCl₂ Density Chart</th>
<th>NaCl Density Chart</th>
<th>Geomelt Density Chart</th>
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<tbody>
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<td>9.71</td>
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<td>44</td>
<td>12.15</td>
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#### Entry Formulas

- **Enter brine concentration (%):** 23 21 9.96 4 8.56 43 10.11
- **Brine density (lbs/gal):** 9.80 22 10.05 5 8.63 44 10.15
- **Enter brine wt% in blend (%):** 83.0% 23 10.13 6 8.69 45 10.19
- **Enter Geomelt concentration (%):** 55 24 10.20 7 8.75 46 10.23
- **Geomelt density (lbs/gal):** 10.61 25 10.30 8 8.82 47 10.28
- **Enter Geomelt wt% in blend (%):** 12.0% 26 10.40 9 8.89 48 10.32
- **Enter CaCl₂ concentration to blend (%):** 32 27 10.50 10 8.95 49 10.36
- **CaCl₂ density (lbs/gal):** 10.99 28 10.60 11 9.01 50 10.40
- **Enter CaCl₂ wt% in blend (%):** 5.0% 29 10.69 12 9.07 51 10.44
- **Enter desired volume of blend (gal):** 5,000 30 10.79 13 9.14 52 10.48
- **Enter final blend density (lbs/gal):** 10.6 31 10.89 14 9.20 53 10.52

#### Gallons to blend together

- **NaCl brine (gals):** 4,491 35 11.28 18 9.52 58 10.73
- **Geomelt (gals):** 500 36 11.38 19 9.60 59 10.77
- **CaCl₂ solution (gals):** 241 37 11.48 20 9.65 60 10.82
- **38 11.57 21 9.73 61 10.86
- **40 11.77 22 9.80 62 10.90
- **41 11.87 23 9.86 63 10.94
- **42 11.96 24 9.94 64 10.98
- **45 12.25 26 10.00 65 11.02
- **Gallons to blend together**

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### Blend Formulas

#### Pressure Manifold

#### Suction Manifold
Anti-Foaming System

Outside Distribution Lines
Fall-Out – Not Yet!

PROVEN SUCCESS

From its conception, the blending system and the results MCDOT has documented have been shared throughout America. The System has been the focus of many seminars including:

- APWA North America Snow Conference
- APWA Congress
- APWA Chicago Metro Chapter Snow Workshop
- University of Wisconsin Managing Snow Operations Course
- Numerous local seminars

In addition, the system was a featured article in the APWA Reporter.

Calcium Chloride Usage

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<th>Year</th>
<th>Usage</th>
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<td>2005</td>
<td>5,700 gal</td>
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<tr>
<td>Cost Savings</td>
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Salt Brine Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost per gal</th>
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<tbody>
<tr>
<td>2004</td>
<td>22 cents per gal</td>
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<tr>
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<td>5 cents per gal</td>
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<tr>
<td>Cost Savings</td>
<td>$9,930</td>
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Tested Blends

<table>
<thead>
<tr>
<th>Blend</th>
<th>85% Salt Brine</th>
<th>10% GeoMelt</th>
<th>5% Calcium</th>
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<tbody>
<tr>
<td></td>
<td>80% Salt Brine</td>
<td>15% GeoMelt</td>
<td>5% Calcium</td>
</tr>
<tr>
<td>80% Salt Brine</td>
<td>10% GeoMelt</td>
<td>10% Calcium</td>
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<tr>
<td>80% Salt Brine</td>
<td>20% GeoMelt</td>
<td>20% Calcium</td>
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</tr>
<tr>
<td>80% Salt Brine</td>
<td>20% GeoMelt</td>
<td>More to Come!</td>
<td></td>
</tr>
</tbody>
</table>

Independent Lab Testing
Los Alamos
Detroit
Evansville
Aurora
West Des Moines
Canton Ohio ODOT

LOCAL, REGIONAL AND NATIONAL
SIGNIFICANCE

“This new SuperMix really seems to be keeping the curves and hills from becoming as ice covered as in past storms. On some of the area roads which are typically not plowed or driven as frequently, we have noticed that the ice and snow does not build up as fast and cars are able to maintain traction easier. I believe this new procedure is definitely going to enhance driver safety.”

Capt. Glenn Olson
McHenry County Sheriff’s Department

“Out of the box thinking has brought notoriety for this innovative process, enhanced our operation, and holds great promise for the snow removal industry.”
Winter Maintenance Subcommittee

Our Experiences

THANK YOU!

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