Anti-Icing – the Next Step

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Educational Goals
By the end of this talk, you should be able to:
- Describe how to transition your winter maintenance strategy to anti-icing
- Identify the steps you have to take to start anti-icing
- Explain how to minimize the risks in anti-icing

What is Anti-Icing?
“The snow and ice-control practice of preventing the formation or development of bonded snow and ice by timely applications of a chemical freezing-point depressant.”

FHWA Manual of Practice for an Effective Anti-Icing Program
What does that mean?

- Pro-active
  - Do to the snow before it does to you
- Mostly uses liquid chemicals
  - Can use pre-wet solids
- Needs new equipment, new operations method, and new chemicals
- So, what's the problem?

Anti-Icing Reservations

- Many folks are concerned about making the switch to anti-icing
- This talk lays out a process you can follow to get started in anti-icing
- Questions are very welcome!

The Challenge of Change

- If you do the things you’ve always done, you’ll get the results you’ve always got
- So, if you don’t like the results you are getting, you’ve GOT to change the way you do things!
So, What Needs to Change?

- First of all, a change in attitude…
- Because it is pro-active, the decisions in anti-icing need more information
- Some of that information will be wrong some of the time (the weather forecast?)
- How will you deal with that when (not if) it happens?

The Toolbox Approach

- Think of anti-icing as adding a bunch of new tools to your winter maintenance toolbox
- Does not mean you have to use them all the time
- Does mean you will have to learn how to use them!

What are the toolboxes?

- Equipment
- Information
- Chemicals
- People
- Other stuff
- We will look at each in turn
- Also look at what can go wrong
Thoughts About Equipment
- It doesn’t have to be hugely expensive
- You can “do it yourself”
- There is help out there for specifying and getting it going
- You can start small and build things up over time

New Equipment
- Must be able to handle liquid
- Storage tanks
- Sprayer units
- Mixing systems
- Transfer with pumps

Brine Storage - Issues
- Must be contained to avoid spillage
- Pumps, hoses etc. need careful layout
- Most folks are using poly tanks – they seem to work well
- Ensure you have enough
Capacity Issues

- Store enough for at least two applications
- Have enough capacity to be able to make enough brine for one application in a 24 hour period
- Water supply may be a limiting factor
  - Iowa has a water tank trailer for just those locations

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Those Pumps and Hoses

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Delivering the Brine

- Many ways of getting this done
- Slide in units were initially popular
- Special trucks are great
- Trailers seem to be the current thinking
  - Easy to hitch up, do a route, then get back out with your regular load
Tank Styles

Different Spray Systems
- Many different ways of doing this
- E.g. spray v stream
- Experience and personal preference generally dictate
- Streaming seems to offer less problems

Pre-wetting Equipment
- A critical part of anti-icing
- Often makes the spinner a bit complex
- Starting to get pretty well refined
Pre-wet systems

Equipment Resources
- Some excellent stuff available
- Iowa DOT
  - http://www.dot.state.ia.us/maintenance/manuals/equip/index.htm
- SICOP web site has some equipment specs too
  - http://www.sicop.net/documents.htm

Information Toolbox
- Want to be pro-active, so…
- Get out ahead of the storm, so…
- Need information about when the storm will start, so…
- Not usually provided in typical NWS forecast, so…
- Hmmm!
What would be best for Weather info?

- Site specific forecasts (weather on one side of the county can be very different from that on the other side)
- Road weather forecasts, especially road temperature
- Frost forecasts (but very difficult)
- Correct all the time (good luck!)

Getting your Weather data

- State DOTs often have RWIS sites
- May make those available
- For example, Iowa DOT
  - [http://www.weatherview.dot.state.ia.us/](http://www.weatherview.dot.state.ia.us/)
- Ask them, they can only say no!

Iowa DOT's Weather Data
### Other Forecast Approaches

- Private vendors have reasonably priced tailored systems
- You must work with your provider, in an ongoing manner
- Frost runs can be scheduled and don’t always need forecasts
  - These can result in great savings

### Chemicals – what to use?

- Need solids and liquids
- Need to be able to pre-wet
- Expect your sand usage to drop significantly
- So, which chemicals?

### Choosing a Chemical

- The start point is good, old fashioned rock salt
- You can use it to make brine, so you can get both liquid and solid from one source
- But some concerns might lead you to go beyond straight salt
Chemical options

- If corrosion is a concern, consider getting a product with an inhibitor
- If you cannot make brine easily, consider having a liquid delivered
- Your five basic options are salt, calcium chloride, magnesium chloride, potassium acetate, and CMA

Personnel Toolbox

- Training
  - Decision making
  - Operations
- Procedures
- Buy-in by the team

Personnel Pitfalls

- Easy to neglect
- Without this being done well, all else is just junk
- May require a change of attitude throughout agency (and above)
- Potentially the largest barrier
New Management Techniques

- Have to train your workforce in new ways of doing business
- They may be skeptical!
- Training ideas in the FHWA Manual
- Will you support them when things go wrong?
- Will you help them deal with the challenges of getting a new system operational?

What About Other Stuff

- Host of solutions out there for more specific challenges
- Check out the exhibit floor
- Ask on the snow and ice list-serve
- Some examples that I know work

Truck Mounted Thermometers

- Not a perfect tool
- Can give different readings depending on pavement type
- Great for tracking trends
- Focus your attention where it should be – on the road
Innovative Protection of Infrastructure

- Using epoxy-based pavement overlays
- Limit penetration of chemicals into deck
- BUT, also retain anti-icing chemicals more effectively ("hard sponge")
- Significant benefits in both safety and mobility

Wing Plow Guidance Laser

- Up to 12 cy with 800 gal of liquid
- All stainless construction
- Can do a slurry as well as just pre-wet
- Excellent electronic data collection
So, that’s what we need, how do we implement it?
- It WILL take time (about 5 years for the full transition seems typical)
- Do not try to change everything all at once
- Select one or two routes, and do those first
- Watch it all like a hawk, and learn from mistakes
- Keep on learning!

What Are The Risks?
- Split into three parts
  - Chemicals
  - Information
  - Equipment

Chemical Risks
- Liquids will dilute more quickly than solids
- Occasional instances of chemicals causing slipperiness
- Corrosion and environmental concerns
What Causes Slipperiness?

- A number of situations have been identified that may give rise to this
- Most often, over application seems to be the problem
- May also be concerns – are you actually putting down what you think you are?

Slip Slidin’ Away

- Some evidence that liquids may bring up “crud” to the road surface
  - Early in the season
  - Little rain before application
- May also get evaporation and the right hand side of the eutectic curve
  - Solids precipitate out and cause a slurry

Rock Solid or Slippery?

- Appropriate delivery of chemicals (right amount, right time, etc) avoids slipperiness
- Using the simpler sorts of chemicals also seems to reduce the occurrence
  - Salt brine has very few reported occurrences
- A concern, but NOT a show stopping problem
Anti-Icing and the Environment

- Done right you will use less chemical than in traditional methods
- You will certainly use less abrasives
- But there are concerns, especially over corrosion with certain chemicals

The Abrasives Issue

- Abrasives can create significant air quality concerns
- Increasingly, their use may be limited because of stormwater concerns
- Their effectiveness is limited – almost useless were high speed traffic is present
- Their real costs are much higher than their supply cost

Abrasive Residue
### Environmental Concerns

- Everything we put on the highway ends up in "the environment"
- Depending on climate, it may not get very diluted
- Big problem in areas of low precipitation
- Need to monitor what we do, and ensure we do NOT overuse
- Anti-icing uses less chemical than traditional approaches

### Corrosion Issues

- Many de-icers are corrosive
- Corrosion inhibitors don't always help
- Tests can give skewed results
- An area of concern but again…
- Anti-icing uses LESS chemical than traditional methods

### Information Risks

- You rely on the forecast, and it will be wrong
- Sometimes, no big deal
  - It snows a bit more than forecast
  - The storm did not happen
- Sometimes it is potentially lethal
  - The storm began with rain instead of snow
Managing InfoRisk

- Recognize that the information will be incorrect at times
- Work to improve the quality of the information
- Make sure your forecast provider knows what really worries you!
- Consider using what-if scenarios

The Decision Risk

- Lots of different storm types (250+)
- All require slightly different approaches
- Consider getting some sort of tool to provide some suggested actions for a given storm
- The suggested action serves as a starting point, not a fixed decision— you still have the call!
- Again, do what-if thinking

The Equipment Risk

- If you really want to break something, put it on a snow plow!
- More complex actions means more complex equipment
- Again, do not change everything all at once
- Slow but steady wins this race
The Risks of Not Changing

- Streets that are less safe and less mobile
- Greater environmental damage
- Possible tort costs
- Greater operational costs
- Others

Conclusions

- Switching to anti-icing can be done, and there are methodical ways to do this
- What do we need?
- How do we use it?
- How do we avoid the risks?
- There are answers for all three…
Butler County Engineers
Anti-icing

BCEO Brine Operation
Scott L. Bressler
BCEO Operations Deputy

Anti-icing

- De-icing vs. Anti-icing
- Takes place prior to storm
- Jumpstarts the melting process
- Sticks to the roads
- Salt residue remains on the road if storm is delayed
- Can begin treatment prior to storm

Products Available

- Calcium Chloride
- Potassium Acetate
- Calcium Magnesium Acetate
- Sodium Chloride
- Beat Juice
What are the white lines on the road?

Salt Brine
- Iowa DOT
- ODOT
- Brine is a mixture of water and road salt.
- Concentration of 23% salt
- Freezing point of -6 degrees

How is Brine Made?
- Road Salt is loaded into the 5 ton Hopper
- Takes 2 tons of salt for every 2,000 gallons of brine.
- 3,000 gallons / hour
- Control sump
Storage Tanks

- Automatically transferred to two 6,100 gallon storage tank
- Two Fill Stations plus remote sites
- Five 1,950 gallon Self-loading Direct Application Units
- Takes 11 minutes / truck to fill. 5hp Electric pump, 250 gal/min.

Application to the Road

Multi-lane Application
**Application Rate**
- Pre-treat estimated 670 lane miles of County Rd. at 40 gallons / lane mile.
- Equates to 26,800 gallons.
- Takes one full day to cover using five trucks.
- Brine lasts for up to seven days.

**Old Method Vs. New Method**

<table>
<thead>
<tr>
<th>Old Method</th>
<th>New Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-treat with salt just prior to the storm</td>
<td>Pre-treat with brine 7 days prior to the storm</td>
</tr>
<tr>
<td>Pre-wet the salt with Calcium</td>
<td>Pre-wet the salt with Brine</td>
</tr>
<tr>
<td>Involves Overtime</td>
<td>Regular hours</td>
</tr>
</tbody>
</table>

**BCEO Capital Outlay**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Brine Maker</td>
<td>$17,530</td>
</tr>
<tr>
<td>Five Self Loading Direct App. Units</td>
<td>$49,656</td>
</tr>
<tr>
<td>Four 6,100 Gallon Storage Tanks</td>
<td>$13,944</td>
</tr>
<tr>
<td>One 5,000 Gallon Tanker</td>
<td>$12,000</td>
</tr>
<tr>
<td>Estimated Incidental Cost</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

**Total Cost** $103,130
Savings (Material)

Pre-treat in advance of storm (2003)

- (Old Method) Salt - takes 134 tons of salt to cover the County Roads at $46.50/ton
  $6,231
- (New Method) Brine - takes 26,800 gallons of brine to cover the County Roads at $0.07/gallon
  $1,876
- Savings based on an average 15 events per year
  * $65,325

Benefits

- Safety to the Motorist
- More time to respond
- Easier to plow off
- Less overtime
- Less salt (salt scatter to the ditch)
- Pre-treat in advance of the storm
- Cost savings

Additional Benefits

- Developed a plan that would benefit the County Engineers office as well as the townships and cities. This includes remote brine processing/storage/fill sites.
- Reduced our expenses driving back to the garage to reload. (estimated to be approximately $6,000/yr) labor only
- Provides even a better level of service to the public
Facts we Considered

- The county is 469 square miles. From the BCEO garage, it is twelve miles in any direction.
- It takes approximately 26,800 gallons of brine to pre-treat the entire county.
- With five brine distributors, it takes us a full day to cover the entire county.

Need for Remote sites

- Looked for a site on the east and west side of the county to help reduce travel time.
- Found a township on each side of the county that was interested in purchasing the system and producing brine or storing Brine for the county to draw from.

<table>
<thead>
<tr>
<th>Township</th>
<th>Total Brine Needed</th>
<th>Maintained Roads</th>
<th>County Maintained Roads</th>
<th>County Maintained Brine</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Chester Twp</td>
<td>2240 gallons</td>
<td>28.37 miles</td>
<td>1440 gallons</td>
<td>18.47 miles</td>
</tr>
<tr>
<td>Wayne Twp</td>
<td>2640 gallons</td>
<td>33.16 miles</td>
<td>1680 gallons</td>
<td>21.48 miles</td>
</tr>
<tr>
<td>St. Clair Twp</td>
<td>3440 gallons</td>
<td>42.88 miles</td>
<td>1040 gallons</td>
<td>12.94 miles</td>
</tr>
<tr>
<td>Ross Twp</td>
<td>2640 gallons</td>
<td>33.33 miles</td>
<td>2480 gallons</td>
<td>31.29 miles</td>
</tr>
<tr>
<td>Reily Twp</td>
<td>2240 gallons</td>
<td>28.0 miles</td>
<td>1440 gallons</td>
<td>18.47 miles</td>
</tr>
<tr>
<td>Oxford Twp</td>
<td>2480 gallons</td>
<td>30.87 miles</td>
<td>2160 gallons</td>
<td>26.79 miles</td>
</tr>
<tr>
<td>Morgan Twp</td>
<td>2480 gallons</td>
<td>30.99 miles</td>
<td>1600 gallons</td>
<td>20.42 miles</td>
</tr>
<tr>
<td>Milford Twp</td>
<td>4240 gallons</td>
<td>52.97 miles</td>
<td>1920 gallons</td>
<td>23.83 miles</td>
</tr>
<tr>
<td>Madison Twp</td>
<td>9120 gallons</td>
<td>113.72 miles</td>
<td>2240 gallons</td>
<td>28.18 miles</td>
</tr>
<tr>
<td>Liberty Twp</td>
<td>880 gallons</td>
<td>10.8 miles</td>
<td>0 miles</td>
<td>5.8 miles</td>
</tr>
<tr>
<td>Lemon Twp</td>
<td>2800 gallons</td>
<td>34.62 miles</td>
<td>2080 gallons</td>
<td>25.72 miles</td>
</tr>
<tr>
<td>Hanover Twp</td>
<td>5840 gallons</td>
<td>72.6 miles</td>
<td>1120 gallons</td>
<td>14.23 miles</td>
</tr>
<tr>
<td>Fairfield Twp</td>
<td>5840 gallons</td>
<td>72.6 miles</td>
<td>1120 gallons</td>
<td>14.23 miles</td>
</tr>
</tbody>
</table>
Keep on Improving

- Started w/ three distributors, added two more in 2005
- Added another 6100 gallon storage tank at BCEO

Added three remote sites
Purchased a 5000 gallon tanker
pump material 195gal/min

Results
- Can apply more than 26,800 gallons of brine on all county roads in a full day
- We can deliver brine to the remote sites
- We make and sell brine to other agencies such as the townships, City of Hamilton, City of Oxford, various townships
- We can use our tanker as an additional remote site

Points to Consider
- Size of water service
- Fill stations / pump size
- Automatic transfer
- Remote sites
- Clean system regularly
- Need tanker endorsements
- Watch weather forecasts
- Temperatures
- Inform public
- Type and condition of the trucks you are using
Consider Types of Bodies

Questions