A winter landscape with snow-covered trees and a road under a blue sky. The scene is a wide-angle shot of a two-lane road curving to the right. The road is dark asphalt with a yellow center line. The surrounding area is covered in snow, and the trees are bare and heavily laden with white snow. The sky is a clear, pale blue with some light, wispy clouds. The overall atmosphere is cold and serene.

Chlorides in Winter Maintenance – An International Perspective

Highlights of the Transportation Research Board workshop on winter
maintenance and the environment

Held on January 13, 2019



TRANSPORTATION RESEARCH BOARD

- Provides innovative, research-based solutions to improve transportation.
- Manages transportation **research** by producing publications and online resources.
- **Convenes** experts that help to develop solutions to problems and issues facing transportation professionals.
- Provides **advice** through its policy studies that tackle complex and often controversial issues of national significance.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Workshop on Environmental Issues in Winter Maintenance

- Discussion with attendees from around the world
 - What are their concerns?
 - Have they already solved a problem that I'm struggling with?
 - How can we make win-win changes – now and future?
 - How can products/services be more helpful?
 - Where is research and development most needed?

Workshop Outline

Session 1

State of winter maintenance and overarching issues from winter maintenance and environmental perspectives

Wilf Nixon, Salt Institute

Dave Evans, Virginia Department of Environmental Quality

Session 2

Moving forward, making changes in large and small agencies

Caleb Dobbins, New Hampshire DOT

Phill Sexton, Consultant at WIT Advisers

Session 3

Promising practices, new research

Laura Fay, Montana State University, Western Transportation Institute

Key Themes

- Examples of effective and green practices abound – but are commonly under-adopted



Implementing Excellent Practices

Some examples of practice that are being implemented in response to environmental regulations around the US...

Collected by:
Wilf Nixon, Ph.D., P.E.
VP Science and the Environment
Salt Institute

Storage

- ✓ Good housekeeping policies must be implemented at salt piles
- ✓ All salt will be stored on an impermeable pad
- ✓ Pads must be constructed to avoid drainage onto the pad, and a collection point must be constructed for drainage
- ✓ Salt piles shall be covered at all times except when in active use, unless stored indoors



NH DOT



Application

- ✓ Road salt will be pre-wetted before use
- ✓ Equipment will be purchased and utilized to measure the pavement temperature
- ✓ All salt spreading equipment must be calibrated at least annually. Records of the calibration results must be maintained
- ✓ Develop and implement a protocol to vary the salt application rate based on pavement temperature, existing weather conditions, and forecasted weather conditions



NH DOT

Policy

- ✓ Salt quantity used and storm conditions will be tracked during each storm and recorded
- ✓ A plan must be developed for implementation of anti-icing. The plan should consider increased use of liquids
- ✓ Employees must undergo annual training in best practices in the use of road salt



Performance Measurement

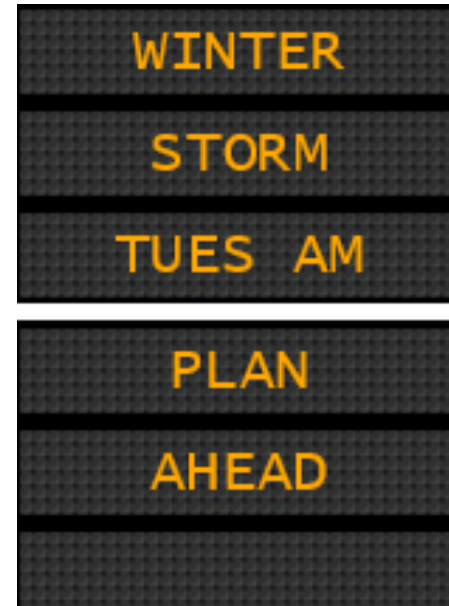
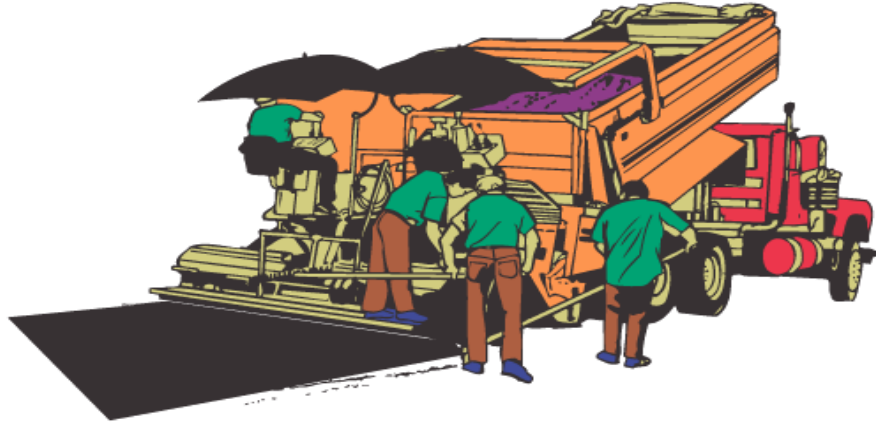
- ✓ Any contractors will be expected to comply with the permittee's own EMPs and training programs
- ✓ Equipment to measure the pavement temperature will be installed on the winter maintenance fleet for a sufficient number of vehicles to adjust application rates for the most efficient levels.
- ✓ A method must be developed to determine whether each truck in the fleet applied salt at the recommended rate, why any variations occurred, and ensure that a variation occurs only when strictly necessary



Shade Removal- Before / After -- NH DOT



Other NH DOT Efforts



Flexible Plow Blades

The more you can mechanically remove, the less that must be chemically removed!

Blades are produced in 3' and 4' lengths.

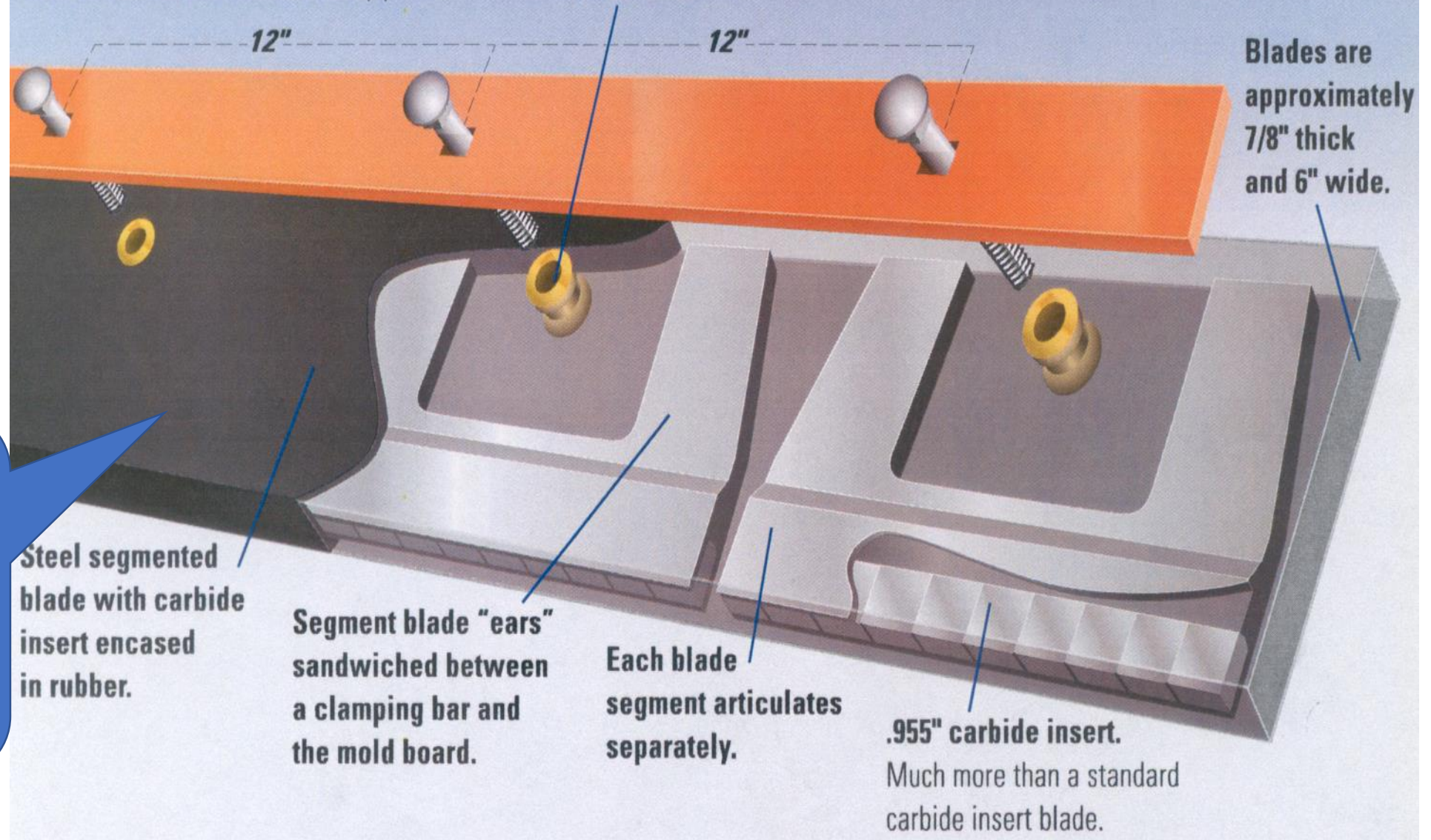
These lengths can be combined to fit most front mounted or underbody plows.

Mounting Bushings Are Spaced At 12" Centers.

This is done to get maximum oscillation.

Directly adaptable to standard highway punched (3, 3, 12") plow

Note: For applications, such as 8" centers, an adapter blade might be required.



Key Themes

- Chloride reduction, budget, and safety are not necessarily at odds.





RESULTS - SWiM™ is Good for Business

No. of Parking Spaces	Cost per Parking Space	SWiM™ Certified? (Yes or No)	Tons Salt applied in a season per 1,000 sq. Ft	Other factors
884	\$365.72	No	1.346	Landscape damage replacements exceeded \$25k due to salt damage. Recorded slip and fall incidents were not available.
832	\$271.29	Yes	0.375	Recorded slip & fall incidents decreased and no landscape damage.
322	\$367.15	No	1.072	Recorded slip & fall incidents increased. <i>Costs included hauling each storm which increases the cost by ~\$200 per parking space.</i>
327	\$286.32	Yes	0.362	No recorded increase in slip & fall incidents.



Co\$st Benefit Analysis



SWiM™ Data Dashboard...

Savings (conservatively) = \$1.7 million & 20,000,000 lbs.
of salt per year

.6tons x \$172/ton x 8 acres = \$627 x 30apps = \$24,768/year x 67 stores

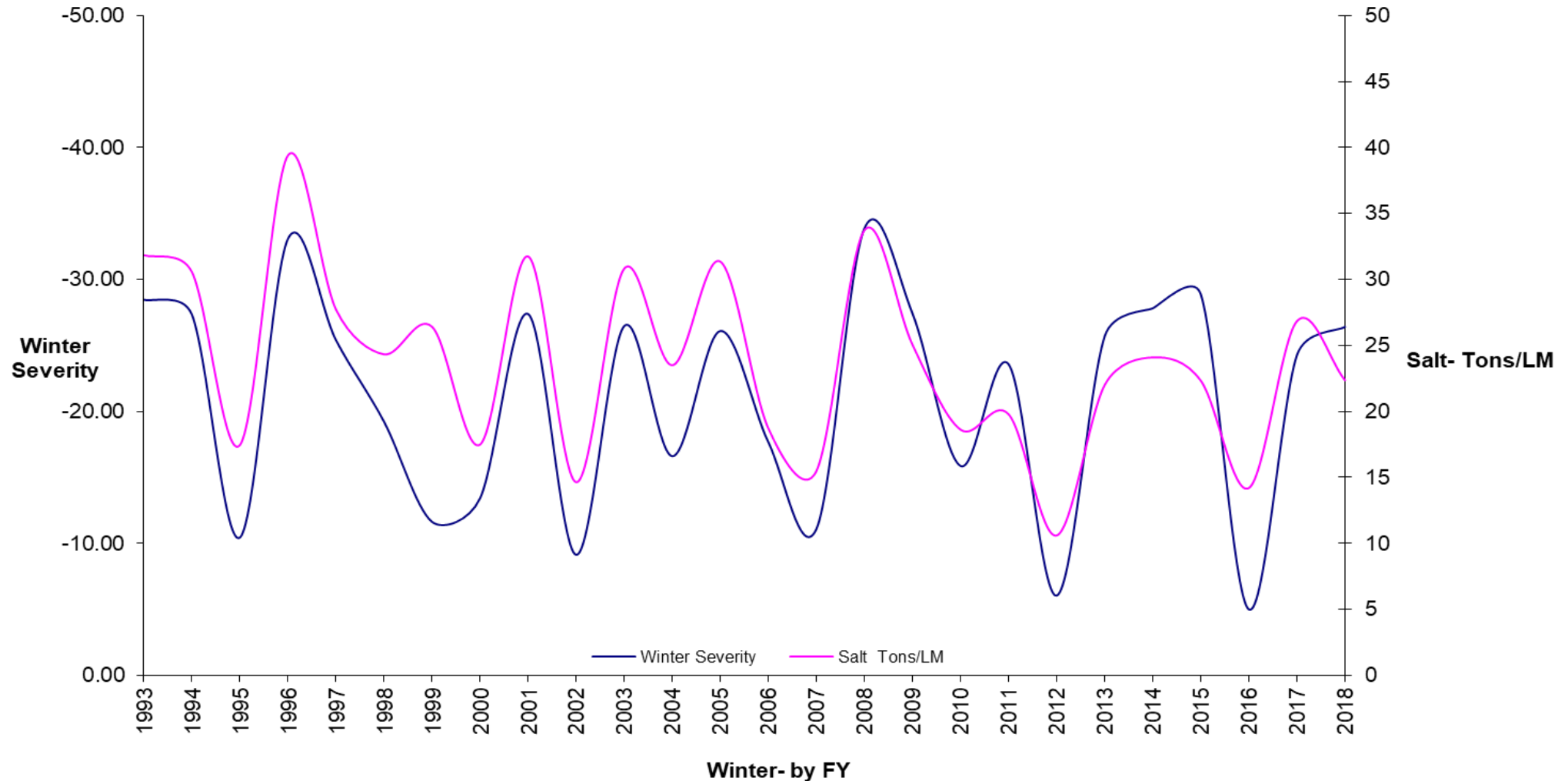


4,000 + fewer
loads / trips



Winter Severity vs. Salt Usage – NH DOT

Derry- PS 528
Winter Severity and Salt Use



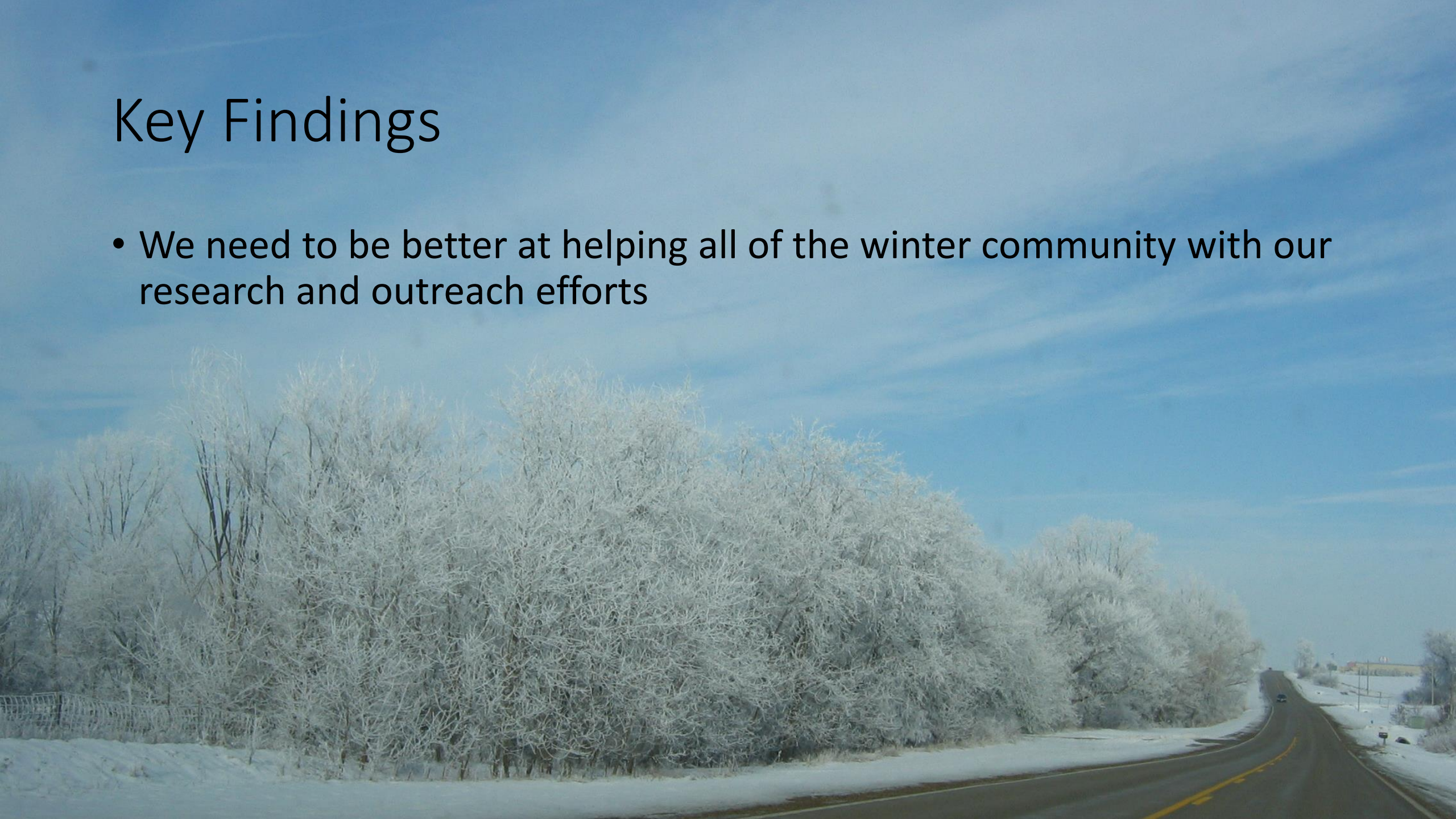
Salt Reduction Due to Best Practices – NH DOT

Derry- Patrol Shed 528

FY	Average WI	Salt Usage-Total Tons	Salt Usage-Tons/LM	Predicted Usage/LM	% Diff/LM
2008	-33.89	3480	33.7	37.8	-10.8%
2009	-27.41	2584	25.0	31.8	-21.3%
2010	-15.87	1921	18.6	21.2	-12.0%
2011	-23.57	2041	19.8	28.3	-30.0%
2012	-6.05	1135	10.6	12.1	-12.3%
2013	-25.71	2442	22.0	30.2	-27.2%
2014	-27.82	2767	24.1	32.2	-25.2%
2015	-28.88	2651	22.3	33.2	-32.7%
2016	-5.00	1741	14.2	11.1	27.8%
2017	-24.27	3395	26.8	28.9	-7.2%
2018	-26.42	2953	22.4	30.9	-27.6%

Key Findings

- We need to be better at helping all of the winter community with our research and outreach efforts



Studies conducted in NH, MN, WI, IL, NY, VA, MD, Ontario and other Great Lakes Regions indicate **a majority of** non point source pollution of fresh watersheds from **chlorides originate from** de-icing salts used by private **PARKING LOTS** and local municipalities.

TROUBLE IN NEW HAMPSHIRE

A 2008 study on chloride contamination along the I-93 corridor helped lead to the creation of New Hampshire's Green SnowPro certification.

Total imports:
4,814 tons/yr

Imports divided
by drainage area:
473 tons/sq mile

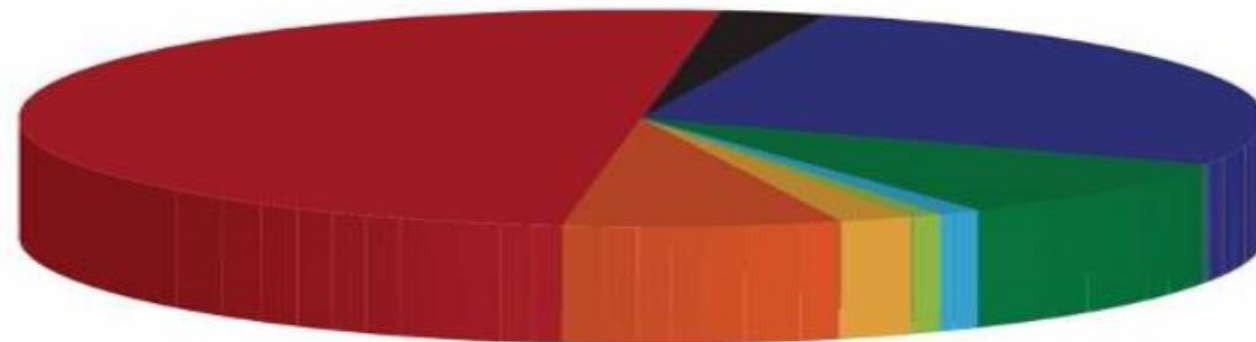
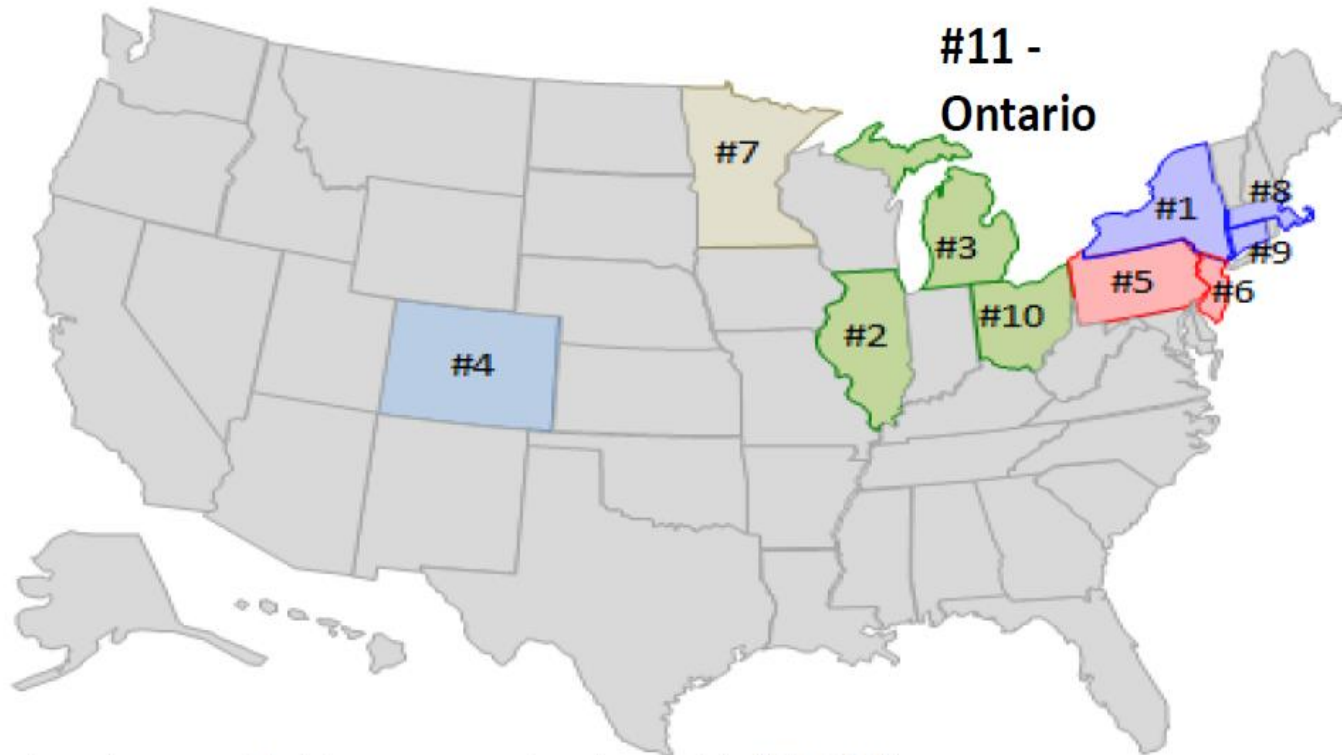


Figure 2. Chloride loads measured in Policy - Porcupine New Hampshire watershed region (Burak, et al., 2008).

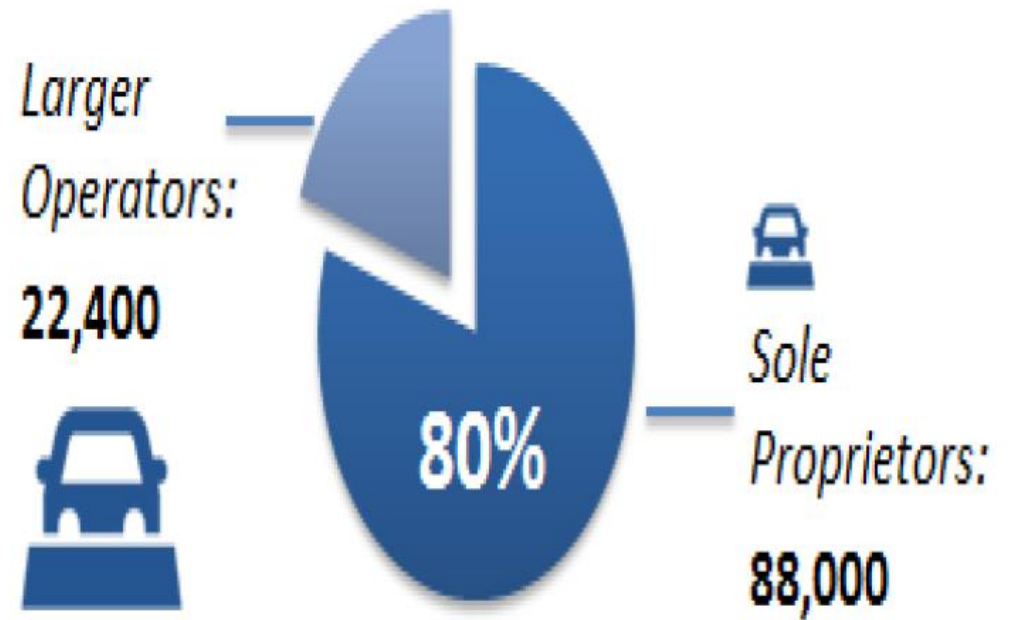
SOURCE: BURACK ET AL. 2008

How can a highly fragmented industry reduce the rate and frequency of salt it applies?



Largest commercial winter management service markets (IBIS, 2014).

TOTAL S&I SERVICE OPERATORS



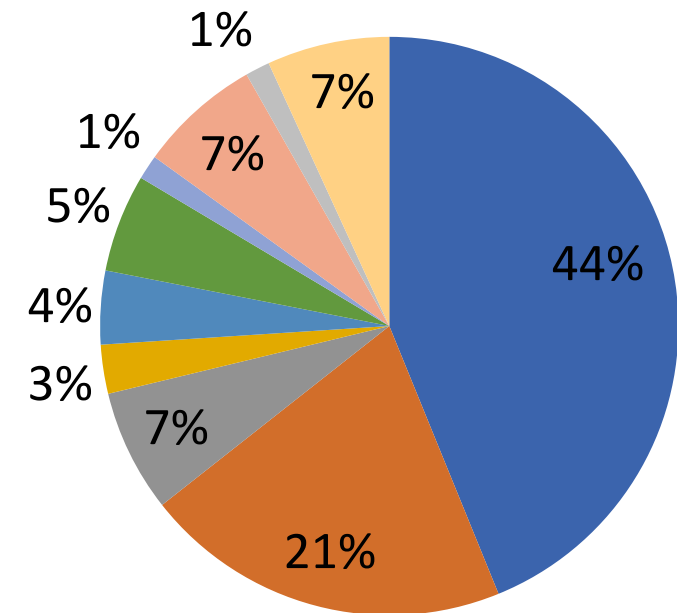
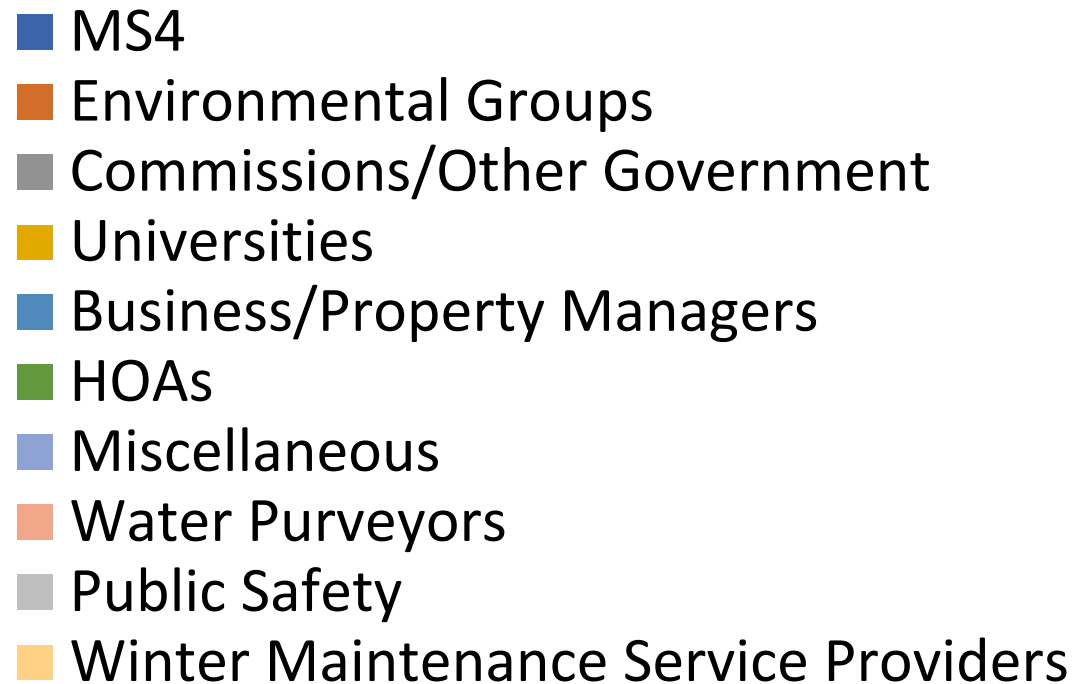
The number of commercial Winter Management Operators confirmed in a 2016 Snow & Ice Management Association industry research study. (Wolf, 2016).



Engaging a Very Broad Set of Stakeholders – the VA DEQ Experience

- Many see winter salt as a road maintenance issue, much more to it....
- Involves variety of public and private parties

Stakeholder Advisory Committee Members (73)



Key Themes

- The biggest barriers do not seem to be technological ones but rather in managing/sparking change



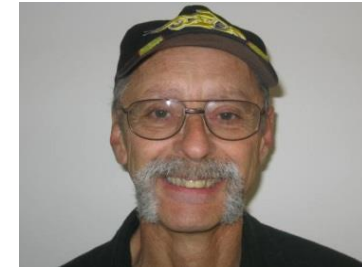
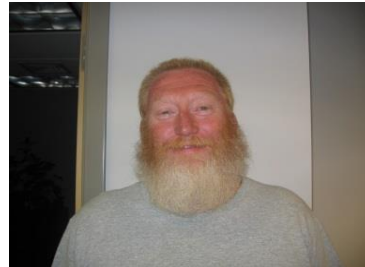
Avoiding Perception of Reduced Public Safety – the VA DEQ Experience

- Acknowledge public safety is top priority
- Review Levels of Service
- Recognize that telecommuting is not always an option
- “Optimizing” salt -- reduce salt and costs while achieving safety and accessibility goals



Conclusions from NH DOT

- Salt use can be reduced from previous levels
- Maintenance personnel must understand that the only way to achieve this goal is thru their actions and commitment



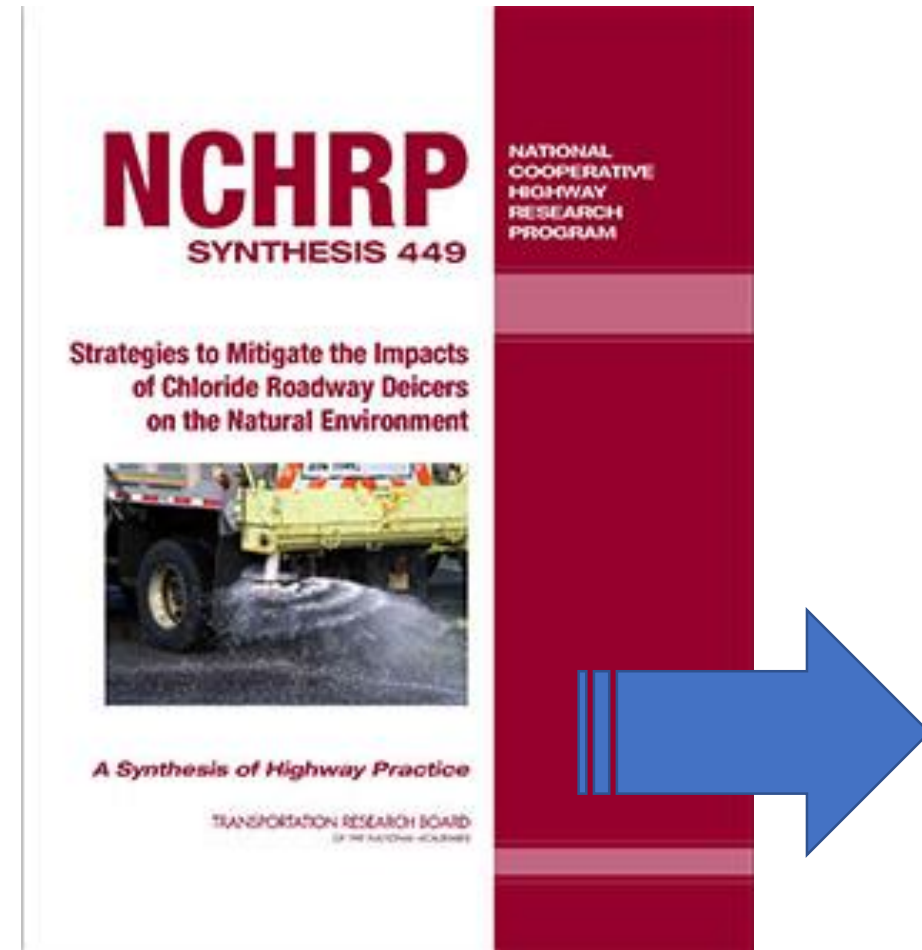
How Do We Encourage More Champions?

- Top down support!
- Listen to what folks on the ground need/want, and let them make it happen!
- Talk about it
 - Present at conferences
 - Write an article (APWA reporter, Roads and Bridges, etc.)
 - Make the information available



Now What? How Is Our Committee to Respond?

- Promote particularly effective programs/methods at a national level
- Reach out to new stakeholders
- Call for research in improving effective & green WM practices





Thanks for Listening Questions/Comments?

Tina Greenfield

Iowa DOT Road Weather Coordinator

Chair, TRB Winter Maintenance Committee

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