

2020 Michigan Winter Operations Conference

Day 3 – Thursday, October 15th



Best Practices for using Liquids in Winter Operations including Liquid Only Routes



TODAYS TOPICS

- WHY?
- BENEFITS OF LIQUIDS
- MAKING AND STORING LIQUIDS
- BLENDING OF LIQUIDS
- APPLYING LIQUIDS AND EQUIPMENT NEEDED
- LIQUID ONLY ROUTES CASE STUDIES – WHO IS ALREADY DOING THIS
- WRAP UP



Why and the Benefits of Liquids



You Are Already Using Liquids

Salt Doesn't Melt Anything

Until It's In
Solution





Typical Liquid Products

- Natural Occurring Salts
 - Sodium Chloride – 23% solution
 - Calcium Chloride – 32% solution
 - Magnesium Chloride – 28% solution
 - Potassium Chloride
- Other Chemicals
 - Urea
 - Calcium Magnesium Acetate
 - Agricultural Products – Both by-products and engineered products
 - Various Additives



Why do we use liquids?

- Reduce salt usage
 - ✓ Prevent or break the bond
 - ✓ Reduce bounce and scatter
 - ✓ Activate salt quicker
 - ✓ Save money
 - ✓ Reduce environmental impacts



Terminology of Treatment Types

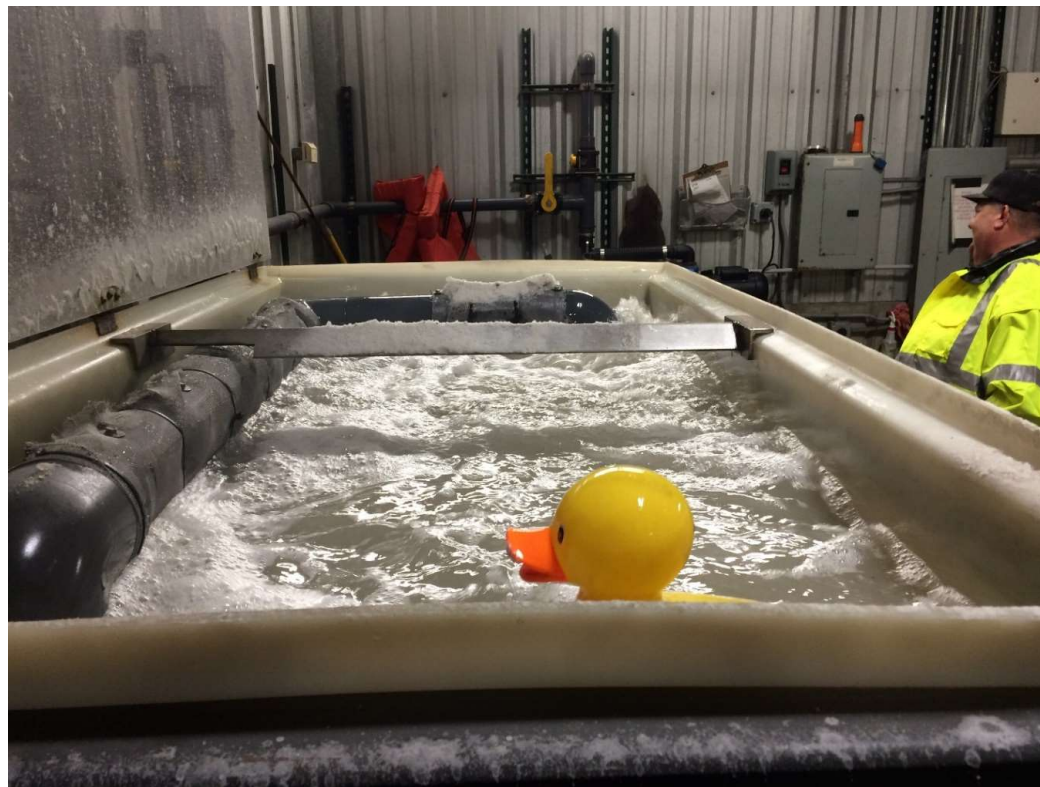
1. De-icing – traditional approach to snow and ice control
2. Anti-icing – sometimes referred to as pre-treating or direct liquid application (DLA)
 1. Typically with liquids
 2. Pre-wetted solids
3. Pre-wetting – applying liquids to solids before placement on surface or roadway
 1. In stock pile (pre-treated salt)
 2. At discharge
 3. On truck load (not recommended)
4. High Volume Output
 1. High amounts of liquids combined with some solids
 2. Direct Liquid Application for de-icing – high amounts of liquids



Making and Storing Liquids



Brine Making is Easy & Cost Effective



Brine Makers



Early

Modern





Continuous Brine Making Machine

Continuous brine making machine. Undissolved fines and solids are automatically and continuously removed during brine production. up to 6,000 GPH output or our Ultimate controls up to 10,000 GPH output.





Liquid Storage – Best Practices

- Above ground storage
- Proper containment system
- Double walled tanks
- Sufficient storage
- Blending liquids





October 13-15, 2020
Virtual Conference



Fort Collins, Colorado

- 10,000 Tons Salt capacity
- 230,000 Gallons

Material Management

- Truck Loading Island
- Quick Attach Setup
- 4 Loading Arms
- 2 Hand Style Hoses
- 160 GPM Loading





Blending Liquids



Chloride Cocktails

The Art Of Blending Liquid Deicers





Mixtures Can Be Purchased





Do Your Homework!

- Blending – How will the products work together?
- What am I trying to achieve?
- What am I applying to the environment?
- What is the cost/benefit ratio?
- Is this my best option?



How sugars help



Automated Blending System



THE OPERATOR CONNECTS THE HOSE,

ENTERS HIS TRUCK NUMBER,

ENTERS AN AMOUNT

AND IT FILLS IT PRECISELY ACCORDING TO THE PREDETERMINED FORMULA





APPLYING LIQUIDS AND EQUIPMENT NEEDED



Anti-Icing Equipment is it right for DLA?





Anti-icing



- Streamer nozzles
- 8" – 12" spacing (2-300 Mm)
- Anti-icing – 20 gal to 50 gal per Lane-mile - for DLA ? How high does it go
- Better friction, established chemical layer and improved public perception



Anti-icing

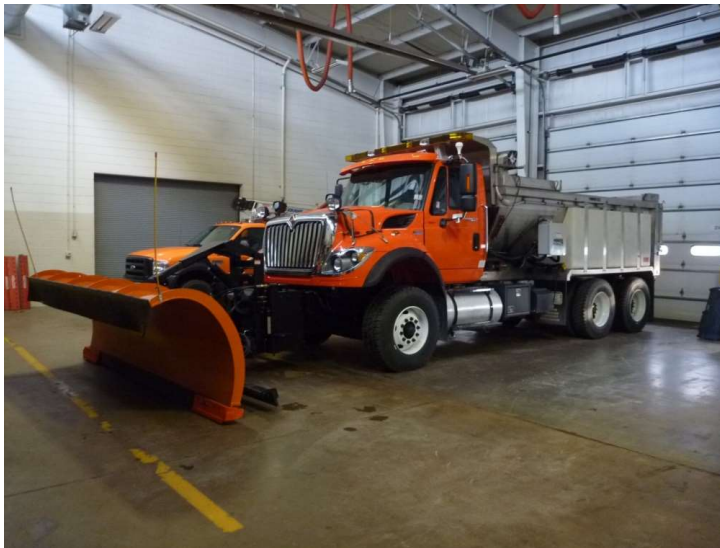
- Proactive strategy accomplished by applying liquid directly to the road surface
- Generally used in advance of an event
- Focus on hills, bridges & major roads
- Benefits;
 - Better pavement conditions
 - Less chemical required
 - Applications can last for days
 - Lower costs resulting from less chemical





Trucks with 970 gallons of On-Board Liquid

These are not anti-icing units





Two flood nozzles



430 gallon tank installed inside the
truck body





Anti-Icing Equipment



Source: City of Waconia



Anti-Icing Equipment





Anti-Icing Equipment



Source: Varitech Industries



Overseas equipment





October 13-15, 2020
Virtual Conference





Wisconsin modified unit – the L Bar

Concentrates the liquid at the
middle of the road.

This is a direct liquid
application modification

The taper of the road allows
the liquid to work its way
across the pavement





LIQUID ONLY ROUTES

CASE STUDIES – WHO IS ALREADY DOING THIS



- **09-02: Identifying the Parameters for Effective Implementation of Liquid-Only Plow Routes (2010)**

This project identified the optimal circumstances and most effective methods for using liquid routes during winter storm events. The researcher produced a quick-reference guide for practitioners that outlined the safe and effective parameters at a glance. The final report also included recommendations on how to field test and verify the recommended practices.

<http://clearroads.org/project/identifying-the-parameters-for-effective-implementation-of-liquid-only-plow-routes/>



Liquid Only Routes - Where?





When?

Warm Pavement Temperatures

- Slushy roadways



Parameter	Most Favorable For DLA	Consider DLA
Pavement Temperature	25°F or above	20°F or above
Storm Intensity (inches/hour)	0.5 inches/hour or below	1.0 inches/hour or below
Moisture Content	Ordinary	Dryer Snowfall (consider plow-only)

CONDITIONS MUST BE CORRECT FOR USING LIQUIDS IN DEICING

Warm Pavement Temperatures

Low or No Additional Snowfall Rates

Short Route Cycle Times

No Blowing Snow





User feedback in McHenry County



3 liquid only routes that start and terminate at the facility



Replaced existing tanks with (10) 15,000 gallon tanks



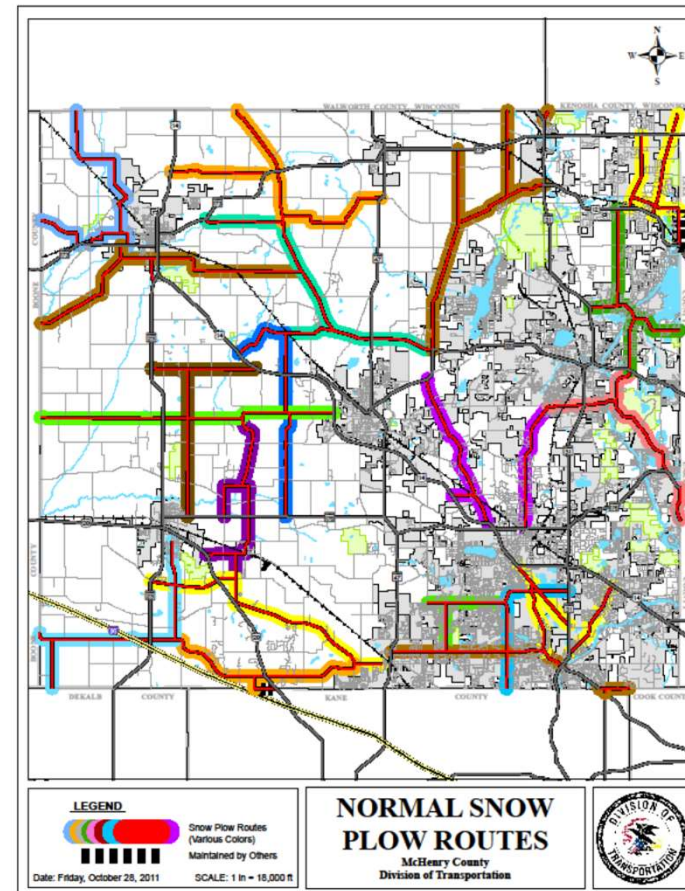
Four tanks holding Supermix, four tanks holding brine, one tank beet juice, last tank calcium chloride. They are running 3 liquid routes 80/20 - 80 %brine/20%beet juice. Chlorides only used in extreme temps.



Results

A 30% reduction in salt use over the routes using granular.

Route completion almost 3 hours sooner than routes using granular.





Ohio DOT

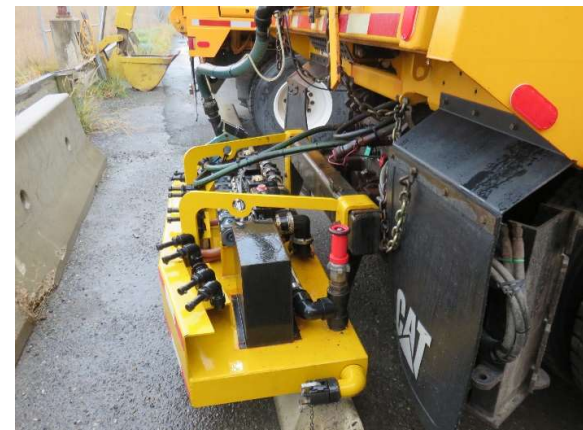


Liquid only routes are used
throughout the winter and on all
ramps to the expressways





British Columbia - Coquihalla Hwy





LIQUID ONLY ROUTES IN WISCONSIN

STATE DRIVEN BUT IMPLEMENTED BY THE COUNTIES



2017 Liquid Only Pilot



2017 Pilot Data

- All liquid applications for 14 storm events
- Cost decrease of 64% on material application
- Application issues with full lane liquid applications 9' with add a lane feature
- Changed application system to twin 4' centerline to quarter crown application with direct flow pencil nozzles 0.008"



October 13-15, 2020
Virtual Conference





New Setup for 2018-2019 Pilot





October 13-15, 2020
Virtual Conference

2018 Liquid Only Pilot

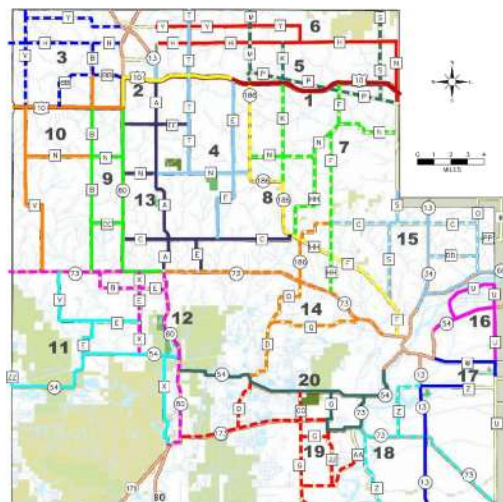




Methodology

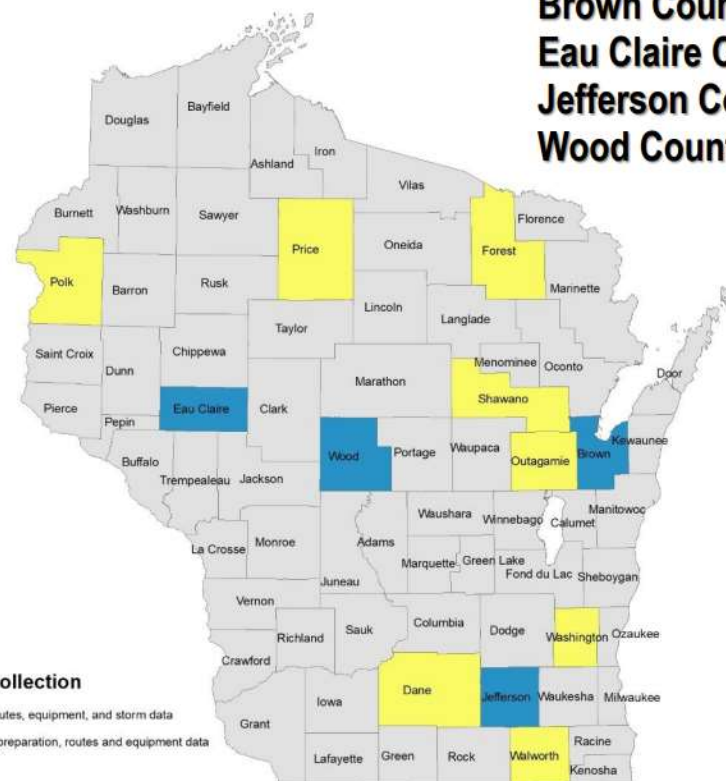
Data Collection

Wood County Winter Maintenance Routes



Data Collection

- Routes, equipment, and storm data
- In preparation, routes and equipment data



Brown County
Eau Claire County
Jefferson County
Wood County





Results Comparison Group Analysis

Wood County

Description	Study	Control	Comparison		p-value
Salt usage (lb/ln-mi)	155	298	-143	-48%	0.019
Cost w/ salt brine \$0.08/gal (\$/ln-mi)	\$8.6	\$16.5	-\$7.9	-48%	0.019
Cost w/ salt brine \$0.14/gal (\$/ln-mi)	\$14.3	\$16.6	-\$2.3	-14%	0.519
Time to Bare/Wet (hr)	9.8	12.5	-2.7	-22%	0.001

Jefferson County (two control routes)

Description	Study	Control	Comparison		p-value
Salt usage (lb/ln-mi)	965	\$1,471	-622	-36%	0.001
		\$1,097	-180	-14%	0.239
Cost w/ salt brine \$0.08/gal (\$/ln-mi)	\$42.0	\$63.9	-\$22	-46%	0.001
		\$47.7	-\$6	-12%	0.300
Cost w/ salt brine \$0.14/gal (\$/ln-mi)	\$47.9	\$63.9	-\$16	-34%	0.007
		\$47.7	+\$0.2	+0.4%	0.969
Time to Bare/Wet (hr)	9.7	16.8	-7.1	-42%	0.001



Wrap Up



So, Liquids Are Always the Answer, Then?

- No, not always – there are times not to use them
- When a storm starts with rain...
- When the temperature is too low for the liquid to be effective – what is the temperature? Depends on the liquid...
- When wind speeds during the storm will be high enough to cause drifting (above 15-20 mph)





Sometimes nothing is the best option



Tue Jan 8 2019 03:27:28 PM



205567 1 Lat: 47.8323 Lon: -96.1427 Time: 2019-01-08 14:42:15



205567 1 Lat: 47.9452 Lon: -96.2209 Time: 2019-01-08 15:07:17
MARCOUX TO TRF



So, If I can't Use Liquids, What Then?

- First thing to note is that not every storm precludes the use of liquids
- But, if some of your storms do not allow liquids then you will not get all the benefits of using liquids
- It may still be advantageous to make use of them when conditions allow

