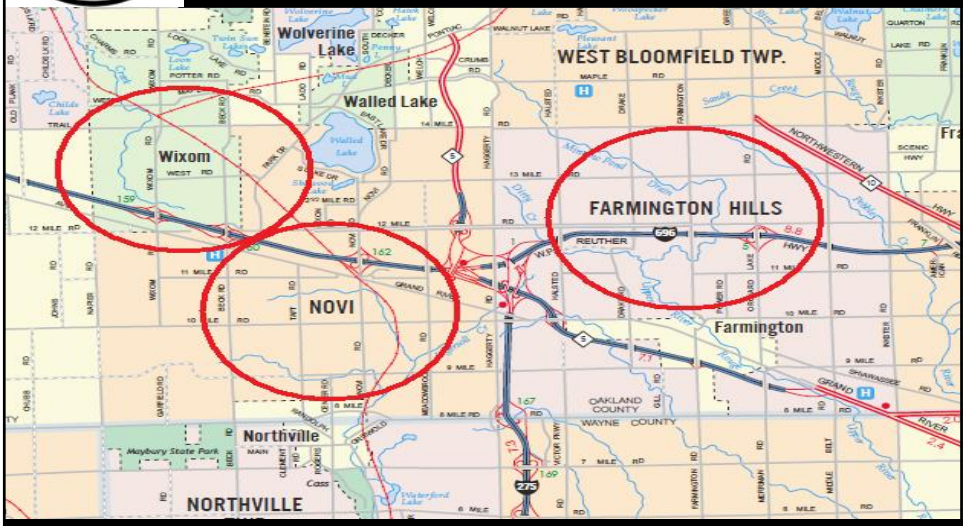
S.E. Michigan Municipalities Collaborate to Advance Direct Liquid Application Strategies

Michigan's Local Technical Assistance Program
LTAP - Bridging the gap between research and practice

3RD Annual Winter Operations Conference
GAYLORD, MICHIGAN
October 16-17, 2013

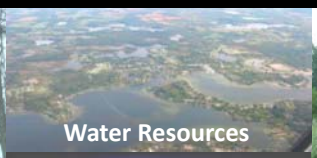
3 Cities that Understand Collaboration



Direct Liquid Application (DLA) Project Goals

- Expand on previous efforts conducted by ClearRoads- 2010
- Determine what percentage of events could be successfully handled with DLA (original conjecture—40-50%)
- Improve service levels
- Reduce cost
- Reduce impact to infrastructure and environmental resources through improved salt use efficiency

Rationale for DLA Implementation



The Use of Road Salts for Highway Winter Maintenance: An Asset Management Perspective

Xianming Shi, Ph.D.
Program Manager, Weather & Winter Mobility
Western Transportation Institute
Montana State University
P.O. Box 174250, Bozeman, MT 59717-4250
Phone: (406) 994-6486
Fax: (406) 994-1697
Email: Xianming_s@coe.montana.edu

ABSTRACT

Chloride-based chemicals, known as road salts, play a key role in ensuring safe winter-driving conditions. However, there are growing concerns over negative impacts that road salts pose on motor vehicles, the transportation infrastructure, and the environment.

The corrosion and environmental costs pertinent to road salts amount up to at least *$469 per ton on average*, and they are often ignored in formulating highway winter maintenance strategies. The magnitude of such hidden costs is significant compared with the nominal cost of using road salts for snow and ice control (approximately three times). Some products for snow and ice control may cost less in regard to materials, labor and equipment, but cost more in the long run as a result of their corrosion and environmental impacts. Therefore, an asset management perspective should be utilized to ensure that any cost savings of winter maintenance practices would not be at the price of deteriorated infrastructure, impaired environment, or jeopardized traveler safety. The crux is to strike the right balance in meeting multiple goals of the highway agency, including safety, mobility, environmental stewardship, infrastructure preservation, and economics. Considerable amount of research is still needed in order to fill the knowledge gap and establish a scientifically robust, defensible decision-making process for highway winter maintenance.

The corrosion and environmental costs pertinent to road salts amount up to at least *$469 per ton on average*, and they are often ignored in formulating highway winter maintenance strategies. The

Based on Dr. Shi's Research

10 year Projected Deferred Maintenance Costs Related to Indirect Costs of Road Salt

These projections are based on the following information:

1.) Road salt cost (delivered--**$40.00/ton**)
2.) Annual salt use--**500,000 tons/year**---This is a cooservative number
3.) Research indicating indirect costs of salt at $500.00/ton---will use conservative number of **$200.00/ton**
4.) Inflation at **3%** per year

Year	Tons*	Indirect cost/Ton	Total Indirect cost/Year**	3% inflation-year end	Prior year	Total Year End
1	500,000	$200	$100,000,000.00			$100,000,000
2	500,000	$200	$100,000,000.00	$3,000,000	$100,000,000	$203,000,000
3	500,000	$200	$100,000,000.00	$6,090,000	$203,000,000	$309,090,000
4	500,000	$200				$418,362,700
5	500,000	$200				$530,913,581
6	500,000	$200				$646,840,988
7	500,000	$200				$766,246,217
8	500,000	$200				$889,233,603
9	500,000	$200				$1,015,910,611
10	500,000	$200	$100,000,000.00	$30,477,318	$1,015,910,611	$1,146,387,929

$1,146,387,929

* This number represents only road salt used on Michigan state roads. Total salt used on other County/City/other Governmental and non Governmental entities is not known
** This number does not include the actual cost of salt estimated at $40.00/ton

2007/2008 salt totals for Michigan state roads was nearly 800,000 tons. The 12 year average from 1997-2008 is 615,000 tons

The mission: Use salt to provide
SAFE & DEPENDABLE Transportation During Winter

Identifying the Parameters for Effective Implementation of Liquid-Only Plow Routes

EVS, Inc.

CLEAR ROADS
research for winter highway maintenance

Indiana DOT Collaboration: Winamac Sub-District
Dennis Belter, InDOT-Project

Link---http://www.clearroads.org/research-projects/09-02liquid-only.html

2010 Clear Roads Study
Participating States/Agencies

Location of Participating Agencies

CLEAR ROADS

During-Storm Direct Liquid Applications (DLA)
A New Tool for the Winter Maintenance Toolbox

7

Identifying the Parameters for Effective Implementation of Liquid-Only Plow Routes

EVS, Inc.

CLEAR ROADS
research for winter highway maintenance

Direct Liquid Application Guidelines

Parameter	Most Favorable For DLA	Consider DLA	Notes
Pavement Temperature[1]	25°F or above	20°F or above	**Trends** ↑↓
Storm Intensity (inches/hour)	0.5 inches/hour or below	1.0 inches/hour or below	**Cycle Times-1.5-2 hours Best**
Moisture Content	Ordinary	Dryer Snowfall	Dry/powder snow - consider plow only Wet snow – can dilute chemical quickly "Ordinary" approx. 10:1 snow/liquid ratio

Identifying the Parameters for Effective Implementation of Liquid-Only Plow Routes

EVS, Inc.

CLEAR ROADS
research for winter highway maintenance

Example During-Storm Direct Application Rates for Salt Brine (NaCl)[2,5]
Illustration Only (adjust based on local factors and experience)
Gallons Per Lane Mile (gplm)
Pounds Per Lane Mile (pplm) shown in parentheses

	Pavement Temperature			
Event Type	32-30°F	29-27°F	26-24°F	23-21°F
For 2-H				
Light Sn (less tha				
Medium Snow[1] (0.5"/hour to 1.0"/hour)				NR
For 3-Hour Cycle Time[3]				
Light Snow (less than 0.5"/hour)				
Medium Snow[1] (0.5"/hour to 1.0"/hour)				NR

Application rates varied from 30-90 G/LM

Clear Roads Study "Success Stories"

Success Stories
(examples from agencies)

- Used 15,000 tons less salt relative to adjacent maintenance areas (approx $750,000)
- Application rates reduced by 33% for their most common application scenarios
- Used 50% less material (per road mile) than adjacent area
- Granular reduced from 8,000 to 40 tons/season

How was DLA utilized?

- **Anti-icing (in conjunction with plow/additional DLA)**
- **Direct application on snowfall events less than 1"**
- **Post plow operations**
- **Black ice/frost treatment**

Could DLA Improve Applied Material Retention?

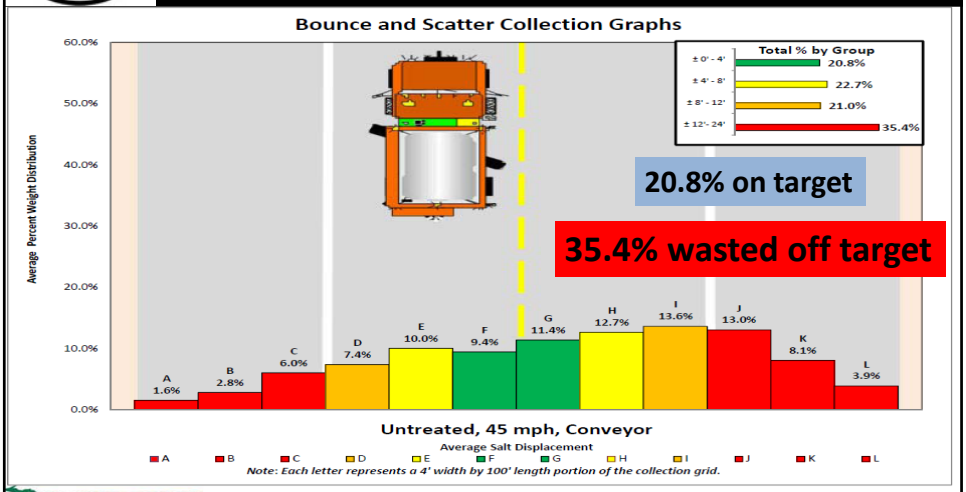
Granted, not all liquid applied in DLA will be retained. BUT……

Assumption: A significantly higher percentage of chemical will be retained on the pavement in the liquid form rather than as a solid.

Conclusion: Research is needed to compare retention of liquid versus solids

Do you know where your deicers end up?

2012 MDOT Bounce and Scatter Study-Speed



http://www.michigan.gov/documents/mdot/Final_ReportNov2012_404228_7.pdf

How much $ was saved utilizing DLA?

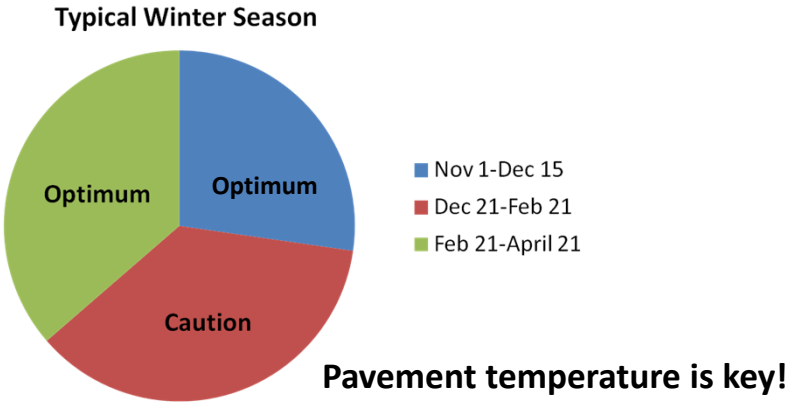
Purdue Road School-2013-Learned of a county and city whom saved nearly 49% utilizing DLA

Wixom, Farmington Hills, and Novi will continue to test in 2013/14

Could DLA Provide Faster L.O.S. Attainment?

Solid salt does not melt anything. It must form a brine before melting can occur.

When is DLA most appropriate?



Pavement temperature is key!

2012/2013 Winter Season in S.E. Michigan

Another Strange One Here!

Typical average events/season---45

Event average was 27 ('12-'13)

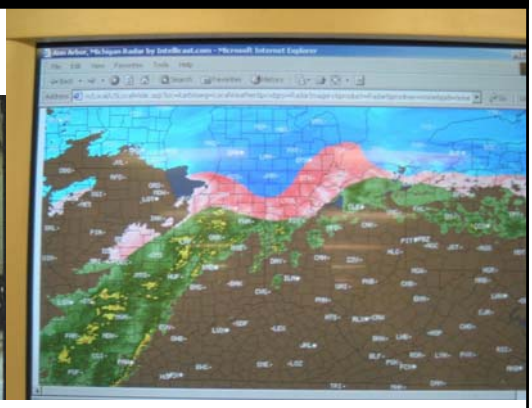
First event—December 24, 2012

Cumulative temp for months of Nov-April has risen nearly 4 degrees F. since 1980 (based on 1940-1980 National Weather Service data from Detroit)

Good Weather Forecasting-Critical

Interpreting Weather Forecast

Weather Services



Internet Weather Sites

DLA Application Guidelines Correlated to Forecasts and Matrix

Deicing Application Rate Guidelines
26' of pavement (typical two-lane road)

These rates are not fixed values, but rather the middle of a range to be selected and adjusted by an agency according to its local conditions and experience.

			Lbs/ two-lane mile			
Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Salt Prewetted/ Pretreated With Salt Brine	Salt Prewetted/ Pretreated With Other Blends	Dry Salt*	Winter Sand (abrasives)
>30° ↑	Snow	Plow, treat intersections only	80	70	100*	Not recommended
	Frz. rain	Apply chemical	80 – 160	70 – 140	100 – 200*	Not recommended
30° ↓	Snow	Plow & apply chemical	80 – 160	70 – 140	100 – 200*	Not recommended
	Frz. rain	Apply chemical	150 – 200	130 – 180	180 – 240*	Not recommended
25 - 30° ↑	Snow	Plow & apply chemical	120 – 160	100 – 140	150 – 200*	Not recommended
	Frz. rain	Apply chemical	150 – 200	130 – 180	180 – 240*	Not recommended
25 - 30° ↓	Snow	Plow & apply chemical	120 – 160	100 – 140	150 – 200*	Not recommended
	Frz. rain	Apply chemical	160 – 240	140 – 210	200 – 300*	400
20 - 25° ↑	Snow or Frz. rain	Plow & apply chemical	160 – 240	140 – 210	200 – 300*	400
20 - 25° ↓	Snow	Plow & apply chemical	200 – 280	175 – 250	250 – 350*	Not recommended
15 - 20° ↑	Snow	Plow & apply chemical	200 – 280	175 – 250	250 – 350*	Not recommended
	Frz. rain	Apply chemical	240 – 320	210 – 280	300 – 400*	400
15 - 20° ↓	Snow or Frz. rain	Plow & apply chemical	240 – 320	210 – 280	300 – 400*	500 for frz. rain
010 15 ↑↓	Snow	Plow treat with blends, and hazardous areas	Not recommended	300 – 400	Not recommended	500 – 750 spot treat as needed
< 0°	Snow	Plow treat with blends, and hazardous areas	Not recommended	400 – 600**	Not recommended	500 – 750 spot treat as needed

How many gallons of salt brine would we need to apply to attain these application rates ?
2.3# (1.043 Kg) salt/ gallon brine.

Extreme Caution!

Avoid!

Link: *www.mnltap.umn.edu/.../WinterParkLotSidewalkMaintFactSheet.pdf*

Where is the liquid cost breakpoint for DLA?

Blends: Cost Per Gallon

Additive A	Agricultural Additive	$1.10
Additive B	Calcium Chloride	$0.85
Brine	Brine	$0.10

Ag. Additive %	Cost	Cal. Chloride %	Cost	Brine %	Cost	Total Cost /Gallon
5%	$0.06	0%	$0.00	95%	$0.10	$0.15
5%	$0.06	5%	$0.04	90%	$0.09	$0.19
6%	$0.07	0%	$0.00	94%	$0.09	$0.16
6%	$0.07	5%	$0.04	89%	$0.09	$0.20
8%	$0.09	0%	$0.00	92%	$0.09	$0.18
8%	$0.09	5%	$0.04	87%	$0.09	$0.22
10%	$0.11	0%	$0.00	90%	$0.09	$0.20
10%	$0.11	5%	$0.04	85%	$0.09	$0.24
20%	$0.22	0%	$0.00	80%	$0.08	$0.30
20%	$0.22	5%	$0.04	75%	$0.08	$0.34

Questions

As the next three speakers share their communities experiences with DLA, please write down any questions you have and submit at the end. We will do our best to answer them.

2013 LTAP WINTER OPS CONFERENCE-Gaylord, MI

Direct Liquid Applications DLA

Wixom Facts

- Maintains 51 lane miles of major and local roads (clears all streets curb-to-curb)
- Clears 9 miles of safety paths
- Clears all municipal parking lots (including the downtown)
- Fleet consists of 5 dump trucks, 3 pick-up trucks and 2 tool-cats
- In last 8 yrs, Wixom reduced salt use by +40%

Wixom's DLA Program

- Began anti-icing (DLA) in 2007 with limited tank capacity (360 gal/truck) and 30 gallons/lane mile
- In 2013, added a truck-mounted (1,000 gallon) tank
  => 50 to 60 gallons/lane mile.

S.E. Michigan Winter Maintenance Team

City of WIXOM

Wixom's DLA Program

- Anti-icing / DLA Process:
  - Apply brine to surfaces prior to snow storms to prevent bonding of ice to road
  - DLA used post-storm events in place of salt

Note: Ineffective results if storm comes in as rain or freezing rain.

S.E. Michigan Winter Maintenance Team

City of WIXOM

Wixom's DLA Program

- Same truck utilized for salt application by means of hook-lift
- INCREASED VERSATILITY

S.E. Michigan Winter Maintenance Team

City of WIXOM

Wixom's DLA Program

- Tool-cat holds 100 gallons of brine
- Used exclusively at City Hall, Police Department, Library and Community Center
- Replaced 'icy-melt' usage at City offices (cost saving over $2,000 per year)

S.E. Michigan Winter Maintenance Team

City of WIXOM

Wixom's DLA Program

- Benefits of DLA:
  - Burns through ice more quickly than salt or icy-melt
  - Does NOT refreeze
  - Does NOT track into buildings
  - Works at any temperature below freezing (applied after sweeping or plowing)

S.E. Michigan Winter Maintenance Team

City of WIXOM

Wixom's DLA Program

- Brine mixture:
  - Salt brine is ideally comprised of 23.3% salt
  - Additives (agricultural bi-products, calcium chloride and/or magnesium) are used to increase efficiency and lower working temperatures
  - Wixom currently uses 80% salt brine and 20% "Boost"

S.E. Michigan Winter Maintenance Team

City of WIXOM

Wixom's DLA Program

- DLA's application after 48 hours

S.E. Michigan Winter Maintenance Team

City of WIXOM

CITY OF WIXOM
DEPARTMENT OF PUBLIC WORKS
2041 CHARMS ROAD
WIXOM, MI 48393
www.wixomgov.org

Mark Clancey
mclancey@wixomgov.org
(248) 624-0141

S.E. Michigan Winter Maintenance Team

City of WIXOM

2013 LTAP WINTER OPS CONFERENCE

S.E.MI.Wint.Maint.Team-DLA PROJECT

Farmington Hills, MI - Findings

S.E. Michigan Winter Maintenance Team

FARMINGTON HILLS FACTS

- Area residents and businesses have high expectations for the City's public services LOS (Level Of Service)
- Division of Public Works (DPW) maintains a network of more than 58 miles of major roads and 243 miles of paved and unpaved local roads (centerline)
- *160 Major Rd. Lane miles* (some are 5 + lanes wide)
- 9TH largest municipal street network in the state of Michigan and the largest in Oakland County
- APWA 2011 Excellence in Snow and Ice Control Award

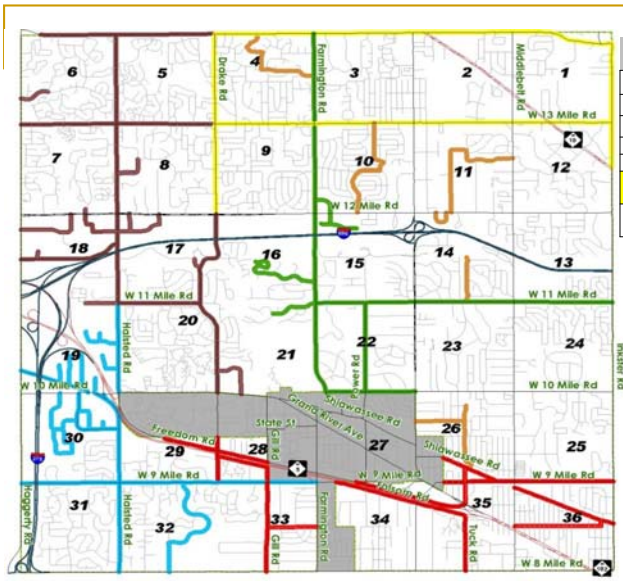
S.E. Michigan Winter Maintenance Team

Bryan Pickworth
Road Maintenance Supervisor
City of Farmington Hills, MI
Division of Public Works

- 22 years as an employee of the City beginning as a Laborer in 1991, moving up through the ranks to Equipment Operator III/Crew Leader in 2001, and then promoted to Road Maintenance Supervisor in 2004
- 2009 graduate of Michigan APWA's Michigan Public Service Institute

Current Responsibilities:

- Snow and Ice control, Liquids production, Storm water drainage maintenance, Forestry operations, Landscape & ROW mowing maintenance, Irrigation, Gravel road and shoulder maintenance, Street sweeping and various other in-house & contracted services.



Map Color	Lane-Miles
Brown	28.2
Yellow	37.9
Green	29.8
Red	28.7
Blue	33.9
Rt Total	158.5
Orange	9.4
	167.9

Legend
Snow Plow Routes
BUS ROUTE
CENTRAL
NORTHEAST
NORTHWEST
SOUTHEAST
SOUTHWEST

TRAINING-EQUIPMENT READINESS

- Calibration of granular equipment. (Utilizing "catch" tests and scales)
- Pre-winter meeting: procedures and "game plan" for the winter DLA research, **including operator input & expectations.**
- **Training** of personnel (Controllers, goals, etc.)

Do your best to get BUY IN…

TEST MATERIALS – RESEARCH & DEVELOPMENT – LIQUIDS

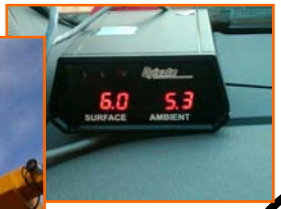
- Do research (APWA, Clear Roads, DOT websites, etc.)
- Use a hand sprayer, existing equipment
- Start "small", network, consider **Shared Services** **(different materials etc)**

TEST ISSUES, RESEARCH & DEVELOPMENT – DLA-DE-ICING

- Commitment-Support
- Equipment-Condition
- Consider low volume areas, parking lots-Shallow ditches
- Boulevard-Divided Roads
- Different types of Pavements
- Spot Test areas
- Temp. Parameters
- "Error on side of Caution"

S.E. Michigan Winter Maintenance Team

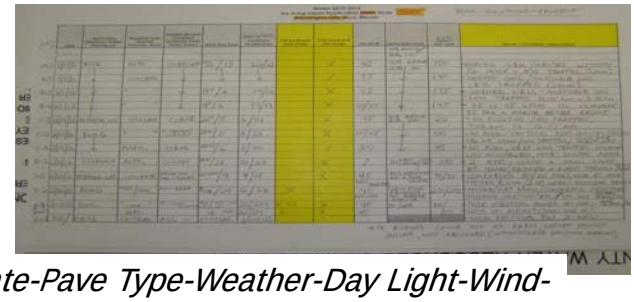
TOOLS TO MANAGE THE DLA PROCESS (Pavement vs. *Air* TEMP)



- Simple Handheld Infrared, Equipment-Mounted
- Weather Reports/Service/ Network with Agencies

S.E. Michigan Winter Maintenance Team

Hard Copy of Data Logs--*Very Important*



Date-Pave Type-Weather-Day Light-Wind-Dew point-Pave Temps-GPLM-Materials Used-Qty.-Results, Comments, Observations , Comparative Data

Brine Costs Farmington Hills DPW Winter 12/13

Unit Costs

	$/1000 cft	gal/cft	$/gal	
Water	$33.62	7.48	$0.004	
	$/ton	gal/ton	$/gal	
Salt	$46.51	900	$0.052	
	$/gal	$/gal (15%)	$/gal (20%)	
Beet	$1.50	$0.23	$0.30	
			$/gal (32%)	
Liq Calc. Chloride-Delivered			$0.58	
	$/hr	gal/hr	$/gal	
Labor	$44.11	1000	$0.044	
Operator 2 – loaded (electrical costs etc.)				

Pure Brine Cost

$/gal	$0.10

85/15 Blended Brine

$/gal	$0.31

80/20 Blended Brine

$/gal	$0.38

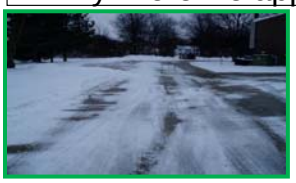
Loading of liquids- "KISS"…keep it simple silly Indoors, Outdoors- Valves, Pumps Etc.

DLA TOOLS -ANTI-SURGE BLENDING CONSIDERATIONS

- Spheres or Balls to increase safety, braking, minimize driver fatigue, wear & tear on hauling vehicle
- Blending options, barrels, totes, bulk delivery, pricing

FH's DLA -DE-ICING APPLICATIONS

- Roads, Roundabouts, Parking Lots, Sidewalks
- Anywhere we apply Granular Salt



S.E. Michigan Winter Maintenance Team

DLA DE-ICING -Manual vs Auto

Consider using a flow meter for consistent application (GPLM)

S.E. Michigan Winter Maintenance Team

12-24-12 Xmas Eve (100%brine) 55 gplm-wind 8mph-NE/dp 22/pave +28/-9:45pm-No Blading ¾ inch of snow prior to application-Concrete Surface

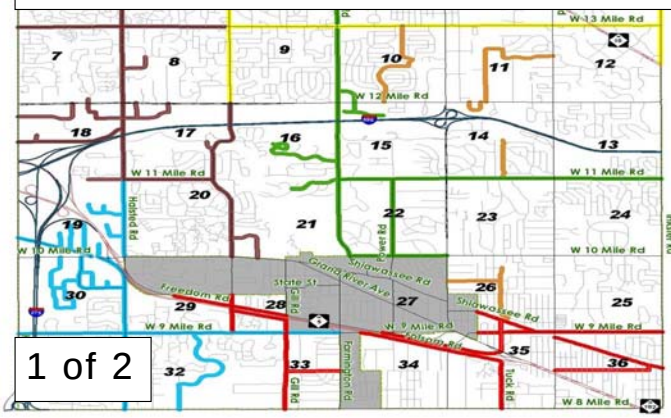
12-25-12 Xmas Next Morning (100%brine) 55 gplm-wind 6mph-NE/dp 22/pave +28/-7:45am- No Blading -Concrete Surface-Additional Lt. Dusting-Residual-No Traffic

S.E. Michigan Winter Maintenance Team

***1-5-13 SE Route-Pave+29 Degrees-8PM-10pm Concrete and Asphalt-up to ¾" snow**

***DLA TEST using 1231 GALLONS 85% Brine/ 15% Organic to DE-ICE vs. typical 5-7 yards of Granular with Pre-Wet. Rate 43 GPLM –plowed passing/decel lanes**

*Southeast Rte is the RED Route-28.7 Ln Miles



1 of 2

S.E. Michigan Winter Maintenance Team

1335 Gallon "Slip-In" Single Axle Truck Used on the DLA Test-South East Route

2 of 2

S.E. Michigan Winter Maintenance Team

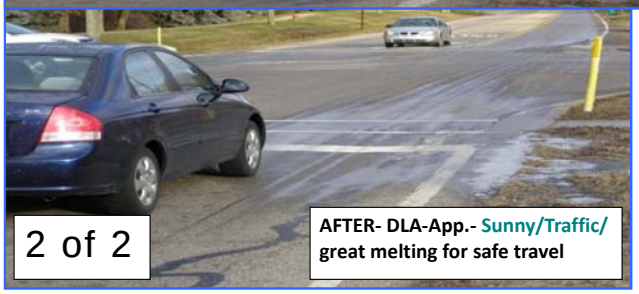
1/14/13 (85%brine 15%Organic) 45 gplm-wind 16mph-W/dp 16/pave +25/-7:45am- prior to application- Lt Traffic-ICY Spots-Frosty-Refreeze-DAS Application

AFTER-85/15 Mix…Quick Melting…Had Granular on Standby—Spots Melted Quickly

1 of 2

S.E. Michigan Winter Maintenance Team

DURING DLA APPLICATION



2 of 2

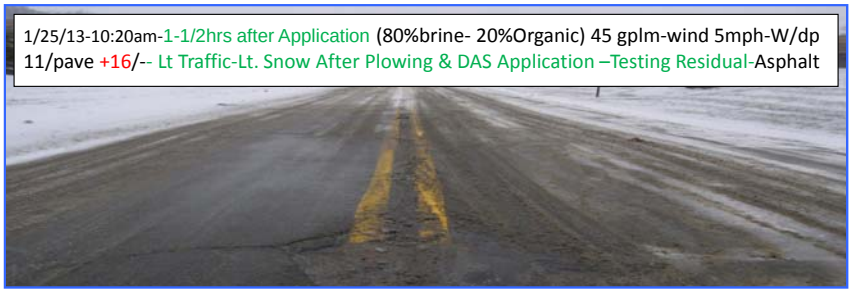
AFTER- DLA-App.- Sunny/Traffic/ great melting for safe travel

S.E. Michigan Winter Maintenance Team

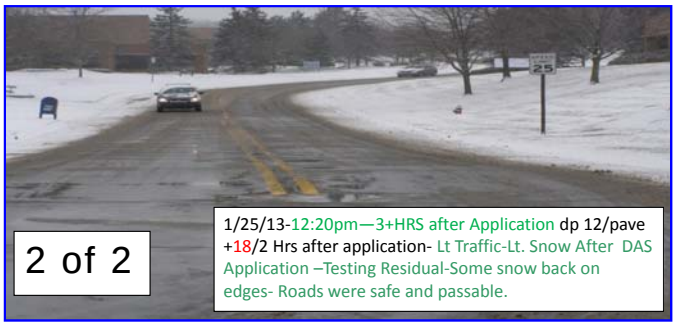
1/25/13- (80%brine 20%Organic) 45 gplm-wind 5mph-W/dp 11/pave +16/-8:45 am-Snow during application- Lt Traffic- 2nd Pass-DAS Application-Asphalt Surface – Plowing with underbody-"belly blade"

1 of 2

S.E. Michigan Winter Maintenance Team



1/25/13-10:20am-1-1/2hrs after Application (80%brine- 20%Organic) 45 gplm-wind 5mph-W/dp 11/pave +16/-- Lt Traffic-Lt. Snow After Plowing & DAS Application –Testing Residual-Asphalt



2 of 2

1/25/13-12:20pm—3+HRS after Application dp 12/pave +18/2 Hrs after application- Lt Traffic-Lt. Snow After DAS Application –Testing Residual-Some snow back on edges- Roads were safe and passable.

1 of 2

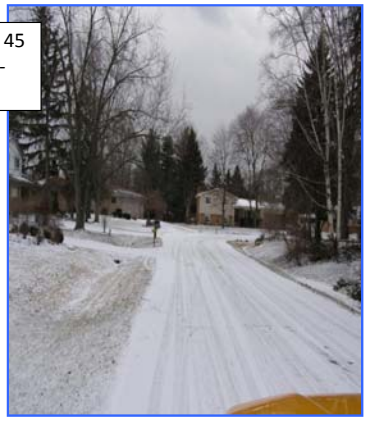
1-31-13-DLA- SM mix (70%brine30%SM) 55 gplm-wind 30mph-NW/dp 15/pave +22/-1:55pm-During application-Concrete-Low Traffic

1-31-13-DLA- SM mix (70%brine30%SM) 55 gplm-wind 30mph-NW/dp 15/pave +22/-2:45pm-50 Mins. after application-Concrete-Low Traffic – Cloudy- Windy-LOS/Fair

2 of 2

S.E. Michigan Winter Maintenance Team

1-31-13-DLA- SM mix (70%brine30%SM) 45 gplm-wind 30mph-NW/dp 15/pave +22/-1:45pm-prior to application-Asphalt



1-31-13-DLA- SM mix (70%brine30%SM) 45 gplm-wind 30mph-NW/dp 15/pave +22/-2:30pm-45 Mins After application-Asphalt—Light Traffic

S.E. Michigan Winter Maintenance Team

[C-3]2-17-13 SM mix (80%brine20%SM) 50 gplm-wind 22mph-west/6 dp/pave+ 11 / 8:04am-prior to application-Pt-Cloudy—Asphalt -Sporadic Traffic

11:00am-3 hrs-After application-Clear—Asphalt -Sporadic Traffic-ATTN: Shaded Area

3-16-13 (80%brine-20% Organic) 45 gplm-wind 12-14mph-NW/dp 25/pave +21/-6:45am- Bladed ¾ inch of snow prior to application- 2nd Pass-Asphalt Surface/Concrete BD/DLA-LT Snow at app. time

Challenging traction if momentum was lost

1 of 2

3-16-13 (80%brine-20% Organic) 45 gplm- wind 12-14mph-2nd Pass, heading towards bridge deck. DLA was working well. Trailer still somewhat unstable. Braking was a challenge.

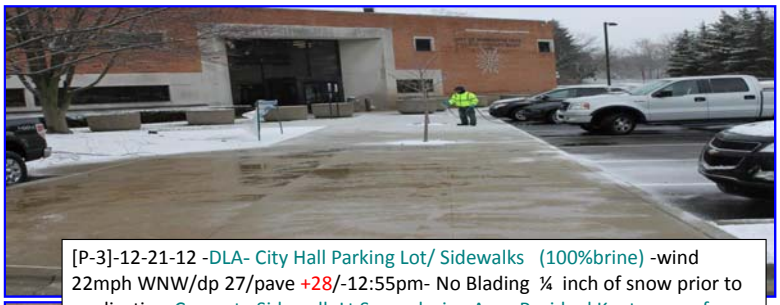
2 of 2

[B-5]3/19/13- (100%brine) 45 gplm- wind 21mph-WSW/dp 18/pave +16 1/3" snow-9:45 am-Lt. Snow during application- Lt Traffic-Concrete Surface – No Plowing - Cloudy / Overcast

Lane Placement W/Liquids

If Equipped w/Multi-Ln Bars

S.E. Michigan Winter Maintenance Team

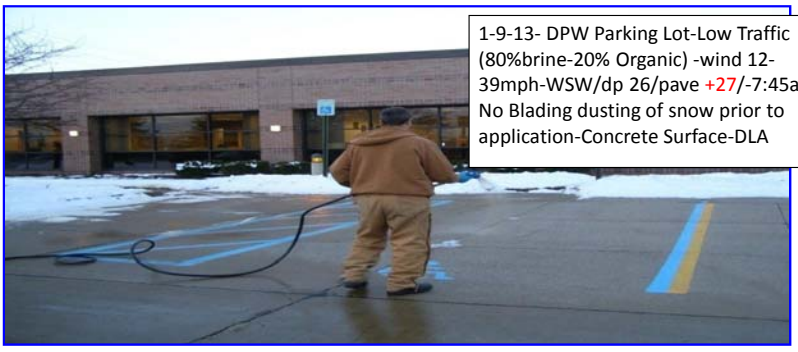


[P-3]-12-21-12 -DLA- City Hall Parking Lot/ Sidewalks (100%brine) -wind 22mph WNW/dp 27/pave +28/-12:55pm- No Blading ¼ inch of snow prior to application-Concrete Sidewalk-Lt Snow during App.-Residual Kept area safe

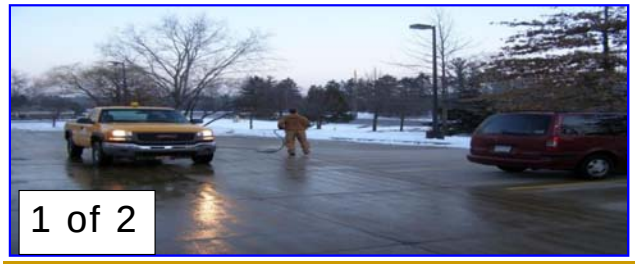
S.E. Michigan Winter Maintenance Team

Parks Dept. Anti-Icing Prior to Event – BUY IN

Walk Behind Liquid Applicator- 12 gallons –Utilized pickup w/tank for nurse truck

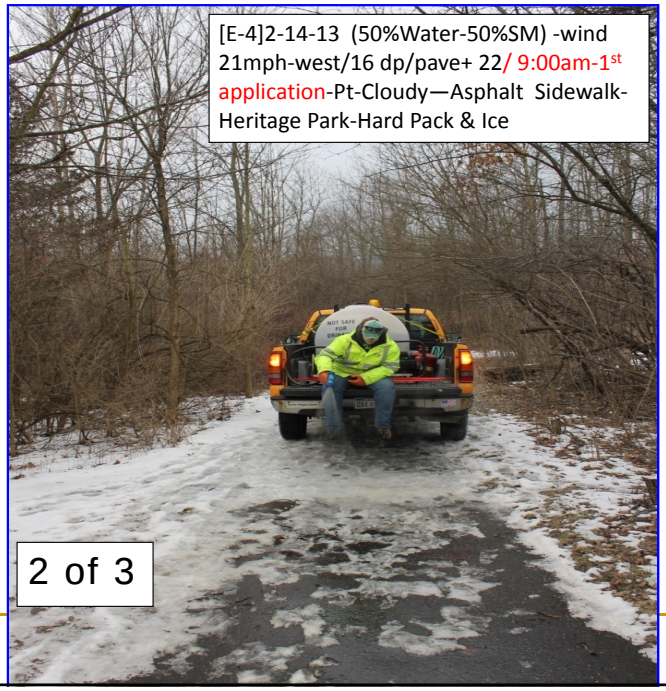


1-9-13- DPW Parking Lot-Low Traffic (80%brine-20% Organic) -wind 12-39mph-WSW/dp 26/pave +27/-7:45am-No Blading dusting of snow prior to application-Concrete Surface-DLA



1 of 2

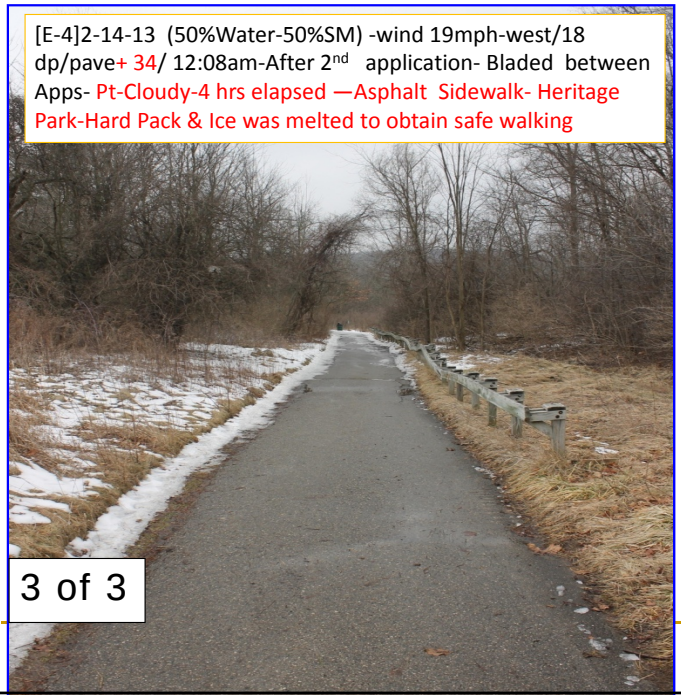
Benefits of Liquid Vs. Solids



[E-4]2-14-13 (50%Water-50%SM) -wind 21mph-west/16 dp/pave+ 22/ 9:00am-1st application-Pt-Cloudy—Asphalt Sidewalk-Heritage Park-Hard Pack & Ice

2 of 3

S.E. Michigan Winter Maintenance Team

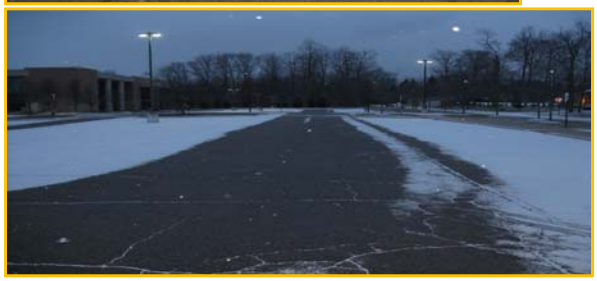


[E-4]2-14-13 (50%Water-50%SM) -wind 19mph-west/18 dp/pave+ 34/ 12:08am-After 2nd application- Bladed between Apps- Pt-Cloudy-4 hrs elapsed —Asphalt Sidewalk- Heritage Park-Hard Pack & Ice was melted to obtain safe walking

3 of 3

S.E. Michigan Winter Maintenance Team

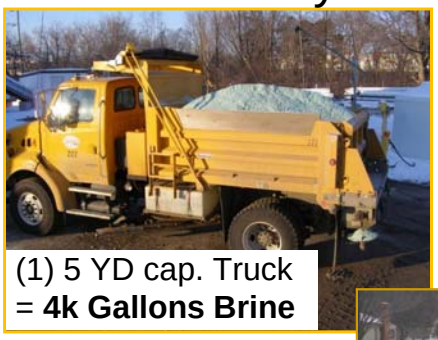
DLA-ANTI-ICING



Dept's out doing other activities- (cold patch, forestry, grading etc.)

S.E. Michigan Winter Maintenance Team

DLA-Efficiency



(1) 5 YD cap. Truck
= **4k Gallons Brine**

S.E. Michigan Winter Maintenance Team

DLA BENEFITS – Learned thus far…

- Liquids already “in solution”
- Achieve Faster Level Of Service
- Another “Tool “ in the toolbox
- No waiting on “Brine” process
- Less chlorides used (Tons of Granular vs. Liquids) 1 ton salt + water = 900 gals of Brine
- Mats, loading time etc. used for De-Icing
- Visually “placing” the liquid where it’s needed
- Equipment in fleet, can be used for Multi-Seasons (Dust Control, ROW Spraying etc.)
- Moisture Content of Snowfall-Sun, Shade, Night, Traffic all affect performance

DLA CHALLENGES – Learned thus far…

- BUY IN
- Make time to Evaluate and Collect Data (Staff)
- Equipment in fleet (GVWR), downtime etc.
- Loading of liquids efficiently (Fast) (GPM/ # of Pumps)
- Fear of co-efficient of friction (tools to measure)
- Residuals (liquids vs. granular)
- Having enough Events / Weather /Fair Analysis
- Tanker Endorsements (1K + in MI)
- Taking Pic’s @ nighttime (snowing etc.)
- **28 events FH’s- 10+ started out as rain**

S.E. Michigan Winter Maintenance Team

- The City of Farmington Hills formed a local Winter Maintenance Team made up of representatives from southeast Michigan communities to network, collaborate, and learn about new techniques. The Committee meets regularly to hear from vendors and private contractors about new products and methods. It gives participants the chance to see what is working for other communities, establish goals, view research, and collect data. The team moves the meeting site to different facilities each time.

S.E. Michigan Winter Maintenance Team

CITY OF FARMINGTON HILLS
DIVISION OF PUBLIC WORKS
27245 HALSTED ROAD
FARMINGTON HILLS, MI 48331
www.fhgov.com

Bryan Pickworth
bpickworth@fhgov.com
(248) 871-2865

FARMINGTON HILLS Michigan

S.E. Michigan Winter Maintenance Team

Welcome

LTAP WINTER OPS Conference

Gaylord, MI 2013 -- DLA

1

City of Novi

Novi – Who, What, Where?

- City Located in southeastern Michigan (25 miles northeast of Detroit).
  - 25 minutes north from the University of Michigan and 45 minutes east from Michigan State University
- 31-square miles, located in Oakland County.
- Population of approximately 56,000 Residents
- Well-connected to highway, rail and air transportation routes offering accessibility second to none.
- Novi takes great pride in having superior parks, wetland and woodland protections and recreation centers.
- Additionally, in Novi, we are extremely proud of our cultural diversity. More than 65 businesses based in Japan and at least 14 businesses based in Germany call Novi "home" in the United States.

83

Department of Public Services - Field Operations Division

- The Department of Public Services includes:
  - Field Operations Division, Engineering Division, and the Water & Sewer Division.
    - 175 Centerline Miles of City neighborhood and major streets
      - All regulatory, street and informational signage
    - 45 Centerline miles of County primary
    - 2,100 Traffic Control Signals
    - 165 Miles of multi-use pathways
    - 4 major bridges
    - 300 miles of water main
    - 4,000 fire hydrants
    - 13,500 water service connections
    - 250 miles of sanitary sewer
    - 1200 acres of parkland
    - 280 vehicles and major pieces of equipment

84

Novi's Road Network

- **Winter Maintenance Responsibilities**
- **Approximately 220 Centerline Miles of Roadway**
  - 145 Lane Miles of County Primary
  - 110 Lane Mile of City Major
  - 300 Lane Miles of City Local
  - 20 miles of pathways and sidewalks
  - 15 municipal parking lots
- **Why use Lane Miles?**
  - **Simply a More Accurate Representation of what is Maintained**
    - Labor Allocations
    - Material use
    - Equipment Requirements

85

Winter Equipment and Labor Resource Overview

- 15 plow trucks
- 3 two yard dump trucks (1-tons)
- 2 utility vehicles
- 29 operators (18 parks and roads, 8 water and sewer, 3 mechanics)
- 6 auxiliary out of department operators
- 1,500 tons of rock salt storage
- 15,000 gallons of liquid

86

Breaking away from the Norm 2007 - 2009

	Number of Events	Snowfall Totals	Number of Citizen Complaints	Annual Ave. Number of Traffic Crashes/DPS Event	Tons of Salt Used	Gallons of Liquid Applied	Average Tons of Salt Used/Event	Total Labor Costs	Average Labor Cost Per Event
2007-2008	47	71.7"	221	4.52	12,621	N/A	268	$ 405,787	$ 8,633.76
2008-2009	33	65.7"	148	4.95	9,868	N/A	299	$ 420,031	$ 12,728.21
2009-2010	33	43.7"	58	3.5	6,932	N/A	210	$ 291,856	$ 8,844.12
2010-2011	63	67.2"	324	4.03	8,653	29,375	137	$ 294,398	$ 4,672.98
2011-2012	24	24.0"	10	1.2	4,665	38,520	194	$ 93,548	$ 3,897.83
2012-2013	26	40.0"	67	1.6	3,395	67,630	131	$ 156,082	$ 6,003.15

87

Level of Service (LOS)

QUESTIONS YOU NEED TO ASK

- What do your elected officials want?
- What does your community really expect (Vocal few or majority)?
- What can your current resources do for you?

RESEARCH YOU NEED TO DO

- Service provided by similar road agencies
- Get out and talk with the community
- What technology fits your budget

Policy Discussion/Adoption… Public Communication

88

Elected Official Input

RESOLUTION

WINTER ROAD MAINTENANCE POLICY
CITY OF NOVI

CERTIFICATION

Level 1 – Snowfall less than (4) Inches; No Accumulation of Ice

Major city and county roads will be plowed and salted on a continuous basis as needed to keep the pavement as bare as possible at all times. Once major roads are cleared neighborhood roads will be cleared during normal weekday working hours. (No Overtime for subdivisions)

Level 2 – Snowfall of (4) Inches or More; Any Accumulation of Ice

Major city and county roads will be plowed and salted on a continuous basis as needed to keep the pavement as bare as possible at all times. Once major roads are cleared neighborhood roads will be plowed on a continuous basis. (Overtime for subdivisions)

89

cityofnovi.org

Liquid Program Upgrades – Step 1

Basic Operations

- Brine Maker
- Storage Tanks
- Salinity Testing Method
- Application Tools
- Application Equipment

90

cityofnovi.org

Liquid Program Upgrades – Step 2

Incremental Upgrades

- Secondary Containment
- Operator Friendly Filling System
- Secondary Pump for Mixing

91

Liquid Program Upgrades – Step 3

"Additional" Labor and Resource Dedication

- Space Dedication
- Increased Capacity
- Team Monitoring and Documenting
- Electrical Upgrades

92

Liquid Program Upgrades

Future Growth and Blending

- Manifold Construction
- Employee Training
- Variable Solution Containment
- Capacity Monitoring

93

DLA
How Does your Agency get Started

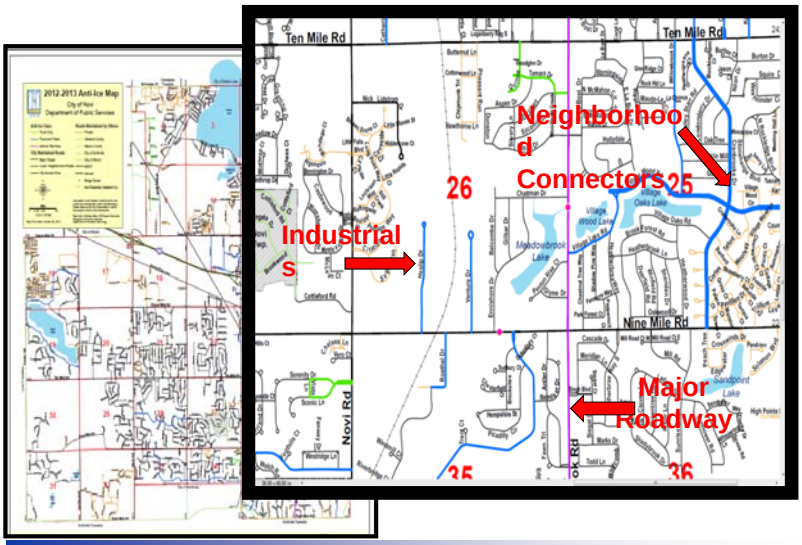
94

Route Selection – Key Points

- What are your existing routes
- Which routes make sense
- Match routes with liquid capability
- Initially find a route that has a low ADT…… *just in case things don't work out the way you planned.*
- *Check with the owning road agency to see if they endorse your maintenance procedure*

95

Liquids Mapping



96

Communication Tools – Social Media

- Agency Website
- Newsletters
- Facebook
- Twitter
- Nixle
- Local Access (SWOCC)
- Local Media

Neighborhood meetings – Don't lose the personal touch with your residents

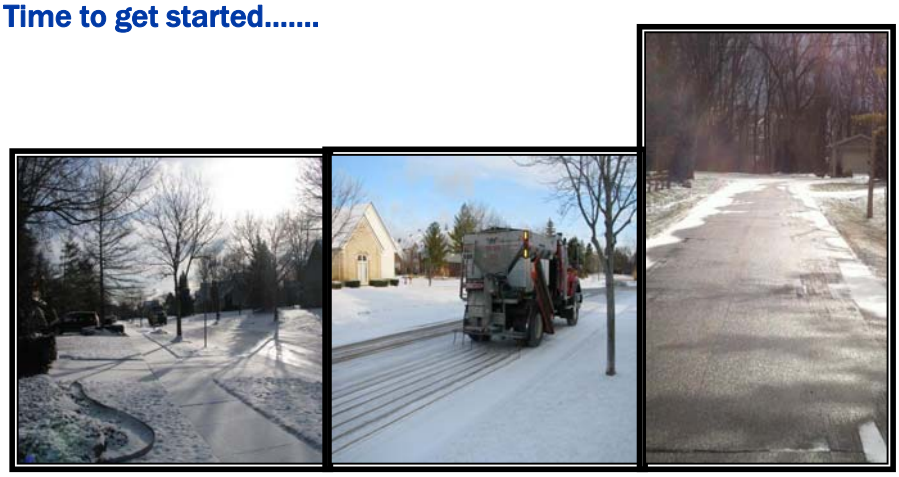
97

Social Media

One winter maintenance tool that DPS uses, even if snow isn't in the forecast, is a solution of saltwater (or brine) and de-sugared beet extract. This liquid is applied to roads when the dew point approaches air temperatures below 32°F – a condition that creates black ice. So if you see trucks applying liquids on a nice sunny day, we're just taking precautionary measures to address roads that may become slippery later.

98

Time to get started.....



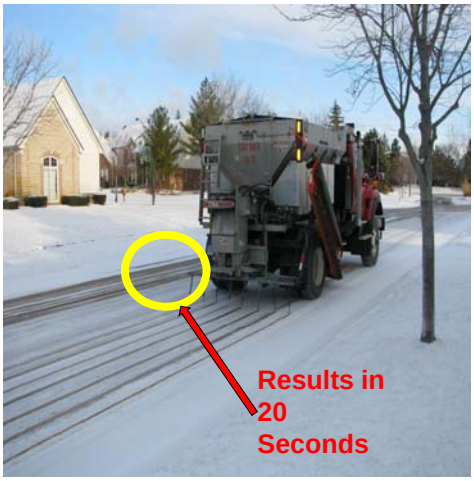
99

Application in Progress....

Date: 3/13/2013 9:16:52 AM
Direction: South West
Speed: 11 MPH
Scraper: Up
Wing-Plow: Up
Granular Material Name: SALT
Granular Set Rate: 0 LB/MI
Prewet Set Rate: 0 GAL/TON
Direct Set Rate: 50 GAL/MI
Direct Lanes Active: 0
Road Temperature: 27 °F
Air Temperature: 27 °F
Spreader Status: S
Driver ID: D REID
Vehicle ID: 613
Granular Spread Rate Index: 0
Prewet Spread Rate Index: 0
Direct Spread Rate Index: 7
Granular Mode: C

10
0

Application in Progress



Date: 3/13/2013 9:17:12 AM
Direction: South West
Speed: 13 MPH
Scraper: Up
Wing-Plow: Up
Granular Material Name: SALT
Granular Set Rate: 0 LB/MI
Prewet Set Rate: 0 GAL/TON
Direct Set Rate: 50 GAL/MI
Direct Lanes Active: 0
Road Temperature: 27 °F
Air Temperature: 27 °F
Spreader Status: S
Driver ID: D REID
Vehicle ID: 613
Granular Spread Rate Index: 0
Prewet Spread Rate Index: 0
Direct Spread Rate Index: 7
Granular Mode: C

Event – 1/24/2013

Decision Making DLA

Forecast Sunshine

Application Weather Conditions

Pre Application – 1/24/2013 – Chip Seal (Hill)/Concrete Bridge

Approximately 11:00 AM

10
3

Results – 1/24/2013 – 10 Minutes after application

50 gal/Lane Mile

10
4

Results – 1/24/2013

10
5

Results – 1/24/2013 Parking Lot

50 gal/Lane Mile

10
6

Results – 1/24/2013 – Westmont Subdivision

Date: 1/24/2013 10:35:13 AM
Direction: South East
Speed: 9 MPH
Scraper: Up
Wing-Plow: Up
Granular Material Name: SALT
Granular Set Rate: 0 LB/MI
Prewet Set Rate: 0 GAL/TON
Direct Set Rate: 45 GAL/MI
Direct Lanes Active: 0
Road Temperature: 17 °F
Air Temperature: 11 °F
Spreader Status: S
Driver ID: C FRITZ
Vehicle ID: 682
Granular Spread Rate Index: 0
Prewet Spread Rate Index: 0
Granular Mode: C

Results – 1/24/2013 – Pre and Post App (3 hour lapse)

413 DLA App Asphalt Roadway Video 2.3

413 DLA 5 hours Asphalt Roadway Video 2.3(

Thursday, January 24, 2013, 10:54:42 AM

Thursday, January 24, 2013, 1:50:22 PM

Result(s) – Event 1/31/2013

Decision Making DLA

Forecast Sunshine

Application Weather Conditions

Pre Application – 1/31/2013 – Chip Seal (Hill)/Concrete Bridge

Approximately 10:20 AM

Results – 1/31/2013 – 10 Minutes after application

Date: 1/31/2013 10:19:55 AM
Direction: West
Speed: 13 MPH
Scraper: Up
Wing-Plow: Up
Granular Material Name: SALT
Granular Set Rate: 0 LB/MI
Prewet Set Rate: 0 GAL/TON
Direct Set Rate: 60 GAL/MI
Direct Lanes Active: 0
Road Temperature: 29 °F
Air Temperature: 24 °F
Spreader Status: S
Driver ID: D REID
Vehicle ID: 613
Granular Spread Rate Index: 0
Prewet Spread Rate Index: 0
Direct Spread Rate Index: 9
Granular Mode: C

Thursday, January 31, 2013, 10:31:45 AM

Thursday, January 31, 2013, 10:29:01 AM

111

Results – 1/31/2013 – 20 Minutes after application

Intermittent Snow Squalls

Approximately 1/2 inch of Accumulation

Did not re-apply

Thursday, January 31, 2013, 10:42:41 AM

Thursday, January 31, 2013, 10:40:50 AM

112

Results – 1/31/2013 – 3 Hours after Application

Comparisons

Date: 1/31/2013 11:02:46 AM
Direction: South
Speed: 16 MPH
Scraper: Down
Wing-Plow: Down
Granular Material Name: SALT
Granular Set Rate: 350 LB/MI
Prewet Set Rate: 18.0 GAL/TON
Direct Set Rate: 0 GAL/MI
Direct Lanes Active: 0
Road Temperature: 28 °F
Air Temperature: 21 °F
Spreader Status: S
Driver ID: D REID
Vehicle ID: 613
Granular Spread Rate Index: 5
Prewet Spread Rate Index: 3
Direct Spread Rate Index: 0
Granular Mode: C

Date: 1/31/2013 11:03:17 AM
Direction: North
Speed: 13 MPH
Scraper: Down
Wing-Plow: Down
Granular Material Name: SALT
Granular Set Rate: 0 LB/MI
Prewet Set Rate: 0 GAL/TON
Direct Set Rate: 60 GAL/MI
Direct Lanes Active: 0
Road Temperature: 22 °F
Air Temperature: 22 °F
Spreader Status: S
Driver ID: D REID
Vehicle ID: 613
Granular Spread Rate Index: 0
Prewet Spread Rate Index: 0
Direct Spread Rate Index: 9
Granular Mode: C

Comparisons Cont.

Not Treated

Treated

Date: 1/31/2013 10:35:09 AM
Direction: West
Speed: 16 MPH
Scraper: Down
Wing-Plow: Up
Granular Material Name: SALT
Granular Set Rate: 0 LB/MI
Prewet Set Rate: 0 GAL/TON
Direct Set Rate: 60 GAL/MI
Direct Lanes Active: 0
Road Temperature: 22 °F
Air Temperature: 23 °F
Spreader Status: S
Driver ID: D REID
Vehicle ID: 613
Granular Spread Rate Index: 0
Prewet Spread Rate Index: 0
Direct Spread Rate Index: 9
Granular Mode: C

DLA Data

Date	Application Location	Roadway Type	Weather Conditions	Wind and Dew Point	Air Temperature	Anti-Icing	De-Icing	Gallon/Ln Mile	Solution Type	Gal. Used	Comments
1/9/13	P	A	S		N/A	no	yes	50/60	85/15	350	½" Snow, Worked Well, Odor Complaints
1/15/13	R/B	A/C	S		29	yes	no	45	85/15	2030	Anti-Iced, Event Never Transpired
1/18/13	R/B	A/C	PS		20	yes	no	45	85/15	3930	Anti-Ice, ½" Snow, Successful
1/24/13	R	A/C	S		10	no	yes	45	Brine	1980	De-Ice, ¼" Snow, Worked as Well as Rock Salt
1/25/13	P	A/C	N/A		21	no	yes	45	Brine	1270	De-Ice, 3" of Snow, 2 applications, Successful
1/31/13	R/P	A/C	O		25	no	yes	45/60	Brine	2820	Very Effective, roads clear in 15 min
2/7/13	R	A/C	O		33	yes	no	45	85/15	1900	Anti-Ice, Heavy Snow, No Results
2/25/13	R	A/C	P/S		31	yes	no	45	85/15	3421	Anti-Ice, Rain Prior to Snow, No Results

IS USING DLA COST EFFECTIVE FOR YOUR ORGANIZATION

Novi Material Application Costs

Units (lbs)	Unit Cost ($.02/lbs)	Application Rate (lbs/InMi)	Cost/LnMi	Lane Miles Serviced (7 ton capacity)
14,000	$ 0.02	200	$ 4.00	70.00
14,000	$ 0.02	250	$ 5.00	56.00
14,000	$ 0.02	300	$ 6.00	46.67
14,000	$ 0.02	350	$ 7.00	40.00
14,000	$ 0.02	400	$ 8.00	35.00
14,000	$ 0.02	450	$ 9.00	31.11
14,000	$ 0.02	500	$ 10.00	28.00
14,000	$ 0.02	550	$ 11.00	25.45
14,000	$ 0.02	600	$ 12.00	23.33

Direct Liquid 1600 gal

Units (gal)	Unit Cost ($.10/gal)	Application Rate (gal/InMi)	Cost/LnMi	Lane Miles Serviced (1,600 gal capacity)
1,600	$ 0.10	30	$ 3.00	53.33
1,600	$ 0.10	35	$ 3.50	45.71
1,600	$ 0.10	40	$ 4.00	40.00
1,600	$ 0.10	45	$ 4.50	35.56
1,600	$ 0.10	50	$ 5.00	32.00
1,600	$ 0.10	55	$ 5.50	29.09
1,600	$ 0.10	60	$ 6.00	26.67
1,600	$ 0.10	65	$ 6.50	24.62
1,600	$ 0.10	70	$ 7.00	22.86

Note: It is possible that up to 30% (4,200 lbs. or $84), of each load could be lost to bounce and scatter if salt is not pre-wet or applied at slow speeds.

DLA will stay in the lane it is applied to, resulting in minimal material loss.

117

What does it take to get you on the road?

Direct Liquid Application

Materials/Equipment	Costs	Unit	Measure	Notes
Brine 23.3% Nacl	$ 0.10	1,600	Gallon	Water, electricity, laborer etc. (unit(s) based off tank capacity)
Material Tank	$ 7.34	0.75	Hour	MDOT Equipment Rental Rates (1600 gal)
Trailer	$ 16.46	0.75	Hour	MDOT Equipment Rental Rates (10 ton min.)
Truck	$ 52.42	0.75	Hour	MDOT Equipment Rental Rates (S.A. w/underbody)
Misc	$ -	0	N/A	Fuel, Fittings, Clamps, Hoses, Pumps, Baffling etc.
Labor	$ 35.00	0.75	Hour	Estimated
Estimated Set-up and Roll Total			**$ 243.42**	**Price based off carrying 1600 gal of liquid and 1 hour prep**

Granular Rock Salt Application

Materials/Equipment	Costs	Unit(s)	Measure	Notes
Rock Salt	$ 45.00	7	Ton	State Contract Pricing (Unit(s) based off truck capacity)
Material Tank	$ -	0	Hour	MDOT Equipment Rental Rates
Trailer	$ -	0	Hour	MDOT Equipment Rental Rates
Truck	$ 52.42	0.5	Hour	MDOT Equipment Rental Rates (S.A. W/Underbody)
Misc	$ -	0	N/A	Fuel, Fittings, Clamps, Hoses, Pumps, Baffling etc.
Labor	$ 35.00	0.5	Hour	Estimated
Estimated Set-up and Roll Total			**$ 358.71**	**Price based off carrying 7 tons of material and 1 hour prep**

118

NOVI'S POTENTIAL SAVINGS PER EVENT

Financial Summary

Material Type	Lane Miles Serviced	Set-up/Fill Cost	Material Cost/Lane Mile	Lane Miles Complete/Fill	Total Truck Fill Cost(s)	Total Material Cost(s)	Overall Total
Brine	555	$ 243.42	$ 5.00	32	$ 4,221.82	$ 2,775.00	$ 6,996.82
Rock Salt	555	$ 358.71	$ 7.00	40	$ 4,977.10	$ 3,885.00	$ 8,862.10

$1865.28
SAVINGS/EVENT

$55,958.40 POTENTIAL
SEASONAL SAVINGS

119

DLA Challenges to Consider

- **Do you have and/or are you willing to invest??**
  - Liquid Manufacturing System
  - Storage and Containment
  - Equipment
    - Versatility ⇨ Can your equipment be used for multiple application types (Granular/Liquid/Both)?
    - Capacity ⇨ How much material can you produce/transport/apply?
    - Efficiency ⇨ Can you meet service level expectations?
  - Staff buy-in
  - Community Awareness

120

THANK YOU

Contact Information

Matt Wiktorowski
Field Operations Senior Manager
(O) 248-735-5640
(D) 248-735-5634
mwiktorowski@cityofnovi.org

Jerry Tremblay
Roadway Asset Manager
(O) 248-735-5640
(D) 248-735-5651
gtremblay@cityofnovi.org

Chuck Fritz
Work Leader
(O) 248-735-5640
(D) 248-735-5658
cfritz@cityofnovi.org

Mark Schwartz
Light Equipment Operator II
(O) 248-735-5640
kroby@cityofnovi.org

Dean Reid
Heavy Equipment Operator
(O) 248-735-5640
dreid@cityofnovi.org

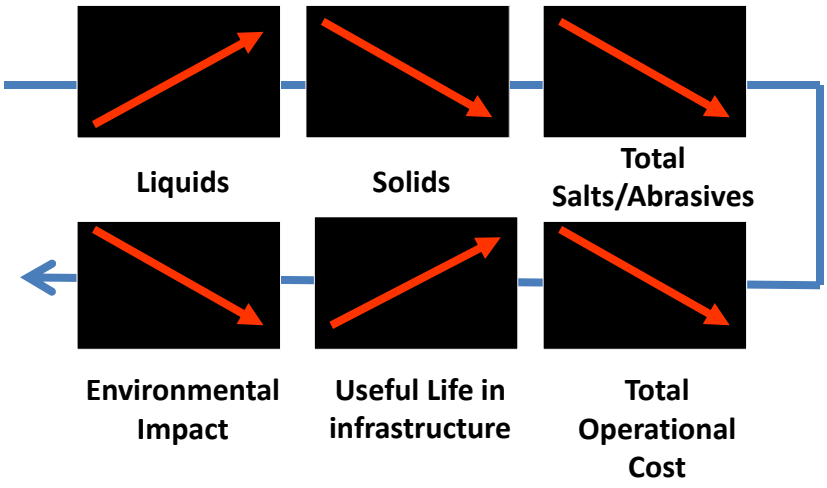
Jerry Orchard
Sign Technician
(O) 248-735-5634
(D) 248-735-5655
jorchard@cityofnovi.org

12
1

Conclusions

- DLA another “tool in the toolbox “
- Know your forecasts and pavement temps
- Understand moisture content of snow
- Combine Forecast with Operations Matrix in the Decision Process
- Examine route lengths for liquid capacity
- Proceed with caution, have contingency plans, and expand only when complete comfort levels assured
- DLA may be a break even proposition but reduced salt reduces infrastructure and environmental damage
- Level of service attainment, in many instances, will be quicker than solids
- MORE research and experience is still needed

DLA will reduce total salt use



Evaluate your Liquids

- A 23.3% Sodium Chloride brine is the most cost effective and considered the safest to use
- Q.C. in brine manufacture is a must
- Additives to brine appear to be effective-continue testing. TRB Report http://docs.trb.org/prp/12-2283.pdf
- Co-efficient of friction information needed for various liquid deicers and or blends. Understand their properties and proper application protocols

Equipment Challenges

Because your solid spreaders will still do most of the work……

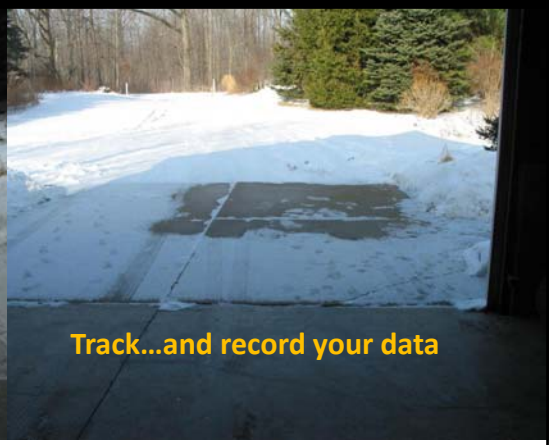
Tanks on trailers

Hook Lift Systems

Combi Systems

…Easy on/easy off and versatility is a must!

Conduct your own experiments!



50 Gal/L.M = 10 oz/100 Sq.Ft.

References

Peterson, Gary, P. Keranen, and R. Pletan, "Identifying the Parameters for Effective Implementation of Liquid-Only Plow Routes", Clear Roads 09-02, 2010.

Ketcham, Stephen A., L.D. Minsk, R. R. Blackburn, E. J. Fleege, "MANUAL OF PRACTICE FOR AN EFFECTIVE ANTI-ICING PROGRAM: A Guide for Highway Winter Maintenance Personnel", FHWA-RD-95-202, 1996. http://www.fhwa.dot.gov/reports/mopeap/eapcov.htm

Blackburn, Robert R., K. M. Bauer, D. E. Amsler Sr., S. E. Boselly, A. D. McElroy, "Snow and Ice Control: Guidelines for Materials and Methods", Transportation Research Board, NCHRP Report 526, 2004.

Levelton Consultants Limited, "Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts", Transportation Research Board NCHRP Report 577, 2007.

Mitchell, Gayle F., C. Hunt, W. Richardson, "Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations-Part III: Optimization of Salt Brine Pre-Treatment Application Rates and Frequency, Ohio Department of Transportation and U.S. Department of Transportation Federal Highway Administration, Ohio Research Institute for Transportation and the Environment, Russ College of Engineering and Technology, Ohio University, September 2003.

Taisto Haavasoja, Juhani Nylander, Pauli Nylander, "Relation of Road Surface Friction and Salt Concentration, Paper presented at SIRWEC 2012, Helsinki, Finland, 23-25 May 2012.

Bolet, L., & Fennesbech, J. K. (translator), "Quality in Spreading:-Reducing Impact on Environment by Addressing Precision in Distribution of Ice Control Agent Spreading Technologies, Paper presented at the 89th Annual Meeting of the TRB, January 2010.

Fennesbech, Jens Kristian, "Ice Control Technology with 20% Brine on Highways", Transportation Research Record, Vol. 1741, pp 54-59, 2001.

Thanks for making our roads safe!

Contact Information

Mark Clancey City of Wixom
Phone: 248/624-0141
Email: *mclancey@wixomgov.org*

Bryan Pickworth City of Farmington Hills
Phone: 248/871-2865
Email: *bpickworth@fhgov.com*

Matt Wiktorowski City of Novi
Phone: 248/735-5640
Email: *mwiktorowski@cityofnovi.org*

Mark Cornwell Sustainable Salting Solutions, LLC
Holly, Michigan
Phone: 248/895-2888
Email: *sustainablesaltingsolution@gmail.com*