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

For Clear Roads by EVS
8/25/2010
Overview

Project Approach

• Clear Roads TAC defines problem and guides project
• EVS conducts research
• Public works experts share experiences
• Field testing recommended to help answer remaining questions and confirm findings
Overview

Conclusions

• Tool has been utilized for ten plus years
• Most success in milder winter climates
• Expanded toolbox - better match tool to storm
• Good consensus on “when” tool is effective
• Field testing could help define “why” tool should be included in toolboxes
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
1. What is During-Storm DLA?

- Directly applying liquids to the roadway surface during the storm event
- Can be “Liquid only”, or DLA supplemented with direct granular
2. Why Use DLA?

• Getting Done Earlier
• Savings
• Minimized Impacts
• Level of Service
• etc.
3. Where?
(locations of agencies who shared DLA experience)
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Where?
Average Temperatures at Project DLA Sites

<table>
<thead>
<tr>
<th>Average Temperatures (°F) for Liquid Only Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fairfield, IA</td>
</tr>
<tr>
<td>Nov</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

Includes highway agencies practicing liquid only.
Where?
Planning for Climate

• In most climates (moderate or cold) some “combination” application approach may be the best strategy

• In very mild climates, DLA alone may be a primary tool (ie Kansas City, ...)
4. When to use DLA?

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Most Favorable For DLA</th>
<th>Consider DLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement Temperature</td>
<td>25°F or above</td>
<td>20°F or above</td>
</tr>
<tr>
<td>Storm Intensity (inches/hour)</td>
<td>0.5 inches/hour or below</td>
<td>1.0 inches/hour or below</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>Ordinary</td>
<td>Dryer Snowfall (consider plow-only)</td>
</tr>
</tbody>
</table>
5. How?

• Toolbox Approach
• Gaining Buy-In
• Equipment Considerations
• Application
How?
Tips to help gain “buy-in”

• Set tool up to succeed
• Contact experts; Visit Sites
• Training (knowledge is power)
• Communication (quick and consistent)
• Know DLA Limitations
• Acknowledge and Support Success
How?

Equipment

- Combination Units
- Slide-In Units
- Liquid-Only Snowplows
- Liquid-Only applicators (no plow)
- Tankers
How?

Slide-In Tank Applicators

- Used by CDOT, McHenry Country, INDOT, ...
- Allows quick “swap” between liquid/granular
- Example: Seasonable approach (tank installed for early/late winter DLA...)
- As short as 30 minutes to install tank
How?
Tankers

• Such as the MoDOT “Salty Dog” shown here
• Valuable to apply DLA quickly
• Mn/DOT “shield” allows app @ 50 MPH
• Example: Used to apply liquids to multi-lanes while following two or three snowplows
• Example: Apply early during storm before accumulation
How?
Combination Applicators

• Simultaneous direct liquid and/or direct granular
• Allows “best of both worlds for many conditions – DLA with “sprinkle” of granular
• Optimize material use
How?
Trailers

- Can be cost effective way to utilize existing equipment for DLA and combo applications
- Takes operators some time to get comfortable with these units, but once comfortable, they are often favored equipment
How?

Plow Trucks with Liquid Tanks

• Effective for designated liquid routes
• Effective for very mild climates where DLA may be primary tool
How?

Designated Liquid Applicators

- Traditional pre-storm anti-icing
- Can be used early during storm DLA
- Can follow plow trucks with DLA
- Early during storm DLA
How?

Customized Pre-Wet Equipment

- Mn/DOT Olivia/Alexandria was limited by only 200 gallon on-board capacity, but wanted DLA in the toolbox
- Innovated a “centerline sprayer” ($20 materials)
- On outbound trip, apply light DLA just over centerline; starts to “work” return-trip lane
- Has optimized material use
How?
Missouri DOT Side Plow Applicator
# How?

## Applicator Equipment Costs

<table>
<thead>
<tr>
<th>Applicator Component</th>
<th>Cost Range and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination Applicator</td>
<td>$30,000 additional (relative to standard plow truck) (Ohio DOT)</td>
</tr>
<tr>
<td>Applicator Spray Bar</td>
<td>$1,000 - $2,000</td>
</tr>
<tr>
<td>Applicator Discharge Pump and Plumbing</td>
<td>$5,000 - $10,000 small flows (lower speed roads/parking)</td>
</tr>
<tr>
<td></td>
<td>$10,000 - $15,000 large flows (higher speed roads)</td>
</tr>
<tr>
<td></td>
<td>(370 gpm preferred if needing 80 gplm)</td>
</tr>
<tr>
<td>Applicator Slide-In Tank</td>
<td>$3,500 (tank only) (1,800 gallon)</td>
</tr>
<tr>
<td>etc…</td>
<td></td>
</tr>
</tbody>
</table>
# How?

Support Equipment Costs

<table>
<thead>
<tr>
<th>Applicator Loading Pump</th>
<th><strong>Preferred</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Larger than 2” port</td>
</tr>
<tr>
<td></td>
<td>300 gpm max</td>
</tr>
<tr>
<td></td>
<td>275 gpm @ 20 psi</td>
</tr>
<tr>
<td></td>
<td>$2,500</td>
</tr>
<tr>
<td>Design Tips (not shown here) also received from experts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Small Brine Maker System</th>
<th>$16,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Load 5,000 gallons in 8 hours (approximate)</td>
</tr>
<tr>
<td></td>
<td>(facilities not included)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Large Brine Maker</th>
<th>$90,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Load 5,000 gallons in 1 hour (approximate)</td>
</tr>
<tr>
<td></td>
<td>(facilities not included)</td>
</tr>
</tbody>
</table>

etc…

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# How?

**Application Rates**  
(Sample for 2-Hour Cycle Time)

<table>
<thead>
<tr>
<th>Event Type</th>
<th>32-30°F</th>
<th>29-27°F</th>
<th>26-24°F</th>
<th>23-21°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Snow (less than 0.5”/hour)</td>
<td>22</td>
<td>33</td>
<td>42</td>
<td>53</td>
</tr>
<tr>
<td>Medium Snow¹ (0.5”/hour to 1.0”/hour)</td>
<td>33</td>
<td>44</td>
<td>53</td>
<td>NR</td>
</tr>
</tbody>
</table>

*Example During-Storm Direct Application Rates  
Illustration Only (adjust based on local factors and experience)  
Gallons Per Lane Mile (gplm)*

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¹Medium Snow refers to snowfall rates between 0.5”/hour and 1.0”/hour.

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6. Special Considerations

- Focus on Hazard Areas
- Granular only on Hazard Areas
- Lower Speed Roadways
- Plow Only
- Consider Target LOS
- Future Considerations
- Chemical Considerations
- Pavement Type (porous pave., 2.5% cross slope, ...)

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## 7. Expert Contact List

<table>
<thead>
<tr>
<th>Area</th>
<th>DLA Expert</th>
<th>Special Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Beloit, WI</td>
<td>Yes</td>
<td>buy-in strategies, partnering</td>
</tr>
<tr>
<td>City and County of Denver, CO</td>
<td>Yes</td>
<td>special environmental considerations</td>
</tr>
<tr>
<td>Colorado DOT</td>
<td>Yes</td>
<td>enhanced (cold-temperature) chemicals, corrosion considerations</td>
</tr>
<tr>
<td>etc...(full list)</td>
<td></td>
<td>Tip: If considering this tool, contact these experts early</td>
</tr>
</tbody>
</table>
# Next Steps

## Field Testing Recommendations

<table>
<thead>
<tr>
<th>Question</th>
<th>Field Testing Recommendation to Answer Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why use DLA?</td>
<td>Cost Benefit Field Tests</td>
</tr>
<tr>
<td>When to use DLA?</td>
<td>Parameters Field Tests</td>
</tr>
</tbody>
</table>
The End

• Thank you!

• Questions?