The Evolution of Optimized and Sustainable Pro-Active Winter Operations (Paper ID: 0016)

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The Evolution of Optimized and Sustainable Pro-Active Winter Operations

- Best Practice and User Experience
  - Foundational Research
  - Integration of the Winter Maintenance & Meteorological Communities (Developed MDSS)
  - The concurrent equipment evolution
  - Comprehensive winter maintenance training
  - Mitigating environmental impacts
  - Cost savings (payback in investment)
  - Evolving pathways to sustainable operations/maintenance
Foundational Research

- SHRP Report H-385: Development of Anti-Icing Technology
- SHRP Report H-683: Anti-Icing Study: Controlled Chemical Treatments
Manual of Practice for an Effective Anti-icing Program:
A Guide for Highway Winter Maintenance Personnel
Table 8. Weather event: light snow storm.

<table>
<thead>
<tr>
<th>PAVEMENT TEMPERATURE RANGE, AND TREND</th>
<th>INITIAL OPERATION</th>
<th>SUBSEQUENT OPERATIONS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>pavement surface at time of initial operation</td>
<td>maintenance action</td>
<td>dry chemical spread rate, kg/lane-km (lb/lane-mi)</td>
<td>maintenance action</td>
</tr>
<tr>
<td></td>
<td></td>
<td>liquid</td>
<td>solid or prewetted solid</td>
</tr>
<tr>
<td>Above 0°C (32°F), steady or rising</td>
<td>Dry, wet, slush, or light snow cover</td>
<td>None, see comments</td>
<td>None, see comments</td>
</tr>
<tr>
<td>Above 0°C (32°F), 0°C (32°F) or below is imminent;</td>
<td>Dry</td>
<td>Apply liquid or prewetted solid chemical</td>
<td>28 (100)</td>
</tr>
<tr>
<td>ALSO -7 to 0°C (20 to 32°F), remaining in range;</td>
<td>Wet, slush, or light snow cover</td>
<td>Apply liquid or solid chemical</td>
<td>28 (100)</td>
</tr>
<tr>
<td>-10 to -7°C (15 to 20°F), remaining in range</td>
<td>Dry, wet, slush, or light snow cover</td>
<td>Apply prewetted solid chemical</td>
<td>55 (200)</td>
</tr>
<tr>
<td>Below -10°C (15°F), steady or falling</td>
<td>Dry or light snow cover</td>
<td>Plow as needed</td>
<td>Plow as needed</td>
</tr>
</tbody>
</table>

Notes:

**CHEMICAL APPLICATIONS.** (1) Time initial and subsequent chemical applications to prevent deteriorating conditions or development of packed and bonded snow. (2) Apply chemical ahead of traffic rush periods occurring during storm.

**PLOWING.** If needed, plow before chemical applications so that excess snow, slush, or ice is removed and pavement is wet, slushy, or lightly snow covered when treated.

1) Monitor pavement temperature closely for drops toward 0°C (32°F) and below.
2) Treat icy patches if needed with chemical at 28 kg/lane-km (100 lb/lane-mi); plow if needed.
3) Do not apply liquid chemical onto heavy snow accumulation or packed snow.

1) Applications will need to be more frequent at lower temperatures and higher snowfall rates.
2) It is not advisable to apply a liquid chemical at the indicated spread rate when the pavement temperature drops below -5°C (23°F).
3) Do not apply liquid chemical onto heavy snow accumulation or packed snow.

If sufficient moisture is present, solid chemical without prewetting can be applied.

1) It is not recommended that chemicals be applied in this temperature range.
2) Abrasives can be applied to enhance traction.
Problems analyzed/solutions proposed
State DOTs presented successful outcomes and implementation processes
Major outcome—develop MDSS
Major outcome—need better understanding of RWIS station data
Major outcome—Clarus accurate weather observation data in a common format
The Equipment Evolution

- International Winter Maintenance Technology Scanning Tour to Japan & Europe in March 1994
  - Rockwell International assisted by using their processes for developing new products and provided professional facilitators to conduct stakeholder meetings
  - Iowa State University Center for Transportation Research & Education provided technical assistance
  - Five state DOTs formed pooled fund (IA, MI, MN, PA, and WI.)
HMCV Features 2002 Final Report

- Automatic vehicle location (AVL)
- Automated activity reporting
- Air temperature measuring device
- On-board computer systems
- Pavement sensing devices
  - Pavement surface temperature
  - Salinity (freezing point detection system)*
- Multiple materials distribution systems
- Increased horsepower
- Increased vehicle conspicuity
- Friction measuring device* (*pending)
Impact of Winter Operations Chemicals on the Receiving Environment

- Mountainous areas—damage to pine trees
- Surface runoff damaging lakes
- Contamination of shallow wells

May 2007, NCHRP Report 577, *Guidelines for the Selection of Snow & Ice Control Materials to Mitigate Environmental Impacts*

- Evaluated environmental and corrosion impacts of 42 frequently used winter maintenance chemicals
  - Decision tool
  - Purchase specification
  - Monitoring program
AASHTO’s suite of winter maintenance methods & equipment training [www.sicop.net](http://www.sicop.net) (documents)

- Anti-icing/RWIS
- Selecting Snow & Ice Control Materials to Mitigate Environmental Impacts
- Equipment Maintenance
- Proper Plowing Techniques
- Deicing
- Blowing Snow Mitigation
- Winter Maintenance Management
- Performance Measures for Snow & Ice Control Opns
Savings and Payback

- **Anti-icing and RWIS**
  - Benefit/cost 2:1 to 13:1 on investment (1993)
  - Plus increase travel safety & level of service
  - Improved environmental quality

- **MDSS**
  - New Hampshire DOT Case Study (2009)
    - 17% savings to provide same level of service (MDSS vs without MDSS)
  - Indiana DOT (2009)
    - $10 million savings in salt and $1 million savings in overtime (normalized to varying winter conditions)
Evolving Pathways to Sustainable Operations

- AASHTO Center for Environmental Excellence
  - One stop source of environmental information for transportation professionals

- FHWA Sustainable Highways
  - Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) pilot tested in 2011

- APWA Center for Sustainability
  - Framework for Sustainable Communities
Contact Information

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