“How Chlorides Work in Deicing Compounds”

DuPage County Department of Transportation
Wheaton, Illinois

September 24, 2015

Speaker:  Mark Cornwell
Sustainable Salting Solutions, LLC
Special Thanks!

DuPage County Department of Transportation

DuPage River Salt Creek Workgroup and its Supporting member communities

Those attending and contributing experience!!!
Public Safety/Agency Budgets
A Tough Balancing Act

Public Safety and Annual Budgets

Less Salt and Abrasives
Worst example of salt over kill in a parking lot

No...this isn’t snow! It rained hard two days later
What kinds of information are required to make sound decisions regarding material selection and use?
Winter Preparation-Site Inventory and Mapping

Snow Storage

Base Map used for field note collection

Total Parking lot Sq.Ft.-34,000

Raised catch basin

Loading Dock

Fire hydrant

Brick paving 2,000 Sq.ft.

Special intersection

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Sidewalk Obstacles

Sidewalk obstacles result in damaged equipment in reduced levels of safety
Dry Runs of Routes

- Changes in staff
  - New employees
- Changes in the landscape
  - Where to pile snow
- New walks
- Dangerous obstacles

Information Courtesy of the University of Wisconsin
Combat Readiness Required!
Weather Forecasts

- Weather forecasts trigger the readiness alert.
- What determines or triggers a “Call-in”
- Who makes the call?
- Are procedures Outlined, Distributed, and Reviewed?
- How long does it take to get the troops in to fight the battle?
Good R.W.I.S. Program VERY Important

Weather Services

Internet Weather Sites

R.W.I.S
## Prioritized RWIS Observations

1. Precipitation Type  
2. Surface Temperature  
3. Surface Status (dry/wet)  
4. Precipitation Rate/Intensity  
5. Visibility  
6. Precipitation Accumulation  
7. Chemical Percentage  
8. Dew point  
9. Air Temperature  
10. Ice Percentage  
11. Freezing Point Temperature  
12. Depth of Water Layer  
13. Wind Speed  
14. Relative Humidity  
15. Wind Direction  
16. Barometric Pressure  
17. Subsurface Temperature  
18. Wind Gusts

### Cameras
Categorize Winter Precipitation by 5 Main Types with sub-categories

• Hoar Frost, fog, or Dusting

• < 2 inches
  • Trending warmer or colder

• < 4 inches
  • Trending warmer or colder
  • Wind?

• > 8 inches
  • Same sub-categories as for 4”

• Freezing rain (should we add Rain?)
Historical Indexes

Snow Fall (inches)

Number of Responses

Labor & Contractor Costs ($)

Snow/Ice Melt Chemical Costs ($)

Equipment Rental Costs ($)

Grand Total ($)

Information Courtesy of Michigan State University
Measuring performance (Benchmarking) winter maintenance/customer service expectations

Internal

• Customer call logs?

• Time to achieve cleared pavement goals?

• Total costs per event?
Graphing data

Salt and Sand use compared to Snow and number of Events

Information Courtesy of the University of Michigan
## Minnesota Application Guidelines

### Deicing Application Rate Guidelines

<table>
<thead>
<tr>
<th>Pavement Temp. (°F) and Trend</th>
<th>Weather Condition</th>
<th>Maintenance Actions</th>
<th>Lbs/two-lane mile</th>
<th>Dry Salt*</th>
<th>Winter Sand (abrasives)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;30° †</td>
<td>Snow</td>
<td>Plow, treat intersections, only, Apply chemical</td>
<td>80</td>
<td>70</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. rain</td>
<td></td>
<td>80 - 180</td>
<td>70 - 140</td>
<td>100 - 200*</td>
</tr>
<tr>
<td>30° †</td>
<td>Snow</td>
<td>Plow &amp; apply chemical</td>
<td>90 - 180</td>
<td>70 - 140</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. rain</td>
<td></td>
<td>150 - 200</td>
<td>130 - 180</td>
<td>180 - 240*</td>
</tr>
<tr>
<td>25 - 30° †</td>
<td>Snow</td>
<td>Chemical, Apply chemical</td>
<td>120 - 160</td>
<td>100 - 140</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. rain</td>
<td></td>
<td>150 - 200</td>
<td>130 - 180</td>
<td>180 - 240*</td>
</tr>
<tr>
<td>25 - 30° †</td>
<td>Snow</td>
<td>Chemical, Apply chemical</td>
<td>120 - 160</td>
<td>100 - 140</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. rain</td>
<td></td>
<td>160 - 240</td>
<td>140 - 210</td>
<td>200 - 300*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>20 - 25° †</td>
<td>Snow</td>
<td>Chemical, Plow &amp; apply chemical</td>
<td>160 - 240</td>
<td>140 - 210</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td>Frz. rain</td>
<td></td>
<td></td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>20 - 25° †</td>
<td>Snow</td>
<td>Chemical, Plow &amp; apply chemical</td>
<td>200 - 280</td>
<td>175 - 250</td>
<td>250 - 350*</td>
</tr>
<tr>
<td></td>
<td>Frz. rain</td>
<td></td>
<td></td>
<td></td>
<td>Not recommended</td>
</tr>
<tr>
<td>15 - 20° †</td>
<td>Snow</td>
<td>Chemical, Plow &amp; apply chemical</td>
<td>200 - 280</td>
<td>175 - 250</td>
<td>250 - 350*</td>
</tr>
<tr>
<td></td>
<td>Frz. rain</td>
<td></td>
<td></td>
<td></td>
<td>Not recommended</td>
</tr>
<tr>
<td>15 - 20° †</td>
<td>Snow</td>
<td>Chemical, Plow &amp; apply chemical</td>
<td>240 - 320</td>
<td>210 - 290</td>
<td>300 - 400*</td>
</tr>
<tr>
<td></td>
<td>Frz. rain</td>
<td></td>
<td></td>
<td></td>
<td>Not recommended</td>
</tr>
<tr>
<td>0 - 15° †</td>
<td>Snow</td>
<td>Flow &amp; apply chemical</td>
<td>240 - 320</td>
<td>210 - 290</td>
<td>300 - 400*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500 for frz. rain</td>
</tr>
<tr>
<td>&lt; 0°</td>
<td>Snow</td>
<td>Flow &amp; apply chemical</td>
<td>240 - 320</td>
<td>210 - 290</td>
<td>300 - 400*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500 - 750 spot treat as needed</td>
</tr>
</tbody>
</table>

*Dry salt is not recommended. It is likely to blow off the road before it melts ice.

**A blend of CaCl₂, Ca(NO₃)₂, MgCl₂, or NaCl added to MgCl₂ may make ice as low as 32°F.
Pavement Temperature more important than Air Temperature!

Pavement temperature helps determine chemical use
Post Event Analysis

All event data has been collected—Discussion Time—How did we do?

• Identify successes and failures

• Duplicate success where possible and prepare corrective strategy for failures

• Always continue to evaluate new practices against existing

PLAN—DO—CHECK—ACT!!!
Conduct your own experiments!

50 Gal/L.M = 10 oz/100 Sq.Ft.
Trained Workforce: “The Times They are a Changin”

- Reduces operational costs
- Improves operational efficiency and effectiveness
- Shares proper knowledge and job skills
- Improves morale and attitudes
- Enhances organizational and personnel safety
- Mitigates tort liability
- Enhances a positive public and media image

“Curtailing training is short-sighted and is likely to create problems that end up costing more than investment in proper training.”

- Salt Institute
Educating/Informing the Public

• Build an informative agency website
• Utilize mailings
• Local Newspapers
• Community Blogs
• School and Civic Club Involvement

Build Strong Support for Your Agency!!!!!
Educating/Informing the Public

Using Social Media- Great tools to Inform/Teach/Learn
Good Housekeeping measures—Storage and other BMPs
All materials kept under good roof and spillage returned to storage
Typical Material Storage Facilities
Good Secondary Containment

Photo courtesy of the University of Michigan
Double Wall Liquid Storage

Grand Valley State University
Application methods and things to consider
Why Pre-wet/Pre-treat?

Get the salt dissolving faster in lower temperature and with low water volumes

Pre-wet/Pre-treated Salt allows up to 25% application reductions

Solid salt does not melt anything. It must form a brine before melting can occur
How do we Pre-wet Salt and Abrasives

On-Board Pre-wetting Systems
Traditional Pre-wet is 6-10 Gallons/Ton

- At 500#/LM and 10 Gallons/Ton
- Same as a shot glass/100 sq.ft.
Pre-Treating Salt/Abrasives prior to delivery
Methods for Pre-treating Salt or Abrasives

Buy it Pre-Treated
Methods for Pre-treating Salt or Abrasives

Spread it!

Spray it!

Treat it yourself

Stack it!

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Methods for Pre-treating Salt or Abrasives

Pug milling
Anti-icing can save 10 times the cost of de-icing

Slide courtesy of Bret Hodne, City of West Des Moines, Iowa
Deicers help to prevent bonding

Very little salt is required to prevent ice from bonding!

Concentration of NaCl Required to Prevent Freezing and Bonding at 5 degrees F

<table>
<thead>
<tr>
<th>NaCl Concentration (%)</th>
<th>prevent freezing</th>
<th>prevent bonding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8</td>
<td>0.1</td>
</tr>
</tbody>
</table>

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What’s wrong with this picture?

Nozzle height off ground?

Spacing around 8”

Is there dry pavement between lines?

What chemical?

What is the pavement temperature?

It depends!
Watch for re-freeze issue that cause accidents

Melt water re-freeze

Alternating sun and shade can catch people unaware
Calibration:
Second only to plowing for improved salt efficiency
Indiana LTAP Winter Operations Training
Rich Domonoko, Gary, Indiana
November 2012

Calibration Exercises
with City of Gary, West Chicago, Hobart
Do you know where your deicers end up?

Curb and Gutter

Shoulders and Ditches
How much salt is being lost "Off Target" (Bounce, Scatter, Traffic)

• 1970's MDOT Study
  – 25% loss if not pre-wetted

• Denmark Study
  – 34% at application
  – 20-30% through traffic

• 50-60% Potential Material Loss
High liquid to Solid Experience in Minnesota

At 60-80 Gallons/Ton
Significant salt bouncing off road at 35 MPH!

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Observations in Europe: Holton, NL
Application Testing Grid

Holton, Netherlands
Note: The original Grid was designed for a three lane application demonstration.

For a more fined tuned evaluation, include (3) 4 foot lines in each lane. This will allow for a better visual of where materials are deposited.

Provide ample space before entering grid to allow spreading equipment to attain optimal operating speed.

A dark pavement with no cracks is best.
Test to Assure Proper Material Placement!
Spinner Calibration
City of Novi Bounce and Scatter-2011

Truck 605, run at 350lbs/lane mile, 27mph

Test #1 -- Spinner on low, dry salt

Figure 5  Application Test 1--Spinner on Low, Dry Salt (photo credit City of Generic)
Test #4 – Spinner off, pre-wet 10-15 gal/ton

Figure 8. Application Test 4 -- Spinner Off, Prewet 10-15 gal/ton (photo credit City of Generic)
2012 MDOT Bounce and Scatter Study-Speed

Bounce and Scatter Collection Graphs

Average Percent Weight Distribution

Untreated, 25 mph, Conveyor

Average Salt Displacement

Note: Each letter represents a 4’ width by 100’ length portion of the collection grid.

Total % by Group

± 0’ - 4’  65.2%
± 4’ - 8’  22.0%
± 8’ - 12’  7.9%
± 12’ - 24’  4.8%

65.2% on target
20.8% on target

35.4% wasted off target

Calibrate Driver Speed!!
First One to Finish Line Doesn’t necessarily Win.

SLOW DOWN!!

Slide Courtesy of Rich Domonoko, Indiana LTAP
2013 MDOT Bounce and Scatter Study

2013 Advanced Delivery Systems

Salt Slurry

Zero Velocity

Operations Field Services Division
2013 MDOT Bounce and Scatter Study

Bounce and Scatter 2013

2013 Y-Chute at Different Heights

Y-Chute

One Inch Height

Operations Field Services Division
Bounce and Scatter 2013

Access to Findings

A copy of the 2013 Salt Bounce and Scatter Report will be available soon:


Operations Field Services Division

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

Link---http://www.clearroads.org/research-projects/09-02liquid-only.html
2010 Clear Roads Study
Participating States/Agencies

Location of Participating Agencies

We are here
When might DLA be most appropriate?

Typical Winter Season

- Optimum
- Caution

Pavement temperature is key!
Methods for Direct Liquid Applications

Photos courtesy of the University of Michigan Grounds Department
Ohio DOT Liquid Application Tanker
Ohio DOT Liquid Application Tanker
Direct Liquid Applications (D.L.A.)

- Anti-icing (in conjunction with plow/additional DLA)
- Direct application on snowfall events less than 1"
- Post plow operations
- Black ice/frost treatment
Equipment: Efficient, Effective and Versatile

Photos courtesy of: City of Wixom, Michigan
Recent advances in products and use
Sodium Chloride Works Great Down to 15 F.

Effectiveness Of Salt At Night
Ice Melted Per One Pound Of Salt

Remember:
Salt works better in sunshine.

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>Pounds of Ice</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>46</td>
</tr>
<tr>
<td>25°</td>
<td>14</td>
</tr>
<tr>
<td>20°</td>
<td>9</td>
</tr>
<tr>
<td>15°</td>
<td>6</td>
</tr>
<tr>
<td>10°</td>
<td>5</td>
</tr>
<tr>
<td>5°</td>
<td>4</td>
</tr>
<tr>
<td>0°</td>
<td>4</td>
</tr>
<tr>
<td>-5°</td>
<td>3</td>
</tr>
</tbody>
</table>
Agricultural By-Product Deicers

- Used in liquid form
- Often blended with chloride deicers or use in pre-wetting or anti-icing
- Believed to help liquid stay on the road longer in anti-icing applications
- Some suppliers also claim improved low temperature performance vs. salt brine, but this is not backed up by independent research

Slide Courtesy of Ben Jordan, University of Wisconsin, Snow and Ice Control Program
Water Freezes at 0 C (32 F.)
23.3% Salt Brine Freezes at -21 C (-6 F.)

Expensive Valve!

Be Careful!!!!
Liquids Evolution at the University of Michigan

M-50 Sugar Beets

Sodium Chloride Brine w/Additive 9:1 ratio

10% Caliber M1000
90% 23% NaCl Brine
"Super Mix"—85:10:5

-9.4 F Freeze Point

<table>
<thead>
<tr>
<th>Test Requested</th>
<th>MCL</th>
<th>Analysis Result</th>
<th>Units</th>
<th>MDL</th>
<th>Method</th>
<th>Date Completed</th>
<th>Analyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freezing Point</td>
<td>-23.0</td>
<td>Degree C</td>
<td></td>
<td></td>
<td>ASTM D 1177</td>
<td>2/16/2006</td>
<td>JS</td>
</tr>
<tr>
<td>Freeze Point = -9.4 Degrees F.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper, Cu</td>
<td>&lt;0.1</td>
<td>mg/L</td>
<td>0.1</td>
<td></td>
<td>EPA 290.7</td>
<td>2/17/2006</td>
<td>KC</td>
</tr>
<tr>
<td>Corrosion Rate, 3 Day, TSI Coupons</td>
<td>69.2</td>
<td>%</td>
<td></td>
<td></td>
<td>NACE PNS</td>
<td>2/17/2006</td>
<td>JH</td>
</tr>
<tr>
<td>Corrosion Rate Duplicate = 70.0 %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metals Digestion</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td>SW 846 3050</td>
<td>2/14/2006</td>
<td>JS</td>
</tr>
<tr>
<td>Total Phosphate (as P)</td>
<td>16</td>
<td>mg/L</td>
<td>10.00</td>
<td></td>
<td>EPA 365.4</td>
<td>2/16/2006</td>
<td>WW</td>
</tr>
<tr>
<td>Cyanide, Total</td>
<td>0.38</td>
<td>mg/L</td>
<td>0.05</td>
<td></td>
<td>SM 4500</td>
<td>2/16/2006</td>
<td>WW</td>
</tr>
</tbody>
</table>

MCL = Maximum Contamination Level
MDL = Method/Minimum Detection Limit
UR = Unregulated

Thank you for choosing Analytical Laboratories for your testing needs. If you have any questions about this report, or any future analytical needs, please contact: David Bennett
Quality Control Critical-Salt Brine Manufacturing Log

**Brewmeister's Log**

<table>
<thead>
<tr>
<th>Date</th>
<th>Brewmeister</th>
<th>Existing Quantity/Gals</th>
<th>Gals. to be made</th>
<th>Desired Ratio</th>
<th>Additive</th>
<th>Additive Quantity</th>
<th>Circulated 15 min Y/N</th>
<th>Sample Collected</th>
<th>Final Quantity</th>
<th>Sample Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/22/2006</td>
<td>Cornwell</td>
<td>350</td>
<td>4650</td>
<td>8.5:1.5</td>
<td>C5000</td>
<td>697</td>
<td>Y</td>
<td>Y</td>
<td>5000</td>
<td>22209-1</td>
</tr>
</tbody>
</table>

Collect, date and label sample of every batch manufactured!
Evaporated Salt versus Mined Salt for making brine?

Source: Dennis Waite, Warren And Forest County Penn DOT presentation

+5% insoluble/Clean out costs
Get technical data and lab reports

**DESCRIPTION:**

CG-90® Surface Saver® anticorrosive deicer is an enhanced highway deicing salt product containing a corrosion inhibitor. It is a highly effective performer that provides superior protection against salt-induced corrosion of exposed metal surfaces through its corrosion inhibitor, reduced scaling of concrete surfaces due to freeze/thaw cycling, and excellent deicing capabilities. This product causes significantly less scaling on concrete than plain salt (4% solution) on marginally air-entrained concrete as measured by ASTM Standard C-672 and over 50 freeze-thaw cycles in Cargill laboratory tests. Using this product may reduce highway and bridge maintenance costs.

**COMPLIANCE:**

CG-90® Surface Saver® anticorrosive deicer is not approved for human or animal consumption. It is intended for use only as a chemical deicer on roadways and thoroughfares. This product complies fully with ASTM Specifications D-632-99, type 1, grade 1.

**ADDITIVES:**

CG-90® Surface Saver® anticorrosive deicer contains a patented corrosion inhibitor and Magnesium Chloride which enhances deicing capability.

**APPLICATION:**

CG-90® Surface Saver® anticorrosive deicer should be applied at the same rate as regular highway deicing salt.

**HANDLING AND STORAGE:**

CG-90® Surface Saver® anticorrosive deicer requires no additional handling, equipment or labor over and above that used for regular highway deicing salt. To improve caking resistance and reduce run-off, it is recommended that the product be stored in a covered storage shed or tarped. Normal precautionary measures for the safe handling of deicers should be observed.

**PACKAGING:**

CG-90® Surface Saver® anticorrosive deicer is available in bulk and 2000 lb minibulk bags.

**METHODS OF ANALYSIS:**

Methods of analysis are taken from the ASTM designations: D-632-99 and D-634-96, from SHRP H132, and from Cargill. Corrosion measured on 5% solutions of deicer according to ASTM Standard G-21-72. Test method available on request.

**CHEMICAL ANALYSIS:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Units</th>
<th>Typical</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Chloride</td>
<td>%</td>
<td>78.2</td>
<td></td>
</tr>
<tr>
<td>Magnesium Chloride</td>
<td>%</td>
<td>22.0</td>
<td></td>
</tr>
<tr>
<td>Corrosion Inhibitors</td>
<td>%</td>
<td>1.8</td>
<td></td>
</tr>
</tbody>
</table>

**SIEVE ANALYSIS:**

<table>
<thead>
<tr>
<th>U.S. Mesh</th>
<th>Opening Inches</th>
<th>Opening Microns</th>
<th>Typical</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2</td>
<td>0.500</td>
<td>12700</td>
<td>100</td>
<td>100 min.</td>
</tr>
<tr>
<td>3 1/8</td>
<td>0.375</td>
<td>7925</td>
<td>97</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>0.187</td>
<td>4760</td>
<td>55</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>0.0937</td>
<td>2380</td>
<td>38</td>
<td>-</td>
</tr>
<tr>
<td>19</td>
<td>0.0232</td>
<td>590</td>
<td>8</td>
<td>15 max.</td>
</tr>
</tbody>
</table>

Note: Sieve analysis is reported as percent passing.

**PRODUCT BENEFITS:**

- Minimum % protection against salt induced corrosion: 99%
- Magnesium chloride component melts ice down to -25° F
- Reduces surface scaling of concrete due to freeze/thaw cycling.

**PRODUCING LOCATIONS: VARIOUS LOCATIONS ACROSS THE U.S.**

No. 7703 Revised July 2005

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CARGILL DEICING TECHNOLOGY
24950 Country Club Blvd. Ste 450
North Olmsted, OH 44070
1-800-600-7258

NOTICE: All of the above statements, recommendations, suggestions and data are based on our laboratory results, and we believe same to be reliable. Nevertheless, all such statements, recommendations, suggestions and data are made without guaranty or warranty on our part and we disclaim all liabilities and warranties, expressed or implied, (including without limitation those merchantability and fitness for a particular purpose) with respect to the same.
Innovative Idea to Standardize Pre-Wet Systems

Final Custom Liquid Application Chute

Stainless steel chute attaches to the sander with minimal effort.
Equipment Innovations

City of Kentwood, Michigan
Pavement Friction Testing Critical Component for Measuring Winter Conditions

Historical Overview of Friction Testing in Connecticut

Prepared by:
John W. Menault, P.E.
March 2010

Research Project: SPR-2243
Report 1
Report No. CT-2243-1-10-1

Friction Testing and Safety Evaluation

Friction Testing and Safety Evaluation Services

Project Title: "Friction Testing and Safety Evaluation Services"
Objectives: Provide friction testing and roadway safety evaluation services to Connecticut Department of Transportation (ConnDOT) offices upon request to ensure all roadway surfaces provide an acceptable level of surface friction for prevailing traffic conditions.
Methodology: The ConnDOT's wet pavement "Suggested List of Surveillance Study Sites" (SLS/SSS) high accident locations or areas suspected of having slippery pavement are identified and tested for wet-wetness and resistance. Results are summarized and/or reported to the requester.
Equipment: 2008 ASTM E274 Dual-Sided Pavement Friction Tester (DynaTest) with a texture measurement laser device and GPS system.
Program Implementation: 1969
Principal Investigator: John W. Menault, P.E. Phone: 860-258-0352 Email: john.menault@po.state.ct.us
SPR-1417: Project conducted in cooperation with the U.S. DOT Federal Highway Administration

Friction Testing Enhancements

Enhancements to the Pavement Friction Testing Program in Connecticut

Objectives: The Connecticut Department of Transportation (DOT) is researching the relationship between pavement friction and texture; the effects of roadway geometry on friction measurements; potential use of the international Friction Index; and, development of speed correction factors for friction numbers measured at speeds below/above 10 mph.
Project Description:
1. Implement a new pavement friction tester with texture measurement capabilities;
2. Develop speed correction equations for pavement friction measurements;
3. Evaluate the effect of roadway geometry on friction measurements;
4. Compare texture measurements with those from a Circular Track Meter; and,
5. Utilize texture measurements to evaluate use of the International Friction Index (IFI).
Final Report Anticipated: June 2008
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SPR-2243: A project prepared in cooperation with the U.S. DOT Federal Highway Administration (FHWA)

FIGURE A-4 Additional Friction Testing trading cards distributed at the TRB 89th Annual Meeting.

Historical Overview of Friction Testing in Connecticut John W. Menault, P.E. March 2010
Temperature Indicators

Ice Alert
City of Holland—Snow Melt System

Benefits

- No Snow Removal
- Extended Pavement Life
- Extended Brick Paver Life
- No Salt/Sand/Deicer
- Reduced Slip & Fall Liability
- Many Winter Activities Downtown
- Added Customers during Down seasons
- Reduced wear inside retail stores
- Sustainable Practice
- Recruiting

Winter Operations Conference
October 17, 2013

Courtesy of City of Holland, Michigan  Winter Ops. Conference 2013
Design

- Initial install on 3 blocks downtown
- Storefront to Storefront
- Wirsbo Meltaway® System selected
- 1” PE Tubing w/ 6” Spacing
- Melt 1” of Snow/Hour @ 20°F &
Avoiding the pitfalls!
Good Plowing—First Line of Defense

Reduce Pollution by Minimizing Dilution

PLOWING CLEAN = LESS CHEMICAL!!!!!!
Avoid overfilling spreaders

• Overloaded spreaders lead to spillage—Lost $

• Overload truck chassis

• Could violate operator CDL

• Always be sure to remove clumps from grates which can fall off and cause an accident
“Don’t Shoot Till You See The Whites of Their Eyes”

Colonel William Prescott
Battle of Bunker Hill
Be Safe

Make it back home alive and unbroken!
Thanks for making our roads safe!
Questions?

Thank you . . .

Mark Cornwell

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