Iowa Department of Transportation
Snow and Ice Operations

Dennis Burkheimer
Winter Operations Administrator
Office of Maintenance
Iowa Statistics (2006)

- Population- approximately 3 million
- #1 producer of corn (20% of national total)
- #1 producer of soybeans (17% of national total)
- #1 hog producer
- #1 poultry and egg producer
- #2 cattle producer
- #2 agriculture exporter - $16 billion
Topics

- Overview of operations and statistics
- RWIS and Weather Services
- Deicing materials
- Equipment
- Experimental equipment
- Better mousetraps
Overview

- 24,692 lane miles of roadway
- 3,948 lane miles (includes ramps) of Interstate highway
- 6 Districts
- 901 Snowplows
- 1,200 operators, supervisors and mechanics
- 110 maintenance facilities
- $35 million snow/ice budget
2007-2008 Winter Statistics

- Salt used- 301,261 tons
- Salt brine used- 15,625,822 gallons
- Sand used- 59,798 tons
- Calcium Chloride- 120,850 gallons
- Statewide average snowfall- 59 inches
- Dec-Feb was the 23rd coldest and 8th wettest in 135 years of recordkeeping
Snowfall Accumulation (inches)
October 15 to April 15 Average
1983-2004
Salt and Abrasive use Statewide
compared with snowfall

Fiscal Year

Tons (000)

Inches of snowfall

[Graph showing the comparison of salt, abrasives, and snowfall over fiscal years from 1988 to 2008]
Total Snow and Ice Hours of Operation
**Daily Report**

<table>
<thead>
<tr>
<th>Location</th>
<th>COST CENTER</th>
<th>CREATED BY</th>
<th>DATE</th>
</tr>
</thead>
</table>

**Last Updated By** James Vansickle  
**Last Updated** 12/14/2007

**Normal Conditions**

<table>
<thead>
<tr>
<th>24 Hour Summary</th>
<th>Precipitation</th>
<th>Crew Information</th>
<th>Road Closures</th>
<th>Pulled Off Road</th>
<th>Comments</th>
</tr>
</thead>
</table>

- **Trace of Snow**
  - less than 1/10"

- **Snow Amount**
  - 2.5 in.

- **Outside Salt Sales**
  - tons

**RMS Material Usage**

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt</td>
<td>463.36 tons</td>
</tr>
<tr>
<td>Sand</td>
<td>tons</td>
</tr>
<tr>
<td>Salt Brine</td>
<td>10890.10 gal</td>
</tr>
<tr>
<td>CaCl Brine</td>
<td>gal</td>
</tr>
<tr>
<td>CaCl Dry</td>
<td>bags</td>
</tr>
</tbody>
</table>

**NOTE:** Material usage is calculated from the RMS Daily log materials entries. If material usage is blank RMS daily log materials have not been entered.
### District Summary

<table>
<thead>
<tr>
<th>District</th>
<th>Lane Miles</th>
<th>Salt (tons)</th>
<th>Salt Brine (gals)</th>
<th>Calcium Chloride Brine (gals)</th>
<th>Calcium Chloride Flakes (bags)</th>
<th>Sand (tons)</th>
<th>Total Snowice Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>This Pay Period</td>
<td>YTD</td>
<td>This Pay Period</td>
<td>YTD</td>
<td>This Pay Period</td>
<td>YTD</td>
</tr>
<tr>
<td>District 1</td>
<td>4.596</td>
<td>1,477</td>
<td>55,973</td>
<td>47,593</td>
<td>2,212,248</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>District 2</td>
<td>4.690</td>
<td>1,342</td>
<td>37,815</td>
<td>105,252</td>
<td>2,162,509</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>District 3</td>
<td>3.946</td>
<td>2,405</td>
<td>30,786</td>
<td>41,380</td>
<td>985,046</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>District 4</td>
<td>3.792</td>
<td>258</td>
<td>59,186</td>
<td>22,727</td>
<td>1,215,235</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>District 5</td>
<td>4.697</td>
<td>52</td>
<td>47,872</td>
<td>11,208</td>
<td>5,671,506</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>District 6</td>
<td>4.318</td>
<td>1,155</td>
<td>73,567</td>
<td>94,759</td>
<td>3,796,299</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Statewide Summary

<table>
<thead>
<tr>
<th></th>
<th>Salt (tons)</th>
<th>Salt Brine (gals)</th>
<th>Calcium Chloride Brine (gals)</th>
<th>Calcium Chloride Flakes (bags)</th>
<th>Sand (tons)</th>
<th>Total Snowice Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used This Pay Period</td>
<td>6,989</td>
<td>325,863</td>
<td>0</td>
<td>51</td>
<td>1,725</td>
<td>14,692</td>
</tr>
<tr>
<td>Used Year to Date</td>
<td>500,985</td>
<td>15,812,008</td>
<td>120,850</td>
<td>1100.07</td>
<td>59,745</td>
<td>518,008</td>
</tr>
<tr>
<td>Annual 5 year Average Used</td>
<td>195,860</td>
<td>9,601,274</td>
<td>83,850</td>
<td>614</td>
<td>14,553</td>
<td>307,869</td>
</tr>
<tr>
<td>Percent of 5 year Avg Used</td>
<td>153.6%</td>
<td>162.6%</td>
<td>144.1%</td>
<td>179.2%</td>
<td>410.5%</td>
<td>187.6%</td>
</tr>
<tr>
<td>Percent of Winter Season Completed</td>
<td>100.0%</td>
<td>13 of 13 winter pay periods completed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Bi-weekly report Page 2
Iowa RWIS and Weather Information Program
Road Weather Information System (RWIS)- 62 sites

- Wind Speed and Direction
- Air temperature
- Relative humidity
- Precipitation sensor
- Pavement temperature
- Subsurface temperature
Current Iowa RWIS Locations
Iowa is upgrading RWIS sites with new equipment:

- WIVIS precipitation sensors
  - Visibility and precipitation identification
- Road cameras
- Traffic speed sensors
- Sub-surface temperature data probe (TDP)
  - Temperature readings every few inches from 3” below surface to 6’ below
Traffic Speed Sensors

- Radar detection across all lanes (up to 10 possible)

- Reports:
  - Speed
  - Volume
  - Lane occupancy %
  - Long/short length counts
Traffic Speed Sensors

- See if weather is adversely affecting travel
- Is it improving or worsening?
- See which lanes/directions most affected
- Performance measurement

<table>
<thead>
<tr>
<th>Zones</th>
<th>TrfSpd</th>
<th>NormVol</th>
<th>Occup</th>
<th>LongVol</th>
<th>Traffic Daily Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-80 EB Driving Lane (0)</td>
<td>79 mph</td>
<td>23</td>
<td>7%</td>
<td>23</td>
<td>History</td>
</tr>
<tr>
<td>I-80 EB Passing Lane (1)</td>
<td>78 mph</td>
<td>10</td>
<td>1%</td>
<td>9</td>
<td>History</td>
</tr>
<tr>
<td>I-80 WB Passing Lane (2)</td>
<td>71 mph</td>
<td>3</td>
<td>1%</td>
<td>3</td>
<td>History</td>
</tr>
<tr>
<td>I-80 WB Driving Lane (3)</td>
<td>71 mph</td>
<td>16</td>
<td>6%</td>
<td>16</td>
<td>History</td>
</tr>
</tbody>
</table>
Investigating portable/minimal weather stations to fill in gaps between RWIS or for special needs.

- Equipped with:
  - Solar panel
  - Cell modem
  - Road temperature probe
  - Atmospheric sensors
Forecasts (Meridian Environmental)

- Four times a day weather and frost forecasts are delivered via phone, e-mail, Internet and DTN
- Future radar
- Radar with ground truth
- Forecasts shared with other government entities
- Nowcasts with 2 hour advance notice provided via pager
  - Precipitation start time
  - Type of precipitation
  - Pavement temperatures at start of storm
  - Wind speed and direction
Statewide Summary:
Temperatures are very mild this morning and will hold fairly steady, and even fall in some areas, today as a cold front moves through. Some light snow and flurries are possible in some northern and eastern areas, but accumulating snow isn’t expected. Some snow shower activity may be enough to wet some roads though. Winds will also be strong out of the west and northwest today, and while the mild temperatures have likely capped the snow pack with an icy crust, some drifting may still be possible today. Tonight through Wednesday night will be dry.
Why—The slip-in weed sprayer was designed to accomplish weed spraying in a timely manner. Weather conditions and work hours afford a small window of opportunity to spray weeds.

How—To operate the slip-in weed sprayer, simply remove the tailgate of any truck, slip the unit in, latch the tailgate, hook up the two hoses, insert the wiring into the trailer plug in, mix the weed spray, and go! The pump is hydraulically driven off the truck’s spinner or anti-icer unit so pressure can be adjusted from the cab of the truck. The valves are electric for each nozzle and operated by switches mounted in a box that is also located in the truck’s cab.

Cost- $1,758.50

Result—The slip-in weed sprayer performs extremely well and is easy to slip in and out of the tailgate. It enhances efficiency by allowing operators to spray more acres per load and does not require use of a boom. The unit sprays left, right, center and any combination of those directions. There is significantly less drift and the operator is able to spray 0 to 54 feet with the flip of a switch.

Contact—John Jepsen, senior equipment operator, or Kirk Montange, mechanic, at 712-239-2856
Alert System

Alert Criteria

Click on the "Enable" box next to each weather parameter you wish to be Alerted to. Enter a value for the selected parameter where required.

<table>
<thead>
<tr>
<th>Location: Ames</th>
<th>Audible Alert: None</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Alert Type</th>
<th>Variable</th>
<th>Enable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forecast Conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temp &lt;</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Temp &gt;</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Humidity &lt;</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Humidity &gt;</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Wind Speed &gt; 20 mph</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td><strong>NWS Alerts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warnings</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>Watches</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Advisories</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td><strong>Observed Conditions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fog</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Thunderstorm</td>
<td></td>
<td>□</td>
</tr>
<tr>
<td>Freezing Precip</td>
<td>□</td>
<td></td>
</tr>
<tr>
<td>Rain</td>
<td></td>
<td>□</td>
</tr>
</tbody>
</table>
Weatherview

- Weatherview is the DOT’s public access to RWIS and AWOS info.
- Will undergo major revisions becoming available this fall.

www.dotweatherview.com
New Weatherview

- GIS-layered custom maps
- New site info displays
- New winter maintenance tools

New URL -- www.dotweatherview.gov
<table>
<thead>
<tr>
<th>Current conditions</th>
<th>Cedar Rapids Hwy 30 East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air temp: 34</td>
<td>Visibility: 1.2 mi.</td>
</tr>
<tr>
<td>Dew point: 32</td>
<td>Road condition: Wet</td>
</tr>
<tr>
<td>Traffic Speed: 67 mph</td>
<td>Pavement temp: 40</td>
</tr>
<tr>
<td></td>
<td>Wind speed: 9 mph</td>
</tr>
<tr>
<td></td>
<td>Wind direction: SE</td>
</tr>
<tr>
<td></td>
<td>Etc…</td>
</tr>
</tbody>
</table>
Mobile Data

- Display future GPS vehicle info
  - Thermal Maps?
  - Truck locations?
  - Truck activities?

- Publicly available datasets to be determined

12/5/2005 9:00 pm
A2869
Plow: Up
Material: 250 lb/Lm
Liquid: 20 gal/ton
Speed: 40 mph
Direction: W
Location: 42.16 - 93.602
Pave. Temp.: 19 F
Deicing Chemicals
Deicing Chemicals used or Tested by Iowa DOT

- Sodium Chloride
- Sodium Chloride brine
- Calcium Chloride (liquid & dry)
- Calcium Magnesium Acetate (CMA)
- Potassium Acetate
- Ice Ban (experimental) with salt brine
- Geomelt with salt brine
- Ice Slicer
- Liquid Corn Salt (LCS)
- Activar
- Geomelt 55
- Mineral Melt
- First Down
- Clear Lane
- All Clear
- Caliber
- AG 100
- Fusion
- Sodium Chloride/ Calcium Chloride blend
Material Evaluation Process

- Pre-qualification
- Laboratory Testing
- Operational Testing
- Evaluation and Recommendation
Application
Rate- 50 gals/lane mile

Spicy Blend                           Salt Brine
Images after 1\textsuperscript{st} application

Spicy Blend

Salt Brine
Runway Thermal Comparisons

- Thermal images help track cooling effects of chemicals as they melt ice
- Temperature/color scales same in all images
- Images cover approximately 6 square feet of pavement

Spicy blend immediately after 50 gal/lm ‘wheel track’ application

Salt brine immediately after 50 gal/lm ‘wheel track’ application

Whites and yellows indicate warmer temperatures

Dark, purple colors indicate cooler temperatures
Runway Thermal Comparisons

- **Lowest temperature in image:**
  - Salt brine: 1.7 °F
  - Spicy blend: 10.7 °F

[Images of thermal comparisons]

Salt brine immediately after 50 gal/Im ‘wheel track’ application

Spicy blend immediately after 50 gal/Im ‘wheel track’ application
Taxiway Application

Image 19  10:02 AM

Image 20  10:03 AM
Taxiway Thermal Comparisons

- Lowest temperature in image:
  - Salt brine: 4.5°F
  - Spicy blend: 9.3°F

Spicy blend immediately after 70 gal/ln ‘fan spray’ application

Salt brine immediately after 70 gal/ln ‘fan spray’ application
Taxiway Thermal Comparisons

- Lowest temperature in image:
  - Salt brine: 15.1°F
  - Spicy blend: 17.5°F

Spicy blend 30 minutes after 70 gal/ln ‘fan spray’ application

Salt brine 30 minutes after 70 gal/lm ‘fan spray’ application
Salt Prewet with salt brine vs. Salt prewet with Geomelt 55

3/8" ice on road
20-30 mph wind
Sleet

Before

Control Section- Salt brine

Test Section- GeoMelt 55 Mixture
Salt Prewet with salt brine vs. Salt prewet with Geomelt 55

1. 5 hours later
Equipment
Current Fleet

- 900+ trucks (60% tandem axle-40% single axle
- International 7000 series (20,000 and 16,000# front axles
- Life expectancy-16-17 years (purchase 50-60 per year

- Standard on all trucks
  - Stainless steel tailgate spreader
  - Prewet system

- Options
  - zero velocity, single or dual spreaders
  - winter tailgate
  - Wings- front, mid or rear
  - Underbody plow or ice blade
Early Prewet Systems
Manufactured Prewet Systems

- 140 gallon
- 225 gallons
Iowa DOT designed winter tailgate
Dual augers and 250 gallon liquid capacity
Dual Augers

Tilts away for easy removal of materials
A variety of anti-icing systems from home made slip-in units to trailer mounted systems to tankers.
1,800 and 2,700 gallon Iowa DOT designed trailers
Nozzle options
Nozzle options
Combination Calcium Chloride and Sodium Chloride prewet system
Calcium Chloride Injection
Liquids,
Next step!
Laser Guided Wing Plow

GL3000C Guidance Laser mounted under headache rack

Laser spot showing future path of trailing edge
Reverse-a-cast Plow

**Features**

- Heavy duty construction.
- Flexible 3/8” Polymer UHMW moldboard skin plate.
- Plow lets you change casting distances, direction and moldboard shape without slowing down.
- Reversible cutting edge.
- Standard equipment includes: moldboard contouring cylinders, one section trip edge, twin ram reverse or worm gear reverse kit, oscillating drive bar and para-level lift chain arrangement.
Cameras

- Testing 30 camera sets in 2007-2008
- Monitor material application and plow
“Shaker” Wiper Arm Attachment

Physically shakes the wiper arm to remove build-ups of ice and snow.

Often tied with heated washer system

Also marketed under the name “Whaminator” in Canada
Heated Windshield
Combination anti-icing/prewet system with increased liquid capacity
Active adapter allows for the blade to contour to the road. Removing more ice and snow from the wheel ruts
Shop Built Flexible Edge
Shop built flexible edge
Multiple Blade Plow

- Regular Carbide Blade
- Scarifier or Cheese Blade
- Squeegee Blade
Multiple Blade Plow

- Squeegee Blade
- Scarifier or Cheese Blade
- Regular Carbide Blade
Multiple blade plow

Squeegee Blade

Scarifier or Cheese Blade

Regular Carbide Blade
Why a multiple blade plow?

- A standard carbide blade leaves ¼ to ½ inch layer of ice/snow after each pass.

- A standard carbide blade can’t remove slush from the roadway.

- A standard carbide blade will often ride over packed snow.

- Deicing materials applied by the truck will have to melt the snow/ice layer left behind the plow before melting any new snow.
Sand Testing
Same Process repeated on highway test section
Weight of sand left by plow - Road test

- Plow 1: 2.1685 pounds
- Plow 3: 4.7902 pounds
- Plow 5: 6.8762 pounds
- Plow 2: 7.6864 pounds
- Plow 4 (Control): 25.652 pounds
Extended rubber flap to reduce snow blowover onto windshield and creation of snowcloud.

Extended moldboard

Active Adapter attachment

Squeegee blade

Extended rubber flap to reduce snow blowover onto windshield and creation of snowcloud.
Independently controlled squeegee blade
THIS BABY DOESN'T MISS A FLAKE OF SNOW...!
Extra clearing path provides an extension of the moldboard.
Mid-Mount Wing Project
Version 1- Home made system carried up to 3 tanks with 1,800 gallons of total liquid capacity or can also carry 1,200 gallons of liquid and 6-tons of dry material.

Version 2- Pengwyn System- carried 6- 100 gallon tanks in a medium duty truck with the ability to also carry 6 tons of dry material.
Wedge-shaped tanks

- 450 gallons liquid per side
- 7 tons of dry material
- 2” plumbing
FlowBoy Combination unit

2,700 gallon liquid capacity with 17 tons of dry material-
Typical distance before refill = 136 lane miles
Brine tank in trailer
Flow boy spraying two lanes with zero velocity spray system by Spratronics
More Better Mousetraps
Brine makers
Current brine maker
MX 120 Front / Rear Plow
Wet, heavy snow covers warning lights
Air Puffer to blow snow from strobes and other lights
Calibration Scale
Edge rut system
Shoulder rock re-claimer
Mounted on 3-point hitch with 3 blades to pull rock back to the road edge
Cost- $300 without blades
Combination unit
900 gallons liquid, 7 ton dry material
Sign trailer now has capacity to carry 13 Lang support signs and 8 windmaster signs plus sand bags. With this modification, one person can do job without assistance. Cost $400
Utility container- manual lift

Utility box is maneuvered with chains attached to both the truck box and the utility box. The truck box is raised to drop utility box to ground. After item is loaded, the truck box is put down to haul. Utility box rests against wooden bumper guard. Cost-$300
Utility container - electrically controlled
Strong yellow-green border made from aluminum piece added to traffic control device-
Cost-$250
Chute Delivery System

Directs material to precise location on roadway or chute hole can be opened to drop directly onto spinner for broadcast spreading.

Cost: $250
Bob figured the budget cuts would come to something like this.
Miscellaneous

ICE & SNOW
TAKE IT SLOW
Iowa permanent snow fence design
Permanent Snow Fence Storage
Standing Corn
Training

- Driving Simulator
- Winter Expos
- Computer based training
- On-line training via the Internet
- Classroom
Driving Simulator

Simulator and classroom housed in 22 foot Haulmark trailer
Computer Based Training

Equipment Maintenance
Version 1.0, July 2007

No installation required. Just insert CD to run. For best performance, copy contents to hard disk and run Eq.Maint.exe.

Anti-icing / RWIS Training
Iowa DOT - Version 2 - July, 2007

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Computer Based Training (con’t)
“Ice and Snow...Take it slow”

- Posters developed for rest areas and driver license examining stations
- Logo and safety information added to the Iowa DOT web site
- Press releases included a number of messages developed from this campaign