AVL/GPS/MDSS for Improving Winter Operations

Justin Droste P.E.

Michigan Department of Transportation (USA)

August 3, 2015
MDOT Winter Statistics

- 32,000 trunkline lane miles
- Average winter expense is $95 Million
- Average salt usage is 490,000 Tons
- Average price of salt is $65/ton
- MDOT Facilities (white):
  - 300 snowplows
  - 380 operators
  - Over 100 temporary staff
AVL/MDSS Contract Overview

• Awarded Contract to Delcan Technologies September 15th, 2013

• Contract is for 3 years with options for 2 additional years.

• Initial priority is Winter Maintenance Trucks
  • Permanent assigned truck
  • 2000 model year or newer
  • Dickey John Control Point spreader controller

• Vendor is responsible for providing weather forecast and treatment recommendations
Vendor’s Role

- Provide working AVL equipment and sensors
- Secure and manage cellular communications for AVL devices
- Ensure necessary information is available to users for both AVL and MDSS websites
- Provide customer support to all users
- Provide training and training materials as needed
- Project management and weekly calls with MDOT
MDOT's Role

Equipment Installation by Region Mechanics
• MDOT Mechanic installations with vendor support
• Installation inspection and sign off

Project Management
• Weekly conference calls with vendor
• Ensure contract and Department goals are being met

Support
• Provide support to region and garage employees
• Schedule trainings and provide classroom facilities
Data Transmission

- Air and pavement temps
- Plow position
- Camera images
- Spreader information
  - material type
  - application rate
- Engine data
- Location
- Weather information
- Maintenance treatment recommendations

WMTs

AVL Provider (Delcan)

MDSS Provider (Iteris)

Secure Website (s)

Authorized Users
AVL Website

Real-time Data
• Operational
• Engine
• Camera Images

Vehicle: 04-4032
Speed: 17 mph
Belly Blade: down
Right Blade: up
Solid Rate: 350.2 lb/mi
AVL Data Reports

Primary Data Reports

- Salting Speed Compliance
- Material Usage
- Blade usage
- Engine Idle & Diagnostics
- Geofence Data
Material Usage Reporting

(Traditionally done by manual logging of estimated use per shift/route)
AVL Data Reports

Material Usage

- Data from Spreader Controller
- Consistent Naming is critical

<table>
<thead>
<tr>
<th>Solid Material</th>
<th>Solid Code</th>
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<tbody>
<tr>
<td>Prewet Salt with Calcium Chloride (8 gal per ton)</td>
<td>WSalCa</td>
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<tr>
<td>Prewet Salt with Salt Brine (8 gal per ton)</td>
<td>WSalBr</td>
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<td>Dry Salt for spreader prewet</td>
<td>DSalt</td>
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<td>Sand only (dry)</td>
<td>Sand</td>
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<td>Salt/Sand Blend</td>
<td>SalSan</td>
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Material Usage Report

Region: North
Garage: Atlanta; Kalkaska
Date: 3/1/2014 to 3/8/2014
Vehicles: 04-1556; 04-1558; 04-1653; 04-1685; 04-3016; 04-3027; 04-3035; 04-3040; 04-4029; 04-4032; 04-4035

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<thead>
<tr>
<th>Date</th>
<th>Material</th>
<th>Solids Spread</th>
<th>Season Total</th>
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<td>DSALT</td>
<td>533.2 ton</td>
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<td>3/5/2014 DSALT</td>
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<td>Vehicle: 04-1556</td>
<td>3/4/2014</td>
<td>17.7 ton</td>
<td>501.5 ton</td>
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<tr>
<td>Vehicle: 04-1558</td>
<td>3/4/2014</td>
<td>23.0 ton</td>
<td>323.7 ton</td>
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<td>Vehicle: 04-4029</td>
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<td>46.4 ton</td>
<td>538.4 ton</td>
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<td>Vehicle: 04-4035</td>
<td>3/4/2014</td>
<td>0.2 ton</td>
<td>366.1 ton</td>
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Material: SALSAN

Region North
Garage: Kalkaska
Vehicle: 04-1558
3/3/2014 SALSAN 6.8 ton 111.7 ton
Vehicle: 04-4029
3/4/2014 SALSAN 1.7 ton 164.7 ton
Vehicle: 04-4035
3/4/2014 SALSAN 0.2 ton 366.1 ton

Page 1 of 1
10/20/2014 10:48:25 PM
Truck Speed and Effect on Salt Bounce and Scatter
(Michigan DOT 2012 and 2013 studies)

- Truck speed has most influence on salt B&S
- Slower salting speeds reduce costs and benefit the environment
- MDOT Movement to reduce salting speeds to 25mph or less
# AVL Data Reports

## Speed Compliance Report

### Salting Speeds Compliance By Garage - Daily Custom Enhanced

**Garage:** Adrian  
**Dates:** 3/1/2014 to 3/15/2014

<table>
<thead>
<tr>
<th>Name</th>
<th>First Timestamp</th>
<th>Last Timestamp</th>
<th>25mph Compliance</th>
<th>(Data Points)</th>
<th>35mph Compliance</th>
<th>(Data Points)</th>
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<th>Solids Spread (ton)</th>
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<td>04-1475</td>
<td>7:39 AM</td>
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<td>556</td>
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<td>16.27 %</td>
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<td>5815</td>
<td>6122</td>
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FY 2015 Salt Speed Compliance and Efficiency*

**Region: North**

**Date Range: 2/1/2015 to 2/16/2015**

**Salt Usage and Effectiveness**

- **Total Salt Spread (tons):** 953.8
- **OSE (tons):** 778.5
- **DSE (tons):** 175.3
  - **DSE 25 - 35mph (tons):** 133.1
  - **DSE 35 - 45mph (tons):** 33.9
  - **DSE Above 45mph (tons):** 8.4

**Salting Efficiency:** 81.62%

**Winter 2014/2015 Salt Efficiency: North**

- **Date Range:** 11/1/2014 to 2/16/2015

**Salt Speed Compliance**

- **Date Range:** 2/1/2015 to 2/16/2015

**Garage: Reed City**
- **45mph Compliance:** 22.2%
- **35mph Compliance:** 78.0%
- **25mph Compliance:** 78.0%

**Garage: Mio**
- **45mph Compliance:** 33.4%
- **35mph Compliance:** 96.1%
- **25mph Compliance:** 96.1%

**Garage: Marion**
- **45mph Compliance:** 20.2%
- **35mph Compliance:** 95.4%
- **25mph Compliance:** 95.4%

**Garage: Kalkaska**
- **45mph Compliance:** 17.9%
- **35mph Compliance:** 94.8%
- **25mph Compliance:** 94.8%

**Garage: Atlanta**
- **45mph Compliance:** 43.3%
- **35mph Compliance:** 93.6%
- **25mph Compliance:** 93.6%

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*Efficiency based on AVL salt speed compliance data and empirical data from the MDOT Salt Bounce and Scatter Studies. Data assumes standard spreaders used.*

**Salt applied at speeds faster than 25 mph can still benefit the traveled roadway. Increased bounce and scatter at faster speeds diminishes salting efficiency.*
Overall MDOT Efficiency has increased more than 5% since start of season
MDSS Website
(Maintenance Decision Support System)

- Weather Radar with WMT info.
- Info provided to in-cab monitors or desktop.
- Detailed weather forecasts
- Treatment recommendations per route.
### Pavement Forecast and Recommendations

#### Table View

<table>
<thead>
<tr>
<th>Time (MT-AM)</th>
<th>Temp (°F)</th>
<th>Pavement Cond</th>
<th>Maintenance</th>
<th>Rate</th>
<th>Temp (°F)</th>
<th>Pavement Cond</th>
<th>Maintenance</th>
<th>Rate</th>
<th>Wind</th>
<th>Precip Prog (%)</th>
<th>Precip Rate (in/hr)</th>
<th>Liq Acc (in)</th>
<th>Ice Rate (in/hr)</th>
<th>Snow Rate (in/hr)</th>
<th>Snow Acc (in)</th>
<th>Visibility (mi)</th>
<th>Vis Obstruct</th>
<th>Time (AM-PM)</th>
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**150 lbs of Prewet Salt (w/ Brine)**

Start Time: Wed 8:23am  
End Time: Wed 10:03am
MDSS Mobile App

ISSAEST, Fairbanks, AK, USA, August 2-5, 2015
Additional Benefits:
Post Storm/Incident Reviews
I-94 Mega Crash

- By the numbers
  - 193 Total vehicles:
  - EB
    - 26 Trucks
    - 34 Cars
    - 44-hour closure
  - WB
    - 50 Trucks
    - 83 Cars
    - 39-hour closure
  - 1 Fatality
  - 22 Injuries
  - 40,000 lb of fireworks
  - 6,000 gal of formic acid
I-94 Mega Crash
"We've never experienced anything of this magnitude and I hope we never do again," - Michigan State Police Lt. Dale Hinz
Good morning all,

Last night South Haven finally had a small break from the snow at approximately 7pm. I don’t believe that other areas were as fortunate. But then at midnight it started all over again. MDSS is calling for 5.8 inches of snow to fall between now and 5pm with temps hovering around 13 degrees and wind at 10mph gusting to 30mph. Everyone in and all trucks are on the road.

VAN BUREN-
INCLUDING THE CITIES OF...SOUTH HAVEN
338 AM EST WED JAN 7 2015

...WINTER WEATHER ADVISORY IN EFFECT UNTIL 4 PM EST THIS AFTERNOON...

.TODAY...SNOW SHOWERS. AREAS OF BLOWING SNOW. SNOW ACCUMULATION 5 TO 7 INCHES. HIGHS 10 TO 15. NORTHWEST WINDS 15 TO 25 MPH WITH GUSTS TO AROUND 35 MPH. CHANCE OF SNOW 100 PERCENT. WIND CHILL READINGS AS LOW AS MINUS 12.
.TONIGHT...SNOW. SNOW ACCUMULATION AN INCH OR LESS. LOWS 5 TO 10 ABOVE NEAR LAKE MICHIGAN AND ZERO TO 5 INLAND. WEST WINDS 15 TO 20 MPH WITH GUSTS TO AROUND 30 MPH. CHANCE OF SNOW 80 PERCENT. WIND CHILL READINGS AS LOW AS 9 BELOW TO 13 BELOW ZERO.
Lessons Learned

AVL and MDSS are game changers
- Proactive vs reactive
- Adapting operational approach based on MDSS
- Incorporating pavement forecasts into pre-storm planning
- Supervisors and operators are more informed

Takes time to gain trust in MDSS treatment recommendations
(weather forecasting has been a big positive)

Lots of data; What's the most useful?
- Material usage report
- Salting speed compliance reports
- Blade usage
- Supervisors know what their operators are applying
Questions

Tim Croze P.E.
Operations Field Services
517-322-3394
crozet@michigan.gov

Justin Droste P.E.
Operations Field Services
517-636-0518
drostej@michigan.gov