AVL/GPS/MDSS Use for Winter Maintenance

2015 AASHTO SCOM Meeting
Des Moines, IA

Presented by:
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Region Support Engineer
Michigan Department of Transportation
MDOT Winter Statistics

- Average winter expense is $95 Million
- Average salt usage is 490,000 Tons
- Average price of salt is $66/ton
- 300 snowplows
- 380 operators
- Over 100 temporary staff
AVL/MDSS Project Goals

Fleet Management

• Accurate reporting of mileage and hours of vehicles
• Ability to monitor current location of vehicles
• Light fleet and Winter Maintenance Trucks (WMTs)

Winter Maintenance Operations

• Accurate reporting of equipment and material usage
• Route monitoring and optimization
• Maintenance Decision Support System (MDSS)
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 Collection

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

AVL Provider (Delcan)

MDSS Provider (Iteris)

Secure Website(s)

WMTs

Authorized Users
AVL Website

Real-time Data
- Operational
- Engine
- Camera Images

http://mdot.delcan.net
Reports

Standard Reports
• Engine hours
• Odometer
• Vehicle status
• Material usage
  • Type
  • Quantity

Custom Reports
• Salting speed compliance
• Plow blade usage
MDSS Website

- Website Weather Radar with WMT info.
- MDSS info provided to WMT cab.
Year One Accomplishments

- 267 snowplows outfitted
  - 6 regions
  - 30 garages
- Web based AVL & MDSS data access
  - All trucks report data
- Comprehensive trainings
  - 20 equipment installers
  - Over 200 website users
- 130 MDSS routes
- Created several standard reports
- Administrators team created
2014-2015 Winter Season Highlights
Using Data to Improve Operations

- Salting Speed Compliance
- Breadcrumbs
- Camera images from trucks
- Vehicle utilization is uploaded into M5 weekly
- Incident management
- Post storm reviews
- Region communication tool
- Material usage reports
- MDSS mobile app
FY 2015 Salt Speed Compliance and Efficiency

**Salt Usage and Effectiveness**

Region: Superior  
Date Range: 1/16/2015 to 2/1/2015

- **Total Salt Spread (tons)**: 2190.0
- **DSE (tons)**: 353.4
- **Salt Waste 25 - 35mph (tons)**: 249.2
- **Salt Waste 35 - 45mph (tons)**: 76.5
- **Salt Waste Above 45mph (tons)**: 27.7
- **OSE (tons)**: 1836.6
- **Salting Efficiency**: 83.86%

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

- 11/1 to 11/16
- 11/16 to 12/1
- 12/1 to 12/16
- 12/16 to 1/1
- 1/1 to 1/16
- 1/16 to 2/1

**Salt Speed Compliance**

Region: Superior  
Date Range: 1/16/2015 to 2/1/2015

- 25mph Compliance: 90.8%
- 35mph Compliance: 99.1%
- 45mph Compliance: 94.9%

**Garage Speed Data**

- **Garage: St. Ignace**: 47.1% 94.9%
- **Garage: L Anse**: 14.1% 91.0%
- **Garage: Houghton**: 13.2% 81.4%
- **Garage: Engadine**: 36.8% 92.9%

*Salt Efficiency is based on AVL salting speed compliance data and empirical data from the MDOT Salt Bounce and Scatter Studies.*

**Salt applied at speeds faster than 25 mph can still benefit the traveled roadway. Increased bounce and scatter at faster speeds diminishes salting efficiency.**
Breadcrumbs (Historical Playback)

Playback vehicle activity for up to 5 vehicles
- Play, Fast Forward, Rewind, Pause, Restart
- Configurable date and time range (defaults to past 24hrs)
- User selected sensor/engine data fields update as vehicle moves
- Breadcrumb arrows point in direction of travel as vehicle moves
MDSS: Post Incident Reviews

January I-94 Mega Crash

Kalamazoo County Calhoun County
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
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 18mph gusting to 33mph. Everyone is in and all trucks are on the road.

VAN BUREN
INCLUDING THE CITIES OF...SOUTH HAVEN
330 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 19 BELOW ZERO.
# Material Usage Reporting

<table>
<thead>
<tr>
<th>Material Code</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Steel</td>
<td>50</td>
</tr>
<tr>
<td>B</td>
<td>Wood</td>
<td>20</td>
</tr>
<tr>
<td>C</td>
<td>Concrete</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>Plastic</td>
<td>30</td>
</tr>
</tbody>
</table>

Legend:
- **Material Code**: Code for identifying materials.
- **Description**: Type of material.
- **Quantity**: Amount of material used.
### Material Usage (Daily)

**Region:** North  
**Garage:** Kalkaska

**Date:** 2/7/2015 to 2/14/2015  
**Vehicle(s):** 04-1556; 04-1685; 04-3016; 04-3035; 04-4029; 04-4035

<table>
<thead>
<tr>
<th>Date</th>
<th>Material</th>
<th>Solids Spread</th>
<th>Season Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DSALT</td>
<td>123.9 ton</td>
<td>317.70 ton</td>
</tr>
<tr>
<td><strong>Region:</strong></td>
<td>North</td>
<td>123.9 ton</td>
<td></td>
</tr>
<tr>
<td><strong>Garage:</strong></td>
<td>Kalkaska</td>
<td>123.9 ton</td>
<td></td>
</tr>
<tr>
<td>• Vehicle:</td>
<td>04-1556</td>
<td>17.6 ton</td>
<td>317.70 ton</td>
</tr>
<tr>
<td>• Vehicle:</td>
<td>04-1685</td>
<td>24.0 ton</td>
<td>425.70 ton</td>
</tr>
<tr>
<td>• Vehicle:</td>
<td>04-3016</td>
<td>15.2 ton</td>
<td>440.90 ton</td>
</tr>
<tr>
<td>• Vehicle:</td>
<td>04-3035</td>
<td>3.9 ton</td>
<td>153.00 ton</td>
</tr>
<tr>
<td>• Vehicle:</td>
<td>04-4029</td>
<td>28.9 ton</td>
<td>225.90 ton</td>
</tr>
<tr>
<td>• Vehicle:</td>
<td>04-4035</td>
<td>34.3 ton</td>
<td>460.10 ton</td>
</tr>
<tr>
<td></td>
<td>SALSAN</td>
<td>81.2 ton</td>
<td>137.30 ton</td>
</tr>
<tr>
<td><strong>Region:</strong></td>
<td>North</td>
<td>81.2 ton</td>
<td></td>
</tr>
<tr>
<td><strong>Garage:</strong></td>
<td>Kalkaska</td>
<td>81.2 ton</td>
<td></td>
</tr>
<tr>
<td>• Vehicle:</td>
<td>04-1556</td>
<td>31.6 ton</td>
<td>137.30 ton</td>
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<tr>
<td>• Vehicle:</td>
<td>04-1685</td>
<td>8.0 ton</td>
<td>179.70 ton</td>
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<td>• Vehicle:</td>
<td>04-3016</td>
<td>1.7 ton</td>
<td>179.70 ton</td>
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<td>• Vehicle:</td>
<td>04-3035</td>
<td>3.5 ton</td>
<td>223.00 ton</td>
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<tr>
<td>• Vehicle:</td>
<td>04-4029</td>
<td>15.9 ton</td>
<td>167.20 ton</td>
</tr>
<tr>
<td>• Vehicle:</td>
<td>04-4035</td>
<td>20.5 ton</td>
<td>176.30 ton</td>
</tr>
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</table>
MDSS Mobile App

- **Home Screen**: Allows users to access different features of the app.
- **Map Feature**: Provides real-time data on MDSS conditions, including maintenance actions such as plowing and chemical application recommendations.
- **Alerts and Cameras**: Options for viewing alerts and camera feeds relevant to MDSS conditions.
- **Trucks**: Tracks and manages the status of MDSS trucks.

### Data Table

<table>
<thead>
<tr>
<th>Time</th>
<th>Road Cond</th>
<th>% Ice</th>
<th>Mob Index</th>
<th>Maint Action</th>
<th>Frost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tue 9:30: AM</td>
<td>Snow</td>
<td>85</td>
<td>57</td>
<td>N/A</td>
<td>22</td>
</tr>
<tr>
<td>Tue 8:30: AM</td>
<td>Snow</td>
<td>87</td>
<td>55</td>
<td>N/A</td>
<td>40</td>
</tr>
<tr>
<td>Tue 7:30: AM</td>
<td>Snow</td>
<td>100</td>
<td>53</td>
<td>N/A</td>
<td>52</td>
</tr>
<tr>
<td>Tue 6:30: AM</td>
<td>Snow</td>
<td>100</td>
<td>50</td>
<td>N/A</td>
<td>50</td>
</tr>
<tr>
<td>Tue 5:30: AM</td>
<td>Snow</td>
<td>100</td>
<td>56</td>
<td>N/A</td>
<td>52</td>
</tr>
</tbody>
</table>
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
Advice to other Agencies:

- **Get input** from all affected areas of the department before undertaking such a project: fleet, IT, executive management and garage supervisors, at a minimum. Multiple areas should provide input for the RFP requirements.

- **Weekly accountability meetings** with vendor and project management staff help to ensure the agency staff and vendor partners are held accountable for their tasks and deliverables.

- **Not everything will go as planned.** You likely will run into equipment and development issues. These can be worked out by staying committed and keeping communications open.

- To **gain buy-in**, it is necessary to focus more on how these tools can aid with current tasks and reduce manual reporting of labor, equipment and material usage by the operator so they can focus on their maintenance activities.

- **Accepting change** takes some people longer than others.
AVL/MDSS program questions:

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