**Project 16-01: Utilization of AVL/GPS: Case Studies**

**Summary of Michigan DOT In-Person Interviews**

*Overview*

Interviews were conducted by Ming-Shiun Lee and Dan Nelson of AECOM and coordinated with Melissa Longworth of the Michigan Department of Transportation (MDOT) on November 30th, 2017.

*MDOT Staff Interviews*

Meeting attendees throughout the day on Thurs. Nov. 30th included the following individuals:

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| * + *Benjamin Hodges, MDOT Maintenance Supervisor*   + *Mark Crouch, MDOT Maintenance Coordinator*   + *Matt Pratt, MDOT Maintenance Coordinator*   + *Greg Perry, MDOT Operations Engineer*   + *Tim Croze, MDOT Manager of Maintenance Services*   + *Justin Droste, MDOT Assest Management Engineer*   + *Melissa Longworth, MDOT Region Support Engineer* | * + *Ming-Shiun Lee, AECOM Project Principal Investigator*   + *Dan Nelson, AECOM Project Lead Researcher* |

Group met at the MDOT Grand Ledge Garage to interview Ben Hodges and understand primarily the AVL and MDSS application. Ben Hodges described his use of the Iteris MDSS software interface to monitor weather events and snow plow activity. As maintenance supervisor, the use of MDSS helps determine the most optimal time to call in snow plow drivers and determine the best course of material application. Ben also utilizes AVL software provided by Parsons to download material usage reports and salting speed compliance reports.

Matt Pratt and Mark Crouch discussed the types of snow plow equipment that are integrated with the AVL system for data reporting. These include DickeyJohn ControlPoint spreader controllers, RoadWatch pavement temperature sensors, wing plow sensors, tow plow sensors, and front-facing vehicle dash-cams. MDOT staff identified the locations of the components on a few snow plow vehicles in the garage after the meeting. MDOT staff noted that vehicle camera images are taken once a minute and those pictures then appear within the AVL / MDSS software interfaces for review by MDOT maintenance supervisors.

Lessons learned during the installation process were discussed and are summarized below:

* The AVL hardware on the vehicle was initially mounted in the center console area where it was susceptible to damage from liquid spills due to its proximity to cup holders. Hardware was re-located to behind passenger seat.
* Cell / GPS antennae were initially run through an area along side of the vehicle where the cables were susceptible to damage. Re-routing of the cables addressed the issue.
* Process of equipment installation and training of staff was condensed in a short amount of time to get system operational prior to winter weather. Additional time to train vehicle mechanics on equipment installation and garage supervisors on how to use the software would have eased the roll-out of the system.

As far as hardware is concerned, some drivers disliked the monitors in the truck. They felt there were already lots of equipment in the truck and drivers had many things to do. Some also felt that they could use smartphones to achieve the same functionality with radar tracking. MDOT also noted the desire to have an automatic dimming feature for monitors.

Group then traveled to the MDOT Operations Field Services Division office in Lansing to meet with Greg Perry and view how MDOT uses the two different AVL and MDSS software packages. The AVL software package presents a map-based interface that allows MDOT staff to view the locations of snow plow vehicles in the field, which can be filtered in multiple ways (i.e. by region, by county, etc…). The interface allows for selecting specific vehicles on the map and viewing information about that specific vehicle. MDOT staff noted that the map-based interface is not as user-friendly as other Windows-based interfaces, and requires training on how to navigate through various features. It was also noted that snow plow locations are also shared with the MiDrive website that presents traffic and roadway information with the general public. There is a small lag of three to five minutes of when vehicle locations are reported.

AVL training was provided during initial system installation. Formal and informal training was also provided annually. MDSS vendor also provided in-person training to MDOT staff.

AVL system data was polled every minute. The data was stored and managed by Parsons. MDOT didn’t store the data on its own server due to challenges associated with security and other requirements of the MDOT system. MDOT still owns the data and can obtain it at any time. All data were warehoused since the beginning. Only 12-month data was kept as “active” and the remaining data was archived but still accessible. The AVL system data is shared with and can be accessed by MDOT Transportation Operations Centers (TOCs) and MDOT ITS Data Use Analysis and Processing (DUAP) program. The data is also fed into the MDSS.

MDOT staff then demonstrated the Reports feature of the AVL software to show how MDOT maintenance can identify when issues may be occurring with AVL hardware. MDOT staff can use a filter to view snow plow vehicles at specific garages and then view the date and time stamps of specific data elements, which can quickly identify when a GPS antennae may not be functioning, or when vehicle equipment may not be sending information back to the AVL hardware on the vehicle. MDOT maintenance staff can then review that specific vehicle and perform the needed repairs or request assistance from the AVL vendor as needed if replacement parts are required. Other reports frequently used by MDOT staff include reports for blade usage, material usage, and speed compliance.

MDOT worked with Parsons to enhance the reporting features, including enhancing the existing reports as well as developing additional reports useful to MDOT. Melissa Longworth described other reports that could be developed including salting speed compliance reports which help to verify how efficient drivers are at applying salt along roadways. A previous MDOT study has found that 25 MPH is the ideal speed to ensure that salt remains on the road and does not scatter outside of the travel lanes. The structure of this report, and other reports within the AVL system, were requested by MDOT to be provided by the AVL vendor (Parsons) for future analyses by MDOT staff. These reports also help to ensure the efficiency of snow plow operations. MDOT also extracts raw data directly from the AVL software interface for separate analyses and internally developed reports on statewide and regional performance related to snow plow operations.

Greg Perry then demonstrated the MDSS software interface provided by Iteris that is used for monitoring weather forecasts and determining the most efficient times and locations for roadway treatment. Multiple types of alerts could be presented on upcoming weather, road conditions, and where blowing snow would be predicted, along with maintenance alerts that provided treatment recommendations on material to be applied to specific roadways. MDOT archives its previous treatment for the past 24 hours and can look ahead to the next 24 hours as well and see how past treatment may be impacting recommendations, since a comparison of no treatment is presented alongside the current treatment by MDOT. It was also noted that the mobile application has been more useful to snow plow drivers than the laptop / PC-based version given that drivers are mobile in the field.

MDOT staff noted that the integration of the AVL functionality within the MDSS software package provides MDOT maintenance supervisors and operations staff with the most effective tool for responding to winter weather events. Melissa Longworth noted that only a handful of states have performed the integration given the integration effort involved, but that it has proven to be effective for winter maintenance operations.

Tim Croze and Justin Droste of MDOT discussed the overall procurement process that MDOT followed with their AVL / GPS system. MDOT executive management expressed a desire to investigate AVL / GPS systems in early 2013, and MDOT operations and maintenance staff surveyed other states through the Clear Roads and MDSS Pooled Fund studies on lessons learned in the overall process. Among the lessons learned were that the use of separate contracts for AVL and MDSS, in addition to other contracts for cellular equipment, could create issues with the coordination required between multiple contractors.

MDOT released an RFP in spring of 2013 and requested a single point of contact from a Contractor that would be responsible for managing both the AVL and MDSS systems, as a means of ensuring accountability in the integration of the two systems by the selected Contractor. MDOT expressed its desire for the integration of the two systems from the beginning of the contract start date and allowed the Contractor to determine the most optimal plan for delivering the integration for MDOT maintenance operations. Through frequent meetings and communication with the Contractor and its project team, MDOT achieved the desired outcome of implementing the system prior to the 2013-2014 winter season. Key procurement experience and lessons learned include:

* The procurement followed the MDOT best value procurement process. Proposals were reviewed by a Joint Evaluation Committee (JEC).
* The RFP was developed under an aggressive schedule. For the RFP and requirements development, MDOT leveraged the requirements developed by the Wisconsin DOT and the MDSS Pooled Fund program.
* Specifications should not be too specific to limit options and flexibility.
* The MDOT contract with one single vendor might increase the cost but help reduce staff resources for coordinating with multiple vendors, and it also helps integration of multiple systems as desired.

Key benefits of the AVL system as noted by MDOT include:

* Better and more efficient asset tracking
* More efficient tracking of material usage
* Speed tracking and compliance reporting
* Improved reporting efficiency with automated electronic reporting capabilities; reduction in paper reporting.

One of the next steps that MDOT envisions with the MDSS software interface is the creation of a Reports module that would be able to run the same kind of reports that MDOT runs through the AVL software package. This will reduce the amount of staff time spent running two separate software packages and improve the efficiency of MDOT maintenance supervisors in reviewing past winter weather events. MDOT also desires to implement automated reports within the MDSS software package to reduce the amount of time spent completing paperwork that snow plow drivers at the end of their respective shifts.

Other lessons learned gathered from MDOT through the interviews are summarized below.

* Outreach to users, especially prior to installation, helped reduce resistance and promote buy-in.
* Having tech-savvy staff performing outreach, conveying key messages and supporting installation and operations helps alleviate concerns and promote buy-in.
* Adequate training is key to buy-in and successful operation.
* Support from executive management made procurement and roll-out quicker. On the flip side, due to the aggressive schedule as directed by executive management, desired level of user outreach could not be performed.
* Different types of trucks and ages of trucks may require different cabling, connectors, mounting locations, etc. for installation.
* Battery draw can be a concern as there were many devices drawing power from the same battery. Installation of a battery shut off switch could be a solution.
* Resources dedicated to system maintenance should be considered.