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

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

**Overview**

Interviews were conducted by Ming-Shiun Lee and Dan Nelson of AECOM and coordinated with Al Johnson of the Wisconsin Department of Transportation (WisDOT) on December 11th and 12th, 2017.

*WisDOT Staff Interviews*

Meeting attendees throughout the day on Mon. Dec. 11th included the following individuals:

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| * + *Al Johnson, Winter Maintenance Engineer*   + *Mike Adams, RWIS Program Manager*   + *Sharon Bremser, Statewide Bureaus Consultant Supervisor* | * + *James Hughes, Highway Maintenance and Roadside Management Section Chief*   + *Chris Ohm, Bureau of Highway Maintenance* |

Meeting attendees throughout the day on Tues. Dec. 12th included the following individuals:

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| * + *Al Johnson, Winter Maintenance Engineer*   + *Mike Adams, RWIS Program Manager*   + *Pat Gavinski, Sauk County Commissioner*   + *Rob, County Patrol Superintendent*   + *Manuel, County Snow Plow Driver* | * + *Tony, County Vehicle Maintenance Supervisor*   + *Cory, County Vehicle Technician*   + *Anthony, County Vehicle Technician* |

*WisDOT AVL / GPS System Management Level Interviews – Dec. 11th*

Group met at the WisDOT Division of Transportation System Development (DTSD) Offices in Madison to discuss how WisDOT has implemented and utilized their AVL / GPS system. WisDOT noted that their winter maintenance operations are different from a lot of states in that winter maintenance activities on all Interstates and state highways are performed by counties. WisDOT allows each of the 72 counties in the state to procure their own snow plows and equipment that are used for winter maintenance operations on Interstates and state highways. WisDOT provides funding to the counties, but does not technically own any of the snow plow vehicles or any of the equipment associated with the vehicles. This arrangement of winter maintenance operations has been in place between the state and the counties for nearly 90 years.

WisDOT displayed an early interest in AVL / GPS technology for winter maintenance operations, dating back to about 2002, based on the state’s involvement in the Clear Roads pooled fund program and in the MDSS pooled fund program as well. WisDOT was also able to observe how Dane County, which includes the City of Madison, had become the first County in the state to implement an AVL system on their County vehicles.

In February 2008, a severe winter storm hit southeastern Wisconsin and dropped about 20 inches of snow in the Madison area. During the storm, state agencies were slow to recognize the scale of the storm and the extent of the emergency, as thousands of motorists were stranded on northbound I-39 between Madison and Janesville in both Dane and Rock Counties. A post storm review identified that WisDOT and counties could not communicate the location of winter maintenance assets in a timely manner that would have improved the overall incident response to stranded motorists. Given the value that an AVL system for these and Counties would have aided in the overall incident response, WisDOT determined to provide funding for an AVL / GPS system for all County vehicles throughout the state.

WisDOT procured funds through a federal earmark under SAFETEA-LU for the statewide AVL/GPS system procurement for winter maintenance. The funds were used for reimbursing counties for the costs that they would incur for the procurement and installation of the AVL / GPS system.

WisDOT staff then traveled to the various counties to present how counties could procure and install an AVL / GPS system that would be consistent throughout the state. This included the use of Force America equipment for spreader controllers, and the use of Precise MRM (Mobile Resource Management) as the vendor / manufacturer of AVL / GPS equipment. The decision of choosing Force America spreader controllers was based on the Dane County system and their experience, as well as the ability for WisDOT to use the Dane County procurement for statewide procurement. In 2009, Force America acquired Precise MRM, which became a subsidiary of the Force America company.

All Wisconsin counties were then responsible for the procurement and solicitation process of AVL / GPS equipment, in the same way that they were already responsible for the procurement of winter maintenance vehicles and snow plow equipment. Every County in the state currently employs a County Highway Commissioner that manages all County highway maintenance operations, a County Patrol Superintendent that monitors vehicle operators and their use of snow plow equipment, and a County Foreman that maintains all vehicle equipment, including the AVL / GPS system equipment.

Since the initial rollout of the AVL / GPS system, there are approximately 400 County snow plows that have been equipped with AVL / GPS system technology across nearly all of the Counties in the state. These snow plows are responsible primarily for maintaining state highways and Interstates within the counties. Other snow plows that maintain County roads do not have the AVL / GPS system installed on them.

A second phase of the project was initiated in 2014-2015 to upgrade the cellular equipment from its previous 2G network capability to a 3G network capability. This involved the replacement of the Precise hardware that was installed within County vehicles. The upgrade provided increased speeds in the vehicle’s reporting of real-time data which improved the ability of County Patrol Superintendent to monitor vehicle locations and their response to winter weather storms.

*WisDOT Supervisor / Manager Level Interviews – Dec. 11th*

Group continued to meet at the WisDOT DTSD Offices in Madison to discuss how WisDOT staff interact with the AVL / GPS system. Al Johnson noted that WisDOT primarily uses the AVL / GPS system software interface from Precise for post-storm analysis to review how Counties have used salt / brine materials in response to winter weather. In the event that the review finds a discrepancy between certain areas of the County in terms of material amount or application, WisDOT will contact the Counties and present the findings to them for their review and comment.

WisDOT also prepares an Annual Winter Maintenance Report that presents a summary of how the Counties and the state as a whole performed in response to winter weather. This report can illustrate how Counties are performing in relation to neighboring Counties with respect to material usage and a number of other measures for winter maintenance.

Al Johnson noted that the WisDOT had also been involved at an early stage with MDSS testing and development, and once the AVL / GPS system had been installed on County vehicles, WisDOT entered into an agreement with Iteris for the connection of real-time data from the existing AVL / GPS system into an MDSS software interface. The MDSS interface provides County Patrol Superintendents with a weather forecast over the coming 24 hours that will indicate where and when winter maintenance is recommended. MDSS can also provide analytical tools for post-storm analyses by WisDOT for review as needed. The ability to use MDSS was also one of the main motivations for the AVL/GPS implementation in all Counties, as well as the state’s prior research on best management practices pertaining to material usage.

Al Johnson also demonstrated how WisDOT can use the Precise AVL software interface to view the locations of various vehicles by County. Specific vehicles could be selected for further detail to determine how many miles had been driven and how much material that vehicle had been using over a specific period of time. The AVL software interface also provides a bread crumb trail to help locate the route taken by snow plow operators. It was noted that the AVL software user interface was not as user friendly to navigate as the MDSS software interface that WisDOT does also access and monitor.

Jim Hughes attended the meeting to discuss his role as a state level advocate for the use of AVL / GPS systems by Counties to improve their usage of materials ranging from sand to salt to liquid brine. WisDOT staff will attend as many County Commissioner meetings as possible, usually scheduled in the summer and the winter, and Jim notes that these meetings are the best opportunities for WisDOT to communicate with Counties on how AVL / GPS can benefit those counties. It was noted that some counties have been slow to “buy-in” to the use of the AVL / GPS system for helping to optimize material usage, through the use of the MDSS interface, or to help with optimizing snow plow routes.

Jim has noted that the detailed data and reports provided through the AVL / MDSS interfaces have been helpful to get “buy-in” from county commissioners responsible for the use of the AVL / MDSS interfaces to optimize winter maintenance operations. County Highway Commissioners have also been able to speak to one another and demonstrate the benefits of the system and best practices, which can sometimes be more convincing than having WisDOT staff presenting the information.

WisDOT also noted although Counties contract for winter maintenance vehicles and AVL / GPS equipment, WisDOT purchases the salt and liquid brine material and delivers to each county highway department.

The group discussed the topic of displaying winter maintenance vehicle locations on a traffic information page for the general public. WisDOT does not currently provide this information to the public and noted the potential liability concerns due to all winter maintenance activities were performed by counties.

It was also noted that Precise arranges the cellular carrier of preference for the system based on the best cell coverage available. While there are still some coverage gaps in rural areas of the state, WisDOT in general is satisfied with the cellular coverage throughout the state.

*Sauk County Highway Department Interviews – Dec. 12th*

Group met at the Sauk County Highway Department in West Baraboo, WI on Tues. Dec. 12th to review how Sauk County maintenance staff currently support the AVL / GPS system. Within each County, there are the following general positions with regard to highway and winter maintenance:

County Commissioner: Responsible for overseeing all highway maintenance activities in the County, including response during winter storms. Communicates with WisDOT as needed with requests for information on the AVL / GPS system.

County Patrol Superintendent: Responsible for monitoring how multiple vehicles and drivers are operating within the County. Will review the recommended material treatment from MDSS software interface and then communicate the appropriate application rate to County snow plow drivers over radio. Reports to County Commissioner on winter maintenance operations.

County Foreman: Responsible for maintenance of AVL / GPS system equipment and requesting spare parts from the vendor.

Sauk County noted that two technicians were dedicated for AVL/GPS installation: one person handled the installation on new vehicles and another for older vehicles. No installation issues were experienced to date.

An initial concern from counties regarding MDSS treatment recommendations was that if they would be required to follow the recommendations strictly. Mike Adams of WisDOT noted that the treatment recommendations are viewed as guidance for County Patrol Superintendents in communicating the appropriate application rate with snow plow drivers. This clarification by WisDOT has eased some concerns in Counties that might view the recommendations as direction for how to treat roadways.

Counties have also been able to view MDSS recommendations for neighboring counties to gain a better picture on winter storms and progression. Based on the MDSS information, Sauk County could talk to their neighboring counties to get updates on current weather and treatment plans in effect. In addition, Counties have access to and can pull data for post-storm reviews, asset management, and many other purposes. Data is available to the Traffic Operations and Safety (TOPS) Laboratory for planning, operational analysis, research, and training.

Generally snow plow drivers felt the technology helps improve operations. A snow plow driver noted that one of the more positive features of the AVL system has been the ability for them to program an alarm that is provided to the driver when exceeding a speed threshold, or when exceeding a material threshold during snow plow operations. The primary task of maintaining focus on the snow plow route during winter storms, in addition to other equipment and sensors on the plow, can cause the driver to lose sight of their current speed or treatment level. Alarms can also be customized to provide warnings on other items if requested as well.

The County Patrol Superintendent also noted that the MDSS software interface has become more reliable this current year with the incorporation of RoadWatch pavement temperature sensors. WisDOT had previously disconnected all vehicle sensors from reporting data to the central MDSS software due to patent litigation issues in the past years. WisDOT chose not to pay a licensing fee per truck for the data connection, and some Counties saw a drop in the reliability of the MDSS forecasts and recommendations due to the loss of real-time vehicle sensor data on air and pavement temperatures. However, WisDOT has now re-enabled this connection and the County Patrol Superintendent has reported a positive improvement in the performance of the MDSS software.

The County foreman and vehicle technicians noted that County vehicles were not sending vehicle diagnostic data to the AVL system through the OBD port on-board the vehicle. There was some concern by County staff about potential negative issues this integration may have caused to the AVL system. WisDOT noted that the AVL software interface through Precise can be used for some diagnostic checks related to vehicle battery voltages and could provide additional data if there was a connection made between the on-board diagnostics port of the vehicle and the AVL system.

The County Patrol Superintendent was asked if there were any concerns of snow plow operators about the use of the AVL system to monitor the locations of snow plow drivers. It was acknowledged that there were some driver-level concerns about the system being used by superintendents to monitor every route taken by drivers and used as a disciplinary tool against drivers. However, the concerns went away once drivers realized the system was not being used in a disciplinary manner, and more for weather forecasting and planning for winter maintenance operations.

The group noted that the following equipment have been integrated with the AVL/GPS system: ground speed controllers, plow position sensors, spreader controllers/application rates, and air/surface temperature sensors. It was noted that the previously installed RoadWatch Air/Surface Temperature Sensors were near the end of life and their quality has deteriorated over time. Force America has newer sensors, both wire and wireless models. Installation and integration of the wired model has been straightforward for County staff that handle the installation.