On-Ramp to Innovation
every day counts

U.S. Department of Transportation
Federal Highway Administration

INTEGRATING MOBILE OBSERVATIONS (IMO) OVERVIEW

WEATHER-SAVVY ROADS

What is IMO?

Through round 4 of Every Day Counts (EDC-4), the Federal Highway Administration's (FHWA) Weather-Savvy Roads effort promotes two distinct road weather management solutions that allow State and local agencies to proactively manage the surface transportation system ahead of and during adverse weather events: Pathfinder and IMO.

IMO builds on vehicle-based technologies like automatic vehicle location and real-time communication that most states have already implemented in government fleet vehicles. Additional ancillary sensors collect weather and road condition data (such as air pressure, air and surface temperature, spreader rate and materials, windshield wiper status and rate, and relative humidity) and, when available, vehicle systems are accessed to collect and disseminate resident data. The data provides maintenance managers with a detailed view of the weather and road conditions, as well as asset locations along the highway network. This information can support a variety of applications for road weather management maintenance and operations decisionmaking, including road weather forecasts, end of shift reporting, material management, traveler information, performance management, road weather conditions, and maintenance decision support.

IMO Early Adopters

The Minnesota, Michigan, and Nevada Departments of Transportation (DOTs) partnered with FHWA to conduct phased IMO system deployments. The DOTs added external weather sensors to their vehicles; created software and hardware to read the information from the vehicles and external sensors; established communication systems to send the data to servers; and incorporated the data into new and existing systems. The DOTs have gained valuable insights into the uses of the data and are working to transfer this knowledge to others as they continue to enhance and expand their deployments.

Minnesota Department of Transportation (MnDOT)

MnDOT instrumented and deployed 478 heavy duty trucks, 20 light duty trucks, and 5 mowers over three phases of IMO deployment. MnDOT collected data from the vehicle and external sensors using customized software and equipment, then transmitted the data to servers via cellular communications. The data was used by other systems for road weather conditions, end of shift reports, material management, traveler information, and maintenance decision support. For more information, contact Joe Huneke (joseph.huneke@state.mn.us).

Michigan Department of Transportation (MDOT)

MDOT instrumented and deployed 20 snowplows and 40 light duty vehicles with connected vehicle technologies in a two-phased IMO deployment. It created a smartphone application to capture the vehicle and external sensor data via Bluetooth and transmit it via cellular communications. MDOT used the data for road weather conditions, performance management, traveler information, and maintenance decision support. For more information, contact Steve Cook (cooks9@michigan.gov).

Nevada Department of Transportation (NDOT)

NDOT instrumented and deployed 40 vehicles—a mix of heavy and light duty vehicles. It then deployed roadside infrastructure and created hardware and software to collect and transmit vehicle data. NDOT initially used its statewide radio system, before transitioning to multi-modal capabilities that support both cellular and dedicated short-range communications over

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three phases of IMO deployment. The data was used for road weather conditions, vehicle maintenance issues, and maintenance decision support. For more information, contact Rod Schilling (roschilling@dot.nv.gov).

IMO Benefits

Typical IMO benefits include more efficient and proactive road weather maintenance, and operations given better informed transportation management staff, as well as improved traveler information, leading to improved highway safety, mobility, and productivity. Benefits will vary based on the scale of the deployment, and include:

- **Material savings.** Reduced salt and sand usage is one potential benefit of IMO deployment. Real-time information about road weather conditions and fleet vehicle locations can help maintenance staff make better decisions about material application. For instance, the Michigan DOT estimated a 25 percent reduction in salt usage with the installation of automatic vehicle location/Global Positioning System equipment and use of a maintenance decision support system, which was about $2.1 million in annual savings for 340 trucks.
- **Agency efficiencies.** This may include improved reporting accuracy, reduced time spent on reporting, improved situational awareness, reduced response to emergencies, and engine diagnostics and idling information. Real-time information about resource consumption that is more comprehensive and accurate provides agencies with the data needed for decisionmaking. As an example, the Michigan DOT estimated an annual savings of $680,000 due to staff time saved by automatic system reporting.

Tips for Deployment Based on Lessons Learned

While the IMO deployments have successfully achieved stated objectives at each agency, the numerous challenges that were identified and overcome have generated valuable lessons learned, including some of the tips below.

Establish champions. High-level management champions are critical, but it is equally important to establish champions at each maintenance shed to make sure that each vehicle is configured correctly and that drivers are using the system.

Identify agency needs. Given the large amount of data available from the vehicles, it is imperative for stakeholders from around the agency to consider and document how the agency can use the data. Selection of appropriate sensors and communication mechanisms for the deployment should be based on identified needs.

Leverage available resources and expertise. Build on existing standards and resources, where possible, to facilitate the deployment process. Documentation and expertise from FHWA and peer agencies that have deployed IMO can provide valuable insights.

Determine data storage and retention timeframes. The size, speed, and storage capacities of agency servers and how they will feed data to other systems through streaming or file formats is critical.

Plan ahead for vehicle hardware and software. Schedule installations on vehicles. If possible, upgrade software through push technology rather than requiring the presence of the vehicle.

Ensure system compatibility. Make sure that systems and software can work in unison. For instance, if a web application is created, make sure that the agency's web browser is compatible.

Ensure sustainability. In order to create a foundation for long-term use and benefits beyond the initial implementation, procure resilient equipment to endure harsh conditions on plow vehicles; design with future scalability in mind; train numerous staff to operate and maintain deployed systems; and identify a long-term funding source to support, expand, and upgrade the deployed system over time.

IMO Resources

A variety of promotional and technical materials to support agencies interested in deploying IMO technologies are available on the Weather-Savvy Roads IMO Resource Toolkit webpage (https://go.usa.gov/xnS8V). The toolkit includes IMO reports that were developed by each deploying agency to document their implementation processes and lessons learned, as well as the resulting improvements to management strategies for traveler information systems and road weather performance management systems.

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