AASHTO
AASHTO INNOVATION INITIATIVE

AASHTO Innovation Initiative

[Proposed] Nomination of Innovation Ready for Implementation

Sponsor

Nominations must be submitted by an AASHTO member DOT willing to help promote the innovation. If selected, the sponsoring DOT will be asked to promote the innovation to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative.

1. Sponsoring DOT (State): New Jersey Department of Transportation

2. Name and Title: Salvatore Cowan, Senior Director, Transportation Mobility

Organization: New Jersey Department of Transportation

Street Address: : 1035 Parkway Ave

City: Ewing

State: New Jersey

Zip Code: 08625-0600

Email: Salvatore.Cowan@dot.nj.gov

Phone: 609-963-1381

Fax: 609-530-5692

Innovation Description (10 points)

The term “innovation” may include processes, products, techniques, procedures, and practices.

3. Name of the innovation:

Integrated Mobile Observations for NJ Weather Savvy Roads

4. Please describe the innovation.

Installation of the next generation of mobile road weather sensors and windshield cameras in the Safety Service Patrol and road weather maintenance fleet vehicles provides situational awareness to

management. Data is broadcast via FirstNet cellular network to the back-office data repository in real time and displayed in the web-based portal. The system provides visual awareness and road weather analytics and has enabled the maintenance operations personnel to assess the conditions and required actions before, during, and after the weather events more efficiently and with greater confidence.

5. What is the existing baseline practice that the innovation intends to replace/improve?

For the visual situational awareness of the traffic and roadway conditions, NJDOT currently relies on 460 fixed cameras installed along its rights-of-way, which are primary source of visual situational awareness. The agency also operates 41 remote RWIS stations to collect road weather data and inform the operations and maintenance personnel of road conditions across the State's highway system. The pilot project includes acquisition, installation, testing, deployment, and evaluation of equipment that provided remote real-time video stream and road weather sensing capabilities from NJDOT fleet vehicles to the Traffic Management Centers (TMC) and to senior management.

6. What problems associated with the baseline practice does the innovation propose to solve?

It is fiscally inconceivable to install and maintain fixed cameras along every State operated road, or significantly provide complete coverage of the roadway network by road weather information systems (RWIS) stations. This pilot program deploys a mobile weather data collection and processing system as part of the Weather Savvy Roads initiative included in the EDC 4 program. This pilot deployment also supports implementation of Weather Responsive Transportation Management (WRTM) strategies at NJDOT.

7. Briefly describe the history of its development.

The deployment was initiated with a USDOT AID grant in 2019. The hardware installation commenced in the Spring of 2020 and is ongoing. Seventeen vehicles were fully instrumented through the winter 2020/21. An additional seven vehicles have been instrumented in Spring/Summer 2021. The beta version of the web portal was deployed in Summer 2020 and has been used throughout the winter of 2020/21. Enhancements of the web portal are being implemented and are expected to be operational before the start of the Winter Season 2021/22.

8. What resources—such as technical specifications, training materials, and user guides—have you developed to assist with the deployment effort? If appropriate, please attach or provide weblinks to reports, videos, photographs, diagrams, or other images illustrating the appearance or functionality of the innovation (if electronic, please provide a separate file). Please list your attachments or weblinks here.

On the web portal itself, there is a user guide to assist in navigating the site. The web portal was designed to be easy to look at the data and comprehend what is happening on the roadway by the use of dials and colors. As the project was designed to add information and situational awareness to management without requiring vehicle drivers to perform any additional tasks, there is no additional training material for them. With respect to installation of the sensors, we followed the manufacturer's recommendations as well as using a manufacturer representative. As existing vehicles were used, no special vehicle requirements were needed. Our Weather Savvy project just needed to install the Vehicle System (VS) that consisted of four distinct subsystems which are: 1. In-Vehicle Video Camera 2. Road Weather Sensor 3. Onboard Processor (OBP). 4. Wireless Cellular Modem. An "In-vehicle System Setup Guide" document was created to walk through the bench testing of equipment, diagram the flow of information and identify all the components of the overall system.

Attach photographs, diagrams, or other images here. If images are of larger resolution size, please provide as separate files.

Please see Attachment for photos and descriptions.

Attachment Name: AASHTO ALL Nomination Application Attachment- NJDOT Weather Savvy Images.

State of Development (40 points)

Innovations must be successfully deployed in at least one State DOT. The AII selection process will favor innovations that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.

9. How ready is this innovation for implementation in an operational environment? Please select from the following options. Please describe.

☐ Prototype is fully functional and yet to be piloted

☐ Prototype has been piloted successfully in an operational environment

☒ Technology has been deployed multiple times in an operational environment

☐ Technology is ready for full-scale implementation

The prototype web-based application with limited functionality was launched in May 2020 and has been continuously updated and upgraded since then. Some of the key features deployed to date include: 1. Secure user access using SSL certificate and credentialing with username and password; 2. Provides a list of vehicles with an indication of which ones are active; 3. Vehicle dashboard activated by clicking on the vehicle ID in the list. The vehicle trace (leaves tracks of where vehicle has been) with mobile road weather observations is shown on the map in real time; 4. Vehicle dashboard combines the readings from the mobile RWIS sensor (MD-30) and the video stream from the vehicle camera; 5. Virtual video wall module allows the users to display vehicle dashboards with live video streams as tiles on the screen. The sidebar display of the map with the current vehicle locations is optional; 6. RWIS map layer shows the location and live readings from the NJDOT RWIS stations. Currently this data is obtained from the FHWA Weather Data Environment (WxDE); 7. Mobile vehicle trace map layer highlights the trajectories of all IMO vehicles active in the past 30 minutes. The color coding of the trace layer reflects the Road Surface Condition reported by the mobile road weather sensors.

This innovation proven very useful tool during Winter 2020/21 for Maintenance and Traffic Operations Management purpose. This innovation is not just for winter conditions as it was used during a hurricane.

10. What additional development is necessary to enable implementation of the innovation for routine use?

There is no additional development necessary. We have been working on incorporating minor adjustments/improvements/suggestions into the project. All that is needed is to install the Vehicle System (VS) consists of four distinct subsystems which are: 1. In-Vehicle Video Camera 2. Road Weather Sensor 3. Onboard Processor (OBP). 4. Wireless Cellular Modem and utilize the web portal.

11. Are other organizations using, currently developing, or have they shown interest in this innovation or of similar technology?? Yes

If so, please list organization names and contacts. Please identify the source of this information.

Organization	Name	Phone	Email
PA Turnpike Commission	William Howard	717-831-7712	whoward@paturnpike.com
Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.
Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.

Potential Payoff (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over baseline practice.

12. How does the innovation meet customer or stakeholder needs in your State DOT or other organizations that have used it?

This innovation has proven very useful tool during Winter 2020/21 and also during hurricane Ida for Maintenance and Traffic Operations Management purpose. Improved situational awareness, served as a decision support tool. The system was helpful during one particularly long storm to help predict how soon the crews could be released from storm duty. The innovation provided real-time information to management during storms that brought the storms into their offices and management centers that allowed them to both “see” the storm through the cameras as well as have the data (grip, road temperatures, ambient temperature, icing, etc.) to assist in decision making.

13. Identify the top three benefit types your DOT has realized from using this innovation. Describe the type and scale of benefits of using this innovation over baseline practice. Provide additional information, if available, using quantitative metrics, to describe the benefits.

Benefit Types	Please describe:
Improved Safety	The data collected from vehicle-sensors will be stored and available for review and analysis for significant events as part of post-event analysis and evaluation. The real-time data assisted in ensuring roadway conditions were addressed and watched.
Improved Operation Performance	The video feed from on-board video cameras and road-weather data from weather sensors will provide information needed to proactively manage Department's road maintenance and traffic management activities, as well as management of vehicle fleet resources. Efficient deployment of personnel and vehicle fleet to locations affected by adverse weather is critical to improving mobility and safety of the transportation system. The system also provided information that assisted in determining when storm coverage was no longer necessary.
Other (please describe)	**Better Data Collection and Accuracy** – The mobile observations of road-weather conditions obtained from in-vehicle sensors expands the coverage of the roadway network beyond stationary RWIS sensors, and will be used to evaluate accuracy and possibly calibrate the RWIS air temperature and pavement temperature sensors. Additionally, the mobile sensors also show how the highs and lows of roadways can differ in temperature and therefore vary in condition of the roadway (icing/not icing). Permanent RWIS shows the information at that

	specific location and not 1 mile down the road which could be dramatically different.

Provide any additional description, if necessary:

Stronger Collaboration Across Agencies – The video monitoring and road-weather sensor data is provided to traffic operations, roadway maintenance, and emergency response and management units, ensuring that they all have a common situational awareness of the current road-weather conditions and collaborate in developing and executing appropriate response. Working together strengthens the relationship between various entities within NJDOT that are often needed on day-to-day activities.

14 How broadly might this innovation be deployed for other applications. in the transportation industry (including other disciplines of a DOT, other transportation modes, and private industry)?

The technology has a potential for deployment on both regional (e.g., county) and local (e.g., municipal) fleet vehicles involved in traffic operations management and winter road maintenance. Even transit fleet vehicles can be equipped with similar technology integrated in to the AVL system for timely broadcast of location-specific road weather conditions.

Market Readiness (20 points)

The AII selection process will favor innovations that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.

15. What specific actions would another organization need to take along each of the following dimensions to adopt this innovation?

Check boxes that apply	Dimensions	Please describe:
☒	Gaining executive leadership support	Essential to gain support to provide a liaison between different leadership groups with diverse priorities.
☒	Communicating benefits	Vital to communicate with all stakeholders and ensure needs are met. This includes engagement with unions and other work units.
☐	Overcoming funding constraints	Click or tap here to enter text.
☒	Acquiring in-house capabilities	Strong coordination skills to communicate with in-house units; providing education for those involved as to capabilities of system as well as to how to perform maintenance
☐	Addressing legal issues (if applicable) (e.g., liability and intellectual property)	Click or tap here to enter text.
☐	Resolving conflicts with existing national/state regulations and standards	Click or tap here to enter text.
☐	Other challenges	Click or tap here to enter text.

16. Please provide details of cost, effort, and length of time expended to deploy the innovation in your organization.

Cost: $15,000 per vehicle (hardware installation, setup, and integration)

Level of Effort: Focused and flexible effort is required.

Time: Planning and Procurement took around one year and took less than ten months to deploy. Some of the time was impacted due to COVID situations.

17. To what extent might implementation of this innovation require the involvement of third parties, including vendors, contractors, and consultants? If so, please describe. List the type of expertise required for implementation.

NJDOT has an active collaboration with the ITS Resource Center (ITSRC) at NJIT, which provides support in development and deployment of new ITS tools and practices. for this innovation the ITS Resource Center (ITSRC) at NJIT contributed technical expertise during the design of the Weather Savvy pilot project and development and also implemented of the Weather Savvy web-based data portal. The NJIT team oversaw the fleet-vehicle instrumentation, monitored and documented the overall system performance. The ITS Resource Center also utilized two specialized vendors to assist with installation of the equipment in the vehicles.