AIM Innovation Showcase Application

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 present the innovation at the Innovation Showcase during the AASHTO Spring Meeting.

1. Sponsoring DOT (State): Washington

2. Name and Title: Jason Biggs, Director, WSDOT Rail, Freight, and Ports Division

   Organization: Washington State Department of Transportation

   Street Address: 310 Maple Park Ave SE City: Olympia State: Washington

   Zip Code: 98504 Email: jason.biggs@wsdot.wa.gov Phone: 360-705-6902

Innovation Description (30 points)

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

3. Name of the innovation:

Optimizing underutilized truck parking spaces at state owned locations using predictive parking technology.

4. Please describe the innovation.

The proposed innovation comprises two key components aimed at optimizing the utilization of existing truck parking inventory at safety rest areas and weigh stations in Washington State:

1. **Predictive System for Truck Parking Information Management (TPIMS):**

   WSDOT's innovative technology leverages machine learning and historical parking patterns to provide truck drivers with predictive forecasts of truck parking availability at state rest areas and weigh stations along the I-5 corridor. Drivers can access this data through the WSDOT travel website, and it will also be available via the TPIMS application programming interface (API). The predictive parking data is offered in increments ranging from 30 minutes up to 4 hours in advance, with an accuracy of up to 88%.

2. **Weigh Station Parking Utilization:**

   Truck parking is available at Washington State's weigh station facilities, but it is frequently underutilized due to a lack of awareness and visibility regarding available spaces. By partnering with the Washington State Patrol and deploying TPIMS to include parking availability at weigh stations along I-5, WSDOT can maximize the use of existing truck parking inventory. This initiative unlocks more than 100 additional spaces for truck parking.

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

The existing baseline practice that the innovation intends to improve involves the following: **Manual and Inaccurate Truck Parking Information:** Currently, truck drivers primarily rely on manual methods, such as visual assessments or word of mouth, to determine parking availability at rest areas and weigh stations. There is no widespread, reliable system that provides real-time or predictive parking availability information, making it difficult for drivers to plan their stops effectively. This often leads to either overcrowding or underutilization of available truck parking spaces. **Underutilization of Weigh Station Parking:** Truck parking at weigh stations is not widely recognized by drivers, contributing to underuse of these facilities. While parking spaces are available at weigh stations, a lack of visibility and information about availability results in missed opportunities to optimize these spaces, leading to underutilized truck parking inventory. The innovation seeks to replace this outdated and inefficient system by providing drivers with predictive, real-time parking availability data.

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

WSDOT believes that the value of TPIMS real-time data can be significantly enhanced by incorporating predictive truck parking availability. This technology not only provides real-time data but also uses machine learning to analyze historical parking patterns unique to each location. By offering this predictive information, truck drivers can more effectively plan their stops with greater confidence in finding safe parking at public Safety Rest Areas and weigh stations, while remaining compliant with federal hours of service requirements for mandatory rest breaks. Additionally, WSDOT is expanding parking inventory for truck drivers by increasing awareness and promoting the availability of parking at both Safety Rest Areas and the state's weigh stations.

7. Briefly describe the history of its development.

As part of a phased approach, WSDOT initially worked with the research team at the University of Washington Smart Transportation Applications and Research Laboratory (STAR Lab) to conduct a predictive truck parking technology pilot on advanced truck parking management systems. This project developed a comprehensive solution in which a parking detection system collects and processes real-time parking data and developed a multi-timescale prediction occupancy algorithm that estimates future parking availability information. Empowered by artificial intelligence and a deep learning prediction algorithm, the technology pilot achieved an error rate of less than 12 percent in predicting parking availability from 10 minutes to four hours ahead. The deliverables of this project included: A machine-learning algorithm developed for future truck parking availability, a TPIMS pilot website and mobile application that shows real-time and predicted truck parking information at two pilot location sites. WSDOT also received funding from the FMCSA to deploy truck parking detection technology and develop an API to build upon the work delivered with the UW Star Lab. In January 2024 WSDOT received an FHWA INFRA grant award along with Caltrans and ODOT to develop and deploy TPIMS along the I-5 corridor. The result of this phased approach will be delivering TPIMS with predictive parking availability along the I-5 corridor in Washington state.

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 below (if electronic, please provide a separate file). Please list your attachments or weblinks here.

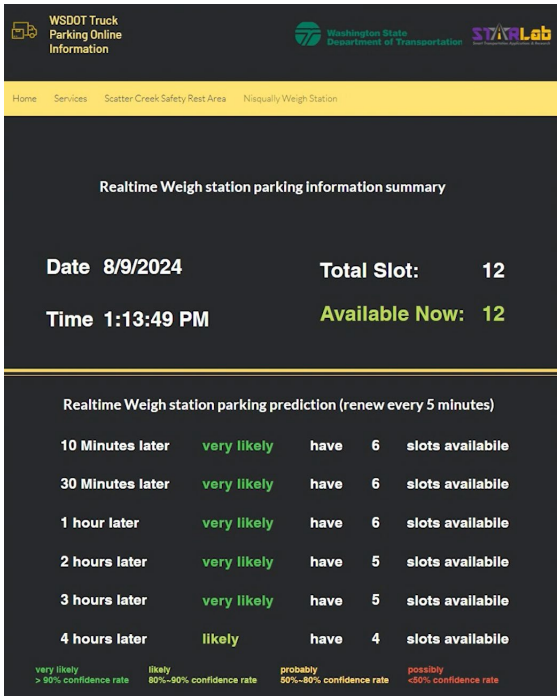
Pilot website: Home | Wsdotparking (uwstarlab.wixsite.com)

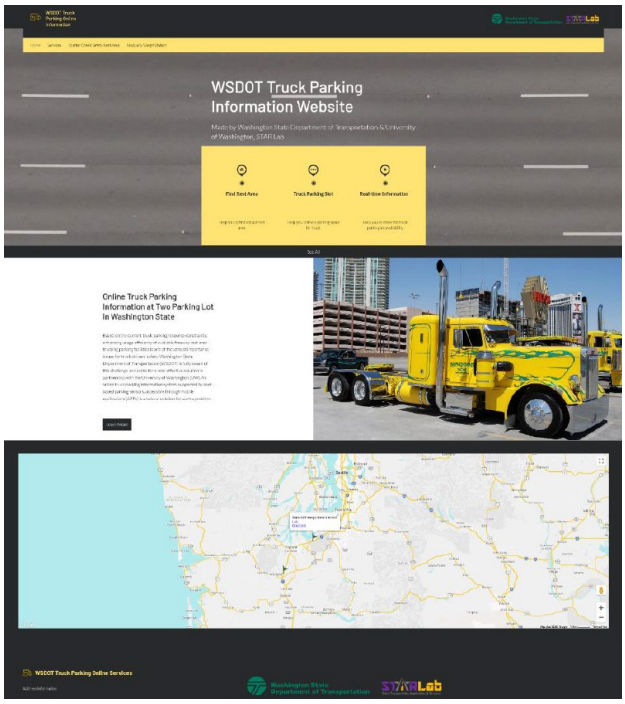
Research report: https://depts.washington.edu/trac/bulkdisk/pdf/904.1.pdf

AASHTO

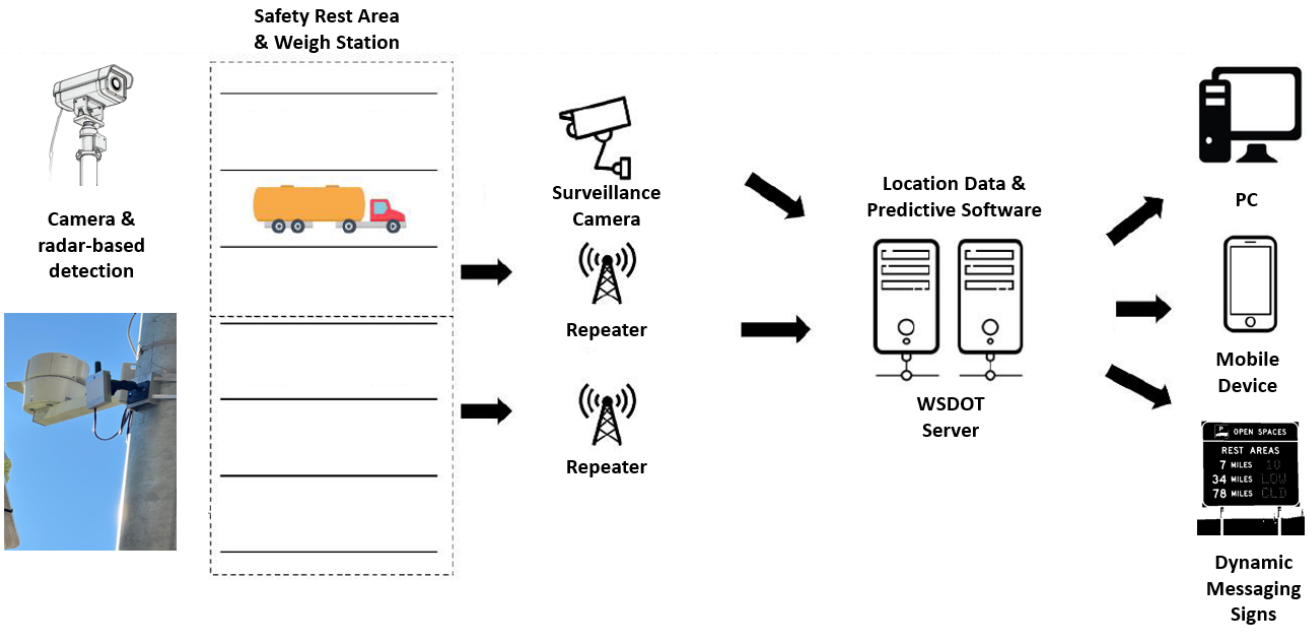
INNOVATION MANAGEMENT

Initial Technology Pilot Website





WSDOT TPIMS Predictive Parking Data Flow



AASHTO INNOVATION MANAGEMENT

State of Development (10 points)

Innovations must be successfully deployed in at least one State DOT. The AIM 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.

☒ Innovation is fully functional and yet to be piloted.

☐ Innovation has been piloted successfully in an operational environment.

☐ Innovation has been deployed multiple times in an operational environment.

☐ Innovation is ready for full-scale implementation.

The TPIMS predictive pilot was deployed at two pilot sites (Nisqually Weigh Station and Scatter Creek Rest Area) between January 2020 to March 2021. Technology pilot (validation) in 2020-21 did not include drivers, but user validation with drivers is scheduled for early 2025.

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

Deployment of camera and radar-based detection technology to replace in-ground detectors. Migration of software server from UW to WSDOT.

11. Do you have knowledge of other organizations using, currently developing, or showing interest in this innovation? ☒ Yes ☐ No

If so, please list organization names and contacts.

Developing a predictive approach to TPIMS is a topic members states of the AASHTO Committee on Planning: Freight Planning Task Force have discussed and are interested in.

Potential Payoff (30 points)

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

12. Identify the top three benefits 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.

AASHTO INNOVATION MANAGEMENT

Benefit Types	Please describe:
Improved Asset Performance	Weigh stations are often overlooked as parking resources, especially during non-operational hours. By incorporating these locations into TPIMS, WSDOT can increase awareness of this underutilized parking inventory. This leads to more efficient use of existing infrastructure.
Improved Safety	Truck drivers forced to park in undesignated and unsafe locations, such as highway shoulders, create safety hazards for both them and the motoring public. TPIMS with predictive parking data reduces this issue by offering drivers better options to plan ahead for safe parking as well as promoting parking at state weigh stations.
Improved Operation Performance	Recent studies have found that the uncertainty of truck parking availability often leads truck drivers to end their day early, ranging from 30 minutes to an hour, to avoid running out of drive time under HOS regulations. Disseminating predictive truck parking data with high accuracy mitigates the chance that the location availability has changed between the driver seeing a sign or planning in advance and their actual arrival time. This foresight reduces the uncertainty of last-minute parking decisions and enables more strategic trip planning.

Provide any additional details below:

Improved Asset Performance: Along the I-5 corridor in Washington State there are 109 underutilized truck parking spaces at six weigh stations. With the average cost to add a new truck parking stall at an existing state property of $175,000 (depending on region and other factors) better utilizing existing truck parking at weigh stations would unlock an equivalent amount of $19M in new truck parking spaces that would otherwise need to be developed to help address the state's deficit.

AASHTO INNOVATION MANAGEMENT

Deployability (30 points)

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

13. What challenges and/or lessons learned should other organizations be aware of before adopting this innovation?

Challenges and Lessons Learned:

Driver Adoption: A significant challenge lies in gaining the trust of the truck driver community regarding the use of predictive parking data, a new concept to the industry. To address this, WSDOT will be actively engaging drivers by collecting feedback from a select group of carriers during the user validation phase. This feedback will help refine how predictive data is presented to drivers and identify opportunities to improve the accuracy of the data.

Awareness of Weigh Station and Safety Rest Area Parking: Increasing driver awareness and changing perceptions about the availability of parking at Washington state's weigh stations and safety rest areas is another challenge. These locations are often underutilized due to a lack of visibility into available spaces. WSDOT is addressing this by deploying TPIMS signage in advance of weigh stations and providing predictive parking data on the WSDOT travel website and mobile app.

Reliable Technology for Identifying Parking Occupancy: Ensuring the accuracy of parking occupancy rates within Safety Rest Areas (SRAs) and weigh stations is crucial for the success of predictive parking systems. Identifying and deploying reliable technology to monitor and report real-time occupancy has been a key lesson learned. The accuracy of these systems directly impacts driver trust and the overall effectiveness of the predictive parking solution.

By proactively engaging drivers, improving the visibility of parking options, and deploying reliable occupancy technology, WSDOT is working to optimize the use of existing parking resources. Organizations considering similar innovations should prioritize driver engagement, the accuracy of data collection, and public awareness campaigns.

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

Cost: $82,000 paid to the University of Washington to develop a truck parking availability prediction algorithm, conduct a truck parking detection accuracy assessment, and develop a pilot website and mobile app. WSDOT Research and Library Services funded $200,000 to develop the initial AI algorithm for the TPIMS system, as well as to create a pilot website and mobile app for public information and use. Grant funding from FMCSA ($2.2 million) was used to purchase and install truck parking detection technology at the two TPIMS pilot locations. Grant funding received from INFRA in January 2024 ($2.3 million plus $1.8 million in state funds) will be used for installation of additional detection technology and data dissemination through dynamic messaging signage, WSDOT travel website and mobile application.

Level of Effort: Click or tap here to enter text.

Time:

Phase	2019	2020	2021	2022	2023	2024	2025	2026	2027	Budget	Key Deliverables
UW	Technology Pilot									$282K	Predictive algorithm, Pilot website and app Detection technology assessment
FMCSA										$2M	Detection technology deployment API Development
INFRA										$4M	Detection technology deployment Dissemnation of predictive parking data

Click or tap here to enter text.

15. 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.

While not mandatory, the implementation of WSDOT's TPIMS predictive data can benefit from the involvement of third parties. The data is accessible through the TPIMS application programming interface (API), allowing for integration with external developers of mobile applications and in-cab technology for drivers. To effectively implement this innovation, the following types of expertise may be required: **Software Development**: Proficiency in creating mobile applications and integrating with APIs. **Data Analytics**: Expertise in analyzing and interpreting predictive data to enhance user experience and application functionality. **User Experience (UX) Design**: Knowledge in designing intuitive interfaces that meet the needs of truck drivers. **Transportation Management**: Familiarity with transportation systems and regulatory requirements to ensure compliance and relevance.