August 2024

TRAC e-News: Delivering Research Results!

The Washington State Transportation Center (*TRAC*), conducts transportation research through collaborative partnerships among WSDOT, the University of Washington (UW), and Washington State University (WSU).

In this issue

Bridges

Developing High Early Strength Concrete for Rapid Bridge Deck Overlay Preservation

Research team: Fred Aguayo (UW) | Travis Thonstad (UW) | Anthony Mizumori (WSDOT) | Mustafa Mohamedali (WSDOT)
Sponsor: WSDOT

Ongoing: High early strength concrete (HESC) is a high performance concrete that can achieve structural quality within 24 to 72 hours of being poured, making it ideal for locations where minimal traffic disruption is crucial. The objective of this study is to develop an HESC mix design with calcium sulfoaluminate (CSA) cement for bridge overlays. CSA is desirable for use in HESC because of its ability to set in as quickly as 15 minutes after placement and to easily surpass a compressive strength of 3,000 psi in under three hours. The researchers will identify the obstacles to successfully and reliably using HESC for bridge deck overlays and will develop standards, specifications, processes, and best practices for constructing HESC overlays in Washington. This will give WSDOT the means to reliably construct overlays to rehabilitate and protect bridges with lower construction costs and less travel disruption. Read more…

Data-Driven Assessment of Post-Earthquake Bridge Functionality and Regional Mobility

Research team: Christopher Motter (WSU) | Adam Phillips (WSU) | Marc Eberhard (UW) | Jeffrey Berman (UW) | Brett Maurer (UW)
Sponsors: PacTrans | WSDOT
Report

Completed: Local, state, and federal engineers and emergency managers need reliable estimates of bridge functionality after an earthquake event so that they can plan pre-event mitigation, post-event response and mobility, and long-term recovery. The goal of this project was to improve the prediction of the post-earthquake functionality of bridges in Western Washington following a Cascadia Subduction Zone (CSZ) magnitude-9.0 earthquake. The researchers conducted model analyses to provide a more detailed understanding of the likelihood of bridge damage and likely service levels after an earthquake. Conclusions were reached by using several new datasets and analysis of representative bridges. This study found that bridge functionality after a CSZ earthquake is likely to be considerably better than that anticipated by a 2019 Department of Homeland Security report. However, the researchers recommended that bridges without shear keys and bearings be prioritized for retrofit. Shorter period bridges near the coast and longer period bridges in locations with sedimentary basins were also identified as being more prone to damage. Read more…

Freight

Real-Time Truck Parking Information Integration, Visualization, and Prediction

Research team: Yinhai Wang (UW) | Matthew Neeley (WSDOT) | Karthik Murthy (WSDOT) | Doug Brodin (WSDOT)
Sponsor: WSDOT
Report: WA-RD 904.1

Completed: Truck parking facilities such as freeway rest areas, welcome centers, and weigh stations are struggling to meet the increasing demand of freight vehicles. Lack of parking spaces and real-time information about parking availability often results in illegal parking and overtime driving. In response, this project worked to improve a system to provide information about real-time and predicted truck parking space availability to freight truck drivers. For the study, the team collected truck parking space availability information from truck detection devices embedded in the pavement of multiple parking lots and transmitted that information to a truck parking information center. They then applied a novel artificial intelligence model based on historical truck parking space occupancy data and other factors to predict parking availability. Empowered by that model and a deep learning prediction algorithm, the pilot truck parking information management system (TPIMS) achieved an error rate of less than 12 percent in predicting parking availability from 10 minutes to four hours ahead. The

researchers also developed a mobile application to disseminate visual, real-time parking availability information. These research products can help improve TPIM systems and enhance the efficiency of truck parking infrastructure usage, thereby increasing the robustness of the entire freight network. Read more…

Intelligent Transportation Systems

Smart Sensor for Snow Avalanche Monitoring, Phase 2

Research team: Yinhai Wang (UW) | Edward McCormack (UW) | James Morin (WSDOT) | Doug Brodin (WSDOT)
Sponsor: WSDOT

Ongoing. WSDOT spends millions of dollars each winter assessing and monitoring the chances of hazardous roadside snow avalanches in Washington's mountains. The objective of this project is to develop an avalanche sensor for deployment by drone on inaccessible slopes above state roadways. This sensor is intended to provide indirect, remote, and real-time information about snow conditions more safely and cost effectively. In this project, the University of Washington's STAR Lab will manufacture six to ten sensors for field testing and will place them on a known avalanche path in Washington's Snoqualmie Pass. The research team will test the ability of drones to accurately drop and retrieve the sensors. In addition, they will test the communication between the sensors and a base station, and they will evaluate the accuracy of the collected snowpack and avalanche information and its value to WSDOT's avalanche staff. Read more…

Maintenance

WSDOT Maintenance Performance Measure Algorithms

Research team: Kishor Shrestha (WSU) | Kelly Shields (WSDOT) | Bruce Castillo (WSDOT) | Doug Brodin (WSDOT)
Sponsor: WSDOT
Report: WA-RD 932.1

Completed. WSDOT Maintenance has been evaluating the effectiveness of its maintenance program through outcome-based performance measures, referred to as level of service (LOS). The purpose of this project was to give WSDOT Maintenance the ability to forecast the LOS performance of its important highway assets. The researchers focused on six highway assets: culverts, barriers/guardrails, traffic signal systems, ditches, slopes, and shoulders. As a start, the researchers created algorithms that will be used as a basis to develop prediction models. Once the prediction models have been

validated, they can be used to forecast the condition of highway assets based on different performance measures across various maintenance activities and funding levels. The results could help the WSDOT Maintenance Division set performance targets that balance available funds, acceptable performance expectations, and maintenance division priorities, potentially preventing the need for expensive reactive maintenance. Read more…

Multimodal Travel

Assessing and Improving the Application of Multimodal Performance Measures to WSDOT Projects

Research team: Don MacKenzie (UW) | John Tevis (WSDOT) | Jon Peterson (WSDOT)
Sponsor: WSDOT
Report: WA-RD 917.1

Completed. This study assessed the application of multimodal performance measures and indicators in WSDOT's highway design process. Over the last thirty years, federal and other policies have shifted transportation planning and design from an auto-centric focus on building out and maintaining the highway network to integrating multimodal transportation systems. For this study, the concept of multimodal included active transportation (pedestrians, bicycles), freight, and transit, as well as single occupancy vehicles. Building on a literature review and interviews, the researchers examined six case studies of multimodal projects across several WSDOT regions in Washington state. They evaluated how those projects have integrated best practices for multimodal planning and performance measurement, as well as opportunities for improvement. The projects ranged from an intersection study in North Wenatchee that was in the early planning stages to completed projects such as a diverging diamond interchange at I-5 and SR 510 in Lacey. All the projects involved improvements to highway intersections, and all of them used alternatives to traditional traffic signals. Read more…

Webinar Wednesdays

WSDOT's Research & Library Services Office hosts Webinar Wednesdays, its continuing series of one-hour webinars to promote research technology transfer, encourage implementation, and foster innovation. Generally held every other month, the sessions cover a wide range of transportation topics. Each webinar showcases research results or innovative practices presented by researchers and subject matter experts, and each features a Q&A segment for attendees to pose questions.

Sign up here for webinar announcements and registration information. Previous webinars are available for access here.

Below is information about WSDOT's most recent research webinar:

Highways, Wildlife, and AI, Oh My! (June 2024)

Presenters: Dr. Fraser Shilling, Director, Road Ecology Center, UC Davis Institute of Transportation Studies | Vedant Srinivas, Applied Science Intern, UC Davis

Access the recording

Wildlife needs to move, and highways can affect that movement. This webinar focuses on two rapidly growing areas in monitoring and resolving this impact: 1) building and monitoring wildlife crossings to permit wildlife movement across highways and 2) using artificial intelligence (AI) tools to detect and identify wildlife. With the I-90 wildlife crossings as a testbed, the researchers share how advanced AI methods are being applied to help WSDOT rapidly measure success in wildlife's use of these crossings.

The topic for the next webinar, tentatively scheduled for September 2024, is **Using Drones to Manage Graffiti**. Join us to learn about how WSDOT's innovative Maintenance & Operations staff are tackling graffiti along roadways with paint drones. Subscribe to the email list to receive the announcement and registration information, coming soon!

Email change

The TRAC e-News is being sent from a new email address, **tracnews@tracuw.org**. This is intended to help prevent our email from landing in your Spam folder. Please be sure to add this address to your address book or safe senders!

TRAC e-News will be delivered about three times a year. For more information about TRAC and the ground-breaking work we are doing, please visit our Current Projects and Research News pages. A downloadable, pdf version of this newsletter is also available.

For contact information, follow these links:

- WSDOT Contacts
- UW Contacts
- WSU Contacts

The Washington State Transportation Center (TRAC) is a cooperative, interdisciplinary transportation research agency. Its members, the Washington State Department of Transportation (WSDOT), Washington State University (WSU), and the University of Washington (UW), formed TRAC in 1983 to coordinate transportation research efforts—both state and commercial, public and private—and to develop research opportunities both nationally and locally. TRAC acts as a link among government agencies, university researchers, and the private sector.

This eNews was sent by: Washington State Transportation Center (TRAC) | 4333 Brooklyn Ave NE | Seattle, WA 98195
trac@uw.edu | http://depts.washington.edu/trac/