



January 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

- Mark Hallenbeck retires from TRAC and the UW
- Designing a way to reduce noise caused by bridge expansion joints
- Reducing greenhouse gas emissions produced by roadway construction
- Deploying a cloud-based system for collaborative corridor incident response
- Developing a business intelligence system for analyzing ORCA fare card data
- Identifying promising locations for transit-oriented development
- Recent WSDOT Webinar Wednesday presentation

Mark Hallenbeck retires from TRAC and UW



After 39 years at the University of Washington, Mark Hallenbeck retired September 15th. From 1993 to 2023 Mark was Director of TRAC, where he was also a principal investigator or collaborator for hundreds of impactful transportation-related studies.

Mark was nationally recognized as an expert in several areas of transportation engineering, and many of the systems, programs, and recommendations he developed were implemented regionally and nationally. Much of Mark's research involved the collection, summarization, and reporting of data that describe the use and performance of transportation systems, whether roadways, transit service, or multimodal networks. Over the years he was involved in initial research behind implementation of Washington state's incident response program, its freeway management system, many state traveler information applications, and the truck weigh station bypass program. Most recently, he worked with multiple organizations in the Pacific Northwest to examine how big data and new technology can be used to improve regional mobility and to determine how changing mobility options affect land-use decisions.

Mark was affiliate faculty in Civil and Environmental Engineering and in Urban Design and Planning. He was a dedicated teacher, and his well-regarded courses in intelligent transportation systems, urban transportation planning, mobile hub design, and sustainable transportation informed and inspired decades of students.

Mark's ties to the UW and TRAC ran deep. He began with TRAC as a Senior Research Engineer in 1984. He also received both his B.S. (1979) and M.S. (1980) degrees in Civil Engineering from the UW.

The search for the new TRAC-UW director is ongoing and should be completed by February 2024.

Bridges

Design and testing of modular expansion joint noise mitigation strategies

Research team: [Per Reinhall](#) (UW) | [Jeff Lipton](#) (UW)
| [Mark Gaines](#) (WSDOT) | [Jon Peterson](#) (WSDOT)

Sponsor: WSDOT

Report: [WA-RD 920.1](#)

Completed: While expansion joints are a necessary component of bridges, they also contribute to noise pollution. This study investigated the design and feasibility of strategies to mitigate noise caused by modular expansion joints (MEJs) on Washington state's Evergreen Point Floating Bridge (SR 520 bridge) over Lake Washington. The three main sources of noise from MEJs are resonance of the air within the gaps, resonance of the beams, and resonance of the tires. For this project, the researchers developed and fabricated a noise mitigation treatment to reduce tire deformation into the beam gaps and subsequently decrease pressure spikes on tires and beam edges. This treatment involved filling the gaps in the MEJs with flexible engineered chevron support structures. Over a two-month test period, the chevrons installed in an MEJ in one lane of the SR 520 bridge proved to be highly effective. More information is available in a longer article on the [UW Mechanical Engineering website](#) and on the [TRAC website](#).



Environment

Greenhouse gas emissions inventory from construction of WSDOT roadways



Research team: [Kate Simonen](#) (UW) | [Loc Tran](#) (WSDOT)
| [Jon Peterson](#) (WSDOT)

Sponsor: WSDOT

Report: [WA-RD 926.1](#)

Completed: State departments of transportation are developing carbon accounting practices and strategies to mitigate the adverse environmental impacts of the materials they utilize such as asphalt, concrete, and steel. To assist WSDOT, researchers at the UW Carbon Leadership Forum assessed and analyzed the greenhouse gas (GHG) emissions of WSDOT's current material practices and explored opportunities to decrease them. Construction-related GHG emissions, also known as *embodied carbon* or *upstream Scope 3* emissions, as opposed to those produced during roadway operation, arise from the manufacturing, transportation, installation, maintenance, and disposal of construction materials. The researchers collected a variety of data and created a framework for a whole lifecycle assessment. They found the five-year average upstream Scope 3 emissions from roadway construction between 2017 and 2021 to be approximately 310,000 metric tons of CO₂ equivalent (a measure of global warming potential). Upstream Scope 3 emissions from

roadway construction were found to be as much of a contributor to WSDOT's GHG emissions as direct and indirect fuel or energy consumption. [Read more...](#)

Freeway and Arterial Management

Deployment of the Washington state virtual environment for multimodal integrated corridor management

Research team: [Mark Haselkorn \(UW\)](#) | [Travis Phelps \(WSDOT\)](#) | [Doug Brodin \(WSDOT\)](#)

Sponsor: WSDOT

Ongoing: A team from the UW Department of Human Centered Design and Engineering is building the Virtual Coordination Center (VCC), a cloud-based platform to support real-time data sharing and coordinated, collaborative response to quickly address major roadway incidents. In summer 2023 the Washington state legislature approved approximately \$2 million to maintain the VCC and expand it to up to five additional jurisdictions in King County. The cloud-based VCC has been designed through a process that has included participation from the regional transportation community, including WSDOT, Seattle DOT, Seattle Police, Seattle Fire, Washington State Patrol, King County Metro, and Sound Transit. The VCC will dramatically reduce the time and increase the effectiveness of incident operations. It will provide a framework within which regional transportation, transit, and law enforcement agencies will be able to coordinate traffic management strategies using real-time data. More information is available in a longer article on the [UW HCDE website](#) and on the [TRAC website](#).



Multimodal Travel

ORCA data for planning



Research team: [Mark Hallenbeck \(UW\)](#) | [Ryan Avery \(UW\)](#)

Sponsors: King County Metro, Sound Transit

Completed. A large portion of all transit rides in the greater Puget Sound region are paid for with the One Regional Card for All (ORCA) electronic transit fare card. TRAC researchers have developed a business intelligence system that takes advantage of data from the ORCA system to provide transit agencies with a way to analyze farecard transactions and better understand transit

travel. This project received funding from a variety of public and private stakeholders, including the Washington State Department of Transportation, King County Metro, Sound Transit, Starbucks, Amazon, Microsoft, The Bill & Melinda Gates Foundation, REI, and Challenge Seattle, to develop a system that allows

ORCA data to describe overall transit use in the region. The data describe when and where riders travel, the types of payment options used, the types of riders using them, which services are successful or need to be adjusted, and changes in transit travel patterns over time. All regional transit agencies can access the ORCA Business Intelligence system by contacting [Ryan Avery](#) at TRAC. [Read more...](#)

Transportation Planning

Developing a multi-criteria prioritization tool to identify promising locations for transit-oriented development on WSDOT-owned park and ride sites

Research team: [Qing Shen](#) (UW) | [Anne Vernez Moudon](#) (UW) | [Arthur Acolin](#) (UW) | [Anthony Buckley](#) (WSDOT) | [Doug Brodin](#) (WSDOT)

Sponsor: WSDOT

Report: [WA-RD 925.1](#)

Completed: By planning and implementing transit-oriented development (TOD) projects, public agencies can promote environmentally responsible and socially equitable transportation services while also making important contributions to alleviating the affordable housing shortage. A key component of TOD is multi-family housing near the transit system. The goal of this project was to develop a planning support tool that WSDOT can use to cost-effectively identify the most promising park and ride sites on which to focus its TOD efforts. The prioritization tool was designed to facilitate the use of public transit and support a more sustainable urban transportation system by prioritizing the locations with higher levels of transit service, denser population and employment, more diverse land uses, higher land values, and a more transit-supportive regulatory environment. To test the resulting tool, the research team used it to measure the TOD potential at three WSDOT-owned park and ride sites in Snohomish, Clark, and Spokane counties in Washington. [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 features a Q&A segment for attendees to pose questions. The 2024 schedule is in development now.

[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:

Long-term performance of shotcrete-concrete interface bonds (November)

Presenter: Haifang Wen, WSU Civil and Environmental Engineering

[Access the recording](#)



Shotcrete is becoming popular for vertical and overhead applications where conventional formwork and repairs are difficult and costly. However, the substrate and the shotcrete overlay interface can be vulnerable, and the bond properties in this region are not well understood. The study discussed in this webinar evaluated the shotcrete-concrete interface bond created with four representative substrate surface preparation methods—chipped, pressure-washed, sandblasted, and as-cast—under three different loading conditions—tensile, shear, and Mode-II fracture—as well as the long-term freeze-thaw durability of these bonds.

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) | 1107 NE 45th St | Seattle, WA 98105
<http://depts.washington.edu/trac/>