August 2023

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

Moudon receives distinguished faculty award

In June Dr. Anne Vernez Moudon was honored with the **Distinguished Faculty Award for Lifetime Achievement** by the UW College of Built Environments (CBE). Moudon is a long-time contributor to TRAC research, conducting TRAC-associated studies in urban form analysis, land monitoring, neighborhood and street design, active travel, and public health for sponsors as diverse as the Washington State Department of Transportation, PacTrans, Puget Sound Regional Council, Seattle Children's Research Institute, Kaiser Permanente, the Research and Innovative Technology Administration (RITA), and the National Institutes of Health.

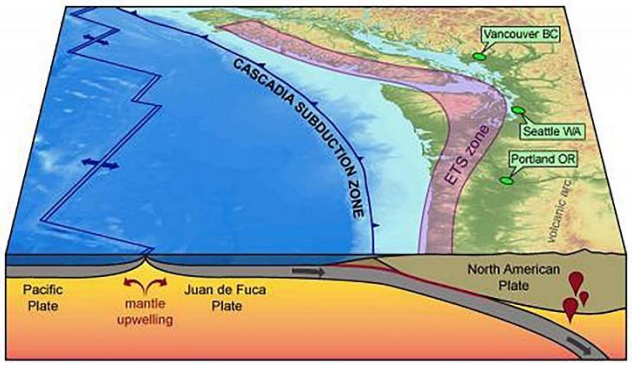
The Distinguished Faculty Award for Lifetime Achievement recognizes faculty members who have made important contributions to their field and have had significant impact on the CBE community. It acknowledges that the distinction of CBE depends on the work of individual faculty members and the recognition that they receive, as well as the achievements of the students whom they teach and mentor. It honors a sustained commitment to their research and a passion for excellence.

Moudon**,** a professor emeritus in Architecture, Landscape Architecture, and Urban Design & Planning, was a member of the faculty from 1981 to 2015; a noted urban morphology designer and planner; Director of the Urban Form Lab from 1994 to the present; a leader in the Urban Design Certificate program; the Associate Dean of Academic Affairs from 1992 to 1995; the Director of Interdisciplinary Ph.D. in Planning from 1998 to 2000; and a founding member of the International Seminar on Urban Form (ISUF). Read more…

Bridges

Impacts of Cascadia Subduction Zone M9 earthquakes on bridges in Washington state

Research team: Mark Eberhard (UW) | Jeffrey Berman (UW) | Brett Maurer (UW) | Bijan Khaleghi (WSDOT) | Mustafa Mohamedali (WSDOT)
Sponsor: WSDOT
Report: WA-RD 908.1



Completed: The Cascadia Subduction Zone has the potential to produce large-magnitude, megathrust earthquakes that will affect the performance of every new and existing bridge in the western half of Washington state. This project evaluated the impacts on bridges of a magnitude 9 (M9) earthquake to help agencies prioritize earthquake retrofit efforts and to support the development of emergency response plans. Among the ten locations the research team studied, the estimated damage to bridges was found to depend on distance from the fault and whether the location was underlain by a sedimentary basin. The researchers recommended that within the sedimentary basins that underlie most of the Puget Sound region, agencies should prioritize the retrofit of bridges with longer effective periods (longer than 0.5 seconds), particularly those on softer sites, to increase the resilience of transportation networks to M9 earthquakes. Read more…

Freeway and Arterial Management

Approaches to target setting for PM3 measures

Research team: Christopher Lindsey (CS) | Moggan Motamed (CS) | Richard Margiotta (CS) | Mark Hallenbeck (UW)
Sponsor: Federal Highway Administration
Report: FHWA-HOP-19-056

Completed: With transportation performance management (TPM), transportation agencies use roadway performance information such as reliability and delay to help make investment and policy decisions to achieve the goals they have set for transportation system performance. The purpose of this project, conducted with Cambridge Systematics, was to provide examples of different options available to state departments of transportation and metropolitan planning organizations for setting the roadway performance targets required for performance management (referred to as PM3 measures). The report provides approaches available to state DOTs for setting roadway performance targets, specifically for travel time-based performance measures. It reviews the concept of TPM—the impetus for target setting—and Performance-Based Planning and Programming, which is a key part of implementing TPM. It also provides an overview of federal target setting requirements and identifies challenges and noteworthy practices from around the country. Read more…

Geotechnical Engineering

Long-term bond characteristics of the interface between the substrate and overlays in shotcrete applications

Research team: Haifang Wen (WSU) | Pizhong Qiao (WSU) | Scott Sargent (WSDOT) | Mustafa Mohamedali (WSDOT)
Sponsor: WSDOT
Report: WA-RD 870.3

Completed: Shotcrete, concrete applied pneumatically at high velocity, has the potential to save costs and construction time when used to replace cast-in-place concrete for retaining walls and slope stabilization. It is becoming popular for vertical and overhead applications where conventional formwork and repairs are difficult and costly. This study evaluated the shotcrete-concrete interface bond by testing four methods for preparing the substrate surface—chipping, pressure-washing, sandblasting, and no preparation—under three different loading conditions: tensile, shear, and Mode-II fracture. The study also investigated the long-term freeze-thaw durability of these bonds and introduced a probabilistic damage model to predict their service lives. The results of this project will help highway agencies achieve the best structural quality and durability when they use shotcrete. Read more…

Highway Safety

Automated traffic sign recognition using computer vision and deep learning

Research team: Yinhai Wang (UW) | Dina Swires (WSDOT) | Doug Brodin (WSDOT)
Sponsor: WSDOT

Ongoing. The importance of traffic signs for traffic operations and safety requires transportation agencies to maintain an inventory of them and their condition. Traditional sign asset management is time-consuming and costly. New, automated solutions are needed to collect traffic sign data and manage signs in a timely and cost-effective manner. To develop those solutions, this study is creating a traffic sign data collection system from open street images, an algorithm for detecting and recognizing traffic signs in those images, and an expandable sample inventory of traffic sign data for a designated region in Washington. The final products will provide an automated solution to reduce manual labor and will significantly contribute to traffic sign asset management. Read more…

Technology Transfer

WSDOT zero-emissions vehicle course development

Research team: Don MacKenzie (UW) | Sayma Rahman (WSDOT) | Jon Peterson (WSDOT)
Sponsor: WSDOT

Ongoing: This project will develop four, one-credit courses on zero-emissions vehicles and associated infrastructure specifically designed to meet the training needs of WSDOT personnel. The four courses will cover the topics of transit decarbonization, electric buses and charging, meeting the power needs for electric vehicle charging stations, and hydrogen vehicles and infrastructure. When completed, each online course will entail 30 to 40 hours of largely self-directed learner effort, spread over four to five modules. Read more…

Transportation Planning

King County Metro support for ORCA data analysis improvements

Research team: Mark Hallenbeck (UW) | Melissa Gaughan (King County Metro)
Sponsor: King County Metro

Ongoing: Analysis of electronic transit farecard data can provide insight into how travelers use the system and how their behavior changes as both the urban environment and transit services change over time. The Next Generation One Regional Card for All (ORCA) effort includes the development and deployment of a database system called DARe (Data Access and Reporting), which is being used to collect, manage, and store data on the use of ORCA cards and accounts. However, to date transit agency analysts have not fully taken advantage of its reporting function. The UW has an ORCA data reporting system that currently houses data from January 2019 through May 2022. This project is funding continued improvements to the UW system. Read more…

Webinar Wednesdays

WSDOT's Research & Library Services Office hosts *Webinar Wednesdays*, a series of one-hour webinars that encourage implementation and foster innovation. Each webinar showcases a research project presented directly by the experts and whose results could eventually be implemented statewide.

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 webinars:

Tidal fish passage and estuarine habitat connectivity (June)

Access the recording

Presenters: Padraic Smith and Doris Small, Washington State Department of Fish and Wildlife

Improving fish access to estuarine and coastal ecosystems will be one of the most effective investments for the protection and recovery of Pacific salmon species. In tidal settings with flow direction reversing each tidal cycle, salmon may pass through structures such as culverts, bridges, and tide gates in both directions and over many tidal cycles. However, the criteria for fish passage were developed primarily for river systems, so current protocols for fish passage barrier assessment have limited utility in estuarine areas. In 2019-2021, PIT-tagged juvenile Chinook and coho salmon were tracked at four estuarine sites in Puget Sound, Washington, to understand directional fish movements related to tidal cycles. The knowledge gained will assist engineers in developing technical guidance for tidal water crossing structures.

Environmental DNA: From knowledge to action for management (May)

Access the recording

Presenter: Dr. Ryan Kelly, University of Washington School of Marine and Environmental Affairs

Information requirements for environmental impact assessments vary by jurisdiction, but nearly all require an analysis of the biological elements of affected ecosystems. Amplicon-sequencing—also called metabarcoding—of environmental DNA (eDNA) has made it possible to sample and amplify the genetic material of many species present in those environments, providing a tractable, powerful, and increasingly common way of conducting environmental impact analysis. This webinar discusses analysis of a 20-month time-series of water samples taken before, during, and after two culvert replacement projects by WSDOT under the Fish Passage program and use of eDNA to monitor four salmonid species throughout the interventions.

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.

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