

Transportation Research



“Research plays a key role in keeping WSDOT efficient by developing and testing innovative approaches in all aspects of our work. Research has helped inform the *Moving Washington* initiative through studies on the causes of congestion, safety, signal timing, tolling strategies, rapid construction, construction timing, and strategies to support use of HOV/HOT lanes, and transit. Research results are also helping develop a sustainable transportation system by improving the life-cycle of our roadways and minimizing the impact of our work on the environment. Through research, we are able to look toward the future and prepare for changes in transportation management.”

— Jerry Lenzi, Chief Engineer
Assistant Secretary of Engineering and Regional Operations, WSDOT



Transportation research addresses specific problems and questions that improve the agency’s ability to deliver transportation projects and operate a safe and efficient transportation system.

strategies that promote transportation efficiency.

“The Research Office made valuable contributions to WSDOT’s climate change work over the past year by helping WSDOT meet the requirements for reducing green house gas emissions.”

—Anne Criss, Climate Change Team Lead, WSDOT, Public Transportation Office

We Do Research That Seizes Opportunities

We also partner with other organizations to conduct research. This collaboration leverages ten dollars of research for every dollar that WSDOT contributes.

Partners in Research

Transportation Research Board (TRB)

TRB is a division of the National Research Council, - the principal operating agency of the National Academies. WSDOT participates in TRB technical committees, project and advisory panels, expert task groups, and policy study panels to influence the selection and conduct of national research projects to best meet our needs.

Washington State Transportation Center (TRAC)

TRAC is a cooperative transportation research partnership of the Washington State University (WSU), the University of Washington (UW), and the Washington State Department of Transportation (WSDOT). TRAC coordinates both state and commercial transportation research efforts and develops national research opportunities and quickly responds to research needs.

Transportation Northwest (TransNow)

TransNow, led by the University of Washington, is a Regional University Transportation Center (UTC), fostering cooperative transportation research and education. Through our partnership we are able to leverage research funding to quickly achieve results and also foster a transportation workforce.

Border Policy Research Institute (BPRI)

The BPRI is a multi-disciplinary research institute at Western Washington University with a focus on policy research related to

the Canada-U.S. border. Research priorities include trade and transportation, economics, environment, immigration and border security.

Region X Transportation Consortium

The Region X Transportation Consortium brings together four state departments of transportation and four university transportation centers (UTCs) in the states of Washington, Alaska, Idaho, and Oregon. The purpose of the consortium is to facilitate collaboration on transportation research and education projects of mutual interest.

Federal and State Agencies

WSDOT frequently partners with the Federal Highway Administration and other state DOTs to conduct research on specific projects and to improve knowledge transfer on specific topics.

“The Washington State Department of Transportation has a well deserved reputation as an innovative organization that is willing to make changes to improve the way it does business. WSDOT’s active research program leverages its resources through participation in national programs and research partnerships.”

— Robert Skinner, Executive Director, Transportation Research Board, National Research Council

What We Do

Research Office Functions:

- Fund Research Activities
- Direct and Manage Research Activities
- Manage Student Studies
- Assist with Research Study Design
- Contract with Universities
- Market Agency Research
- Support Implementation of Research
- Develop Synthesis Reports
- Conduct Simple Surveys
- Connect Staff to Past and Ongoing Research

Who Uses Research

Office	% of expenditures	RAC's*
Planning	0.1	MMT
Urban Planning	2.2	
Community Design	1.7	
Ferries	9.9	
Freight	13.1	
Public Transportation	3.5	I&F
Geo Services	2.2	
Data Office	0.2	
Communications	0.2	Ops
Traffic	22.5	
Maintenance	4.4	
Bridge	4.9	PD
Construction	1.7	
Design	7.4	
Environmental	6.1	
Real Estate	0.3	
Materials	20.2	

The chart includes projects funded by the Research Office and by other WSDOT partners.

*Research Advisory Committees (RAC's): WSDOT committees that provide input to the research program on needs and priorities and promote results.

MMT= Multimodal Transportation
I & F= Information and Finance
Ops = Operations
PD = Project Delivery

For more information contact:

Leni Oman

Director, Office of Research & Library Services

Washington State Department of Transportation

360-705-7974

OmanL@wsdot.wa.gov

Research Office Website:

<http://www.wsdot.wa.gov/Research/>

Americans with Disabilities Act (ADA) Information: Materials can be provided in alternative formats: large print, Braille, cassette tape, or on computer disk for people with disabilities by calling the Office of Equal Opportunity (OEO) at (360) 705-7097. Persons who are deaf or hard of hearing may contact OEO through the Washington Relay Service at 7-1-1.

Title VI Statement to Public: It is the Washington State Department of Transportation's (WSDOT) policy to assure that no person shall, on the grounds of race, color, national origin and sex, as provided by Title VI of the Civil Rights Act of 1964, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its federally funded programs and activities. Any person who believes his/her Title VI protection has been violated, may file a complaint with WSDOT's Office of Equal Opportunity (OEO). For Title VI complaint forms and advice, please contact OEO's Title VI Coordinator at (360) 705-7098.

We Do Research That Solves Problems

The WSDOT research program helps achieve the state's strategic goals for transportation. Each biennium we manage approximately 100 contracts totaling \$10 million from federal, state and local government funding sources.

"The WSDOT Research Office has been a great help to our transportation pooled fund study which will provide measurable results and enhance the efficiency of our program."

—Charlotte Claybrooke, WSDOT, Safe Routes to School Coordinator, Highways and Local Programs

Safety

Safety research projects address design features, seismic stability, crash testing of barriers, analysis and treatment of pedestrian and bicycle accidents and wildlife hazards, work zone safety, and evaluation of system performance. Recent examples are:

A New Approach for Two-Lane Rural Highway Safety



In Washington State, rural two-lane highways experience a disproportionate number of serious injury and fatal collisions. Research has identified a multidisciplinary approach that allows design engineers to consider the surrounding environment and other conditions that might influence the occurrence of a collision. This information will be used to identify safety improvement projects on two-lane, rural highway projects that might not otherwise have been identified.

"WSDOT's status as a proactive agency is due in part to the contribution of research. The Research Office has assisted the Design Office in efforts to reduce serious and fatal collisions. Recent research has provided insight into factors associated with the frequency and severity of collisions on rural two-lane highways. That project produced a countermeasure decision matrix that points designers toward solutions that have proven to be effective."

—Pasco Bakotich, WSDOT, State Design Engineer

Seismic Assessment and Retrofit of WSDOT Bridges



WSDOT has developed a seismic retrofit program for its bridges. While many bridges have been retrofit, there are types of bridges that have not yet been addressed and include multiple column bents and precast/prestressed hollow core concrete piles. A structural analysis is underway to evaluate the seismic vulnerability of these types of bridges and to evaluate potential retrofit techniques.

Preservation

Research on preservation evaluates topics such as corrosion of materials from deicers, lifecycle analysis of pavements, testing of new materials and methods to improve performance. Recent examples are:

Long-Term Corrosion Impacts for Highway Snow and Ice Control Chemicals



Snow and ice control operations are essential to maintain roadway safety, mobility and productivity by providing safe driving surfaces in the winter season. As a result of anti-icing and deicing salt applications, chloride ingress is one of the major forms of environmental attack on concrete pavements and bridges. Chloride ingress can lead to the corrosion of the embedded steel and dowel bars and a subsequent reduction in the strength and serviceability of the concrete. These corrosive effects can result in detrimental impacts to the thousands of miles of roadway and bridges where deicers are used. This research is examining the effects of these chemicals on our concretes, embedded steel, and dowel bars.

Bituminous Surface Treatment Protocol



With constrained budgets and the increased cost of paving materials, a fundamental issue is how to best allocate the available funding for preservation projects. Since there is a significant annualized cost difference between bituminous surface treatment (BST) and hot mix asphalt (HMA) resurfacings, this research examined the expanded use of BSTs on selected routes with high levels of traffic. The study also examined effects of alternating BST and HMA overlays and effects of BST use on system performance. The result was a modification to the traffic level and a change in WSDOT's specifications.

Mobility (Congestion Relief)

Mobility research investigates causes of congestion and methods to minimize those causes, improvements in intelligent transportation system data collection and delivery of that information to users, and factors that address transportation demand management. Recent examples are:

A Self-Adaptive Toll Rate Algorithm for High Occupancy Toll (HOT) Lane Operations



The WSDOT Research Office and Transportation Northwest (TransNow) jointly funded research to develop a self-adaptive toll rate calculation method based on real-time measurements to maximize the efficiency of our tolling operations. A simulation model implementing the new method is underway using traffic volume and roadway geometric data from the State Route-167 HOT lane project. The objective of this research is to reach HOT lane control targets quickly and

effectively for various traffic flow conditions to keep traffic moving smoothly.

"WSDOT is one of the national leaders in the use of advanced traffic management strategies and continues to develop smarter highway systems that are making our highways more efficient, less congested, and safer for all. Research helps us stay on the cutting edge by improving our understanding of system dynamics and developing methods to use our system with increasing efficiency."

—Ted Trepanier, WSDOT, Co-Director Maintenance and Operations, State Traffic Engineer

Storm-Related Closures of I-5 and I-90: Freight Transportation Economic Impact Assessment Report Winter 2007-08



WSDOT staff and WSU researchers designed and developed a new economic assessment methodology to provide a comprehensive analysis of the effects of the I-5 and I-90 closures on the state's freight industry and the economy. The total loss due to the two corridor closures is conservatively estimated at almost \$75 million. This information helps us understand needs and priorities.

"We developed new methodology to accurately estimate the economic impacts of freight system disruptions after the I-5 and I-90 closures in the winter of 2007-08, and the Research Office's quick response funds and expertise were invaluable. It wouldn't have happened without them."

—Barbara Ivanov, WSDOT, Freight Systems Director

Environment

Research on environmental issues associated with transportation include evaluation impacts and mitigation strategies for stormwater, habitat connectivity, wetlands, species, air quality, fish passage and climate change. Recent examples are:

Pile Driving Underwater Sound Impacts

This research is to understand the impact of underwater sound and the energy generated from driving large steel piles on salmonids, other fish species, marine mammals and



diving sea birds. Recent studies indicate the impact of sound is heavily influenced by the hammer operator's procedures. WSDOT is testing various operational procedures to reduce noise levels and possible harmful impacts. Very little information exists to help WSDOT and regulatory agencies accurately predict impact levels and to determine methods to avoid or reduce impacts.

Environmental Investigation of Heavy Metals in Highway Runoff

Stormwater runoff from highways is a growing concern. The Federal Highway Administration currently identifies cadmium, chromium, copper, iron, lead, nickel, and zinc as the heavy metals typically associated with highway stormwater runoff. The U. S. Environmental Protection Agency states that the primary sources of these metals are wear and tear of various vehicle components as tires, engine parts, and brake pads; auto body rusting lubricants; and fuel consumption. Although attempts to simply relate highway stormwater runoff to average daily traffic (ADT) loads are considered, and the complex relationship between metals in highway stormwater runoff and levels of traffic is proven, simply treating stormwater runoff from roads with high ADT is not the answer. This research helped develop methodologies for testing highway stormwater runoff for metals so that we find appropriate treatments to protect any receiving bodies of water.



Stewardship

Stewardship research covers many topics including information management, data collection methods, contracting procedures, revenue analysis, right of way estimation, and more. Recent examples are:

Precast Systems for Rapid Construction of Bridges



Bridge construction can dramatically increase traffic delays and congestion, particularly in urban areas with heavy traffic volumes. Traffic disruption could be reduced significantly if reinforced concrete columns and cross-beams could be precast off site, and then rapidly assembled together at the bridge site. Such systems have been used successfully in states with low seismic activity, but these systems are not suitable for the level of seismicity in western Washington. To take advantage of the benefits of precast components in bridges in Washington State, this research developed systems that can be constructed quickly and that will have good seismic performance.

Transportation Synthesis Reports

Transportation Synthesis Reports (TSRs) are brief summaries of currently available information on topics of interest to WSDOT staff. Online and print sources may include newspaper and periodical articles and research project reports as well as information about the practices of other state agencies. State of the practice information may include surveys of other state DOTs. Examples of recent synthesis reports include:

Transportation's Link to the Economy: Synthesis

This synthesis documents the link between transportation and the economy. Highways, roads, and public transportation systems contribute to virtually everything of value in our economy and lives. The studies show that state and national investments in transportation have measurable benefits to the economy.

Transportation and Climate Change and Vehicle Miles Travelled Reduction: Synthesis

This synthesis includes information on state DOT policies, targets, and measures for climate change, specifically those involving VMT reduction. Many states are in the process of developing or implementing climate action plans, which may recommend policies for DOTs. The research indicates legislation to reduce emissions is on the increase, as well as land-use planning