



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

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## Background

The earthquake performance of bridges is critical to the post-event mobility of nearly all transportation modes, including bicycle, automobile, truck, bus, and rail. Damage to bridges near critical facilities, such as airports and ports, can also limit the contributions of these facilities to

the post-event mobility of people and freight. Accordingly, local, state, and federal engineers and emergency managers need reliable estimates of post-event bridge functionality in order to plan pre-event mitigation, post-event response and mobility, and long-term recovery. The goal of this project is to predict the post-earthquake functionality of bridges in Oregon and Washington following a Cascadia Subduction Zone (CSZ) Magnitude-9.0 earthquake. The project will also evaluate the likelihood that key highway lifeline corridors will be available to support post-earthquake mobility.

Improved estimates of post-earthquake bridge vulnerability and lifeline mobility are complex, because: (1) western Oregon and Washington have more than 10,000 bridges that could be damaged; (2) these bridges are located on a wide range of site conditions; and (3) ground motions have never been recorded for an M9 earthquake in the Pacific Northwest (PNW). An overview of the research approach, including seven work tasks, as well as the databases that will be used to complete each task, is provided in the image below.

## Research Project

Key outputs from this project will be (1) a database of bridge performance metrics for 100,000 simulated cases of bridge and intensity measure; (2) improved bridge fragility relationships for PNW retrofitted and non-retrofitted bridges; (3) a model for predicting subsurface Vs-depth profiles in the PNW; (4) assessment of post-earthquake functionality of approximately 10,000 PNW bridges following an M9 CSZ earthquake; and (5) regional assessment of network mobility, wherein the likelihood of post-event route serviceability is quantified probabilistically. The Item (5) output will be in the form of maps that show probabilistic bridge functionality and re-opening times following CSZ earthquakes. These maps will enable WSDOT and ODOT to make informed decisions on post-earthquake emergency planning routes.

## ABOUT THE AUTHORS

The research team consisted of Christopher Motter and Adam Phillips of Washington State University, and Marc Eberhard, Jeffrey Berman, and Brett Maurer of the University of Washington.

## ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the Washington State Department of Transportation.

## EXPECTED DATE OF COMPLETION

August 2022

## FOR MORE INFORMATION

<http://depts.washington.edu/pactrans/research/projects/data-driven-assessment-of-post-earthquake-bridge-functionality-and-regional-mobility/>

