



**TriDurLE**

**National Center for Transportation  
Infrastructure Durability & Life-Extension**

UTC Project Information – National UTC TriDurLE	
Project Title	Life-Cycle Seismic Resilience Assessment of Reinforced Concrete Bridges in Aggressive Environments
University	Washington State University
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Funding Source(s) and Amount Provided (by each agency or organization)	TriDurLE: \$90,195 WSDOT in-kind match: \$90,195
Total Project Cost	\$190,390 (including cost share)
Agency ID or Contract Number	
Start and End Dates	October 1, 2023 to September 30, 2024 (tentative)
Brief Description of Research Project	Reinforced concrete (RC) bridges in seismic-prone areas may experience multiple earthquakes during their service periods. The exposure of RC bridges in aggressive environments can exacerbate structural deteriorations and reduce their capacity to withstand seismic events. In the meantime, structural damages due to earthquakes may increase the exposure of reinforced steel to aggressive environments and expedite the chloride-induced corrosion processes. Thus, a comprehensive understanding of the interactions of the effects of corrosion and seismic events on structural deterioration is very important to provide a realistic assessment of bridge life-cycle resilience. However, most existing studies have mainly estimated the effect of corrosion-induced deterioration on structural capacity against hazards. While it is really necessary, the impacts of structural damages following earthquakes on the time-dependent corrosion processes have not been investigated in any depth. Moreover, small magnitude earthquakes with high-probability may continuously affect the processes of deterioration for RC bridges, which has been ignored in existing studies. In this context, this project contributes to filling the research gaps by proposing a comprehensive interdisciplinary framework that combines the structural damages due to seismic events and the

	<p>exposure to non-uniform corrosion for RC bridges. First, the probability seismic hazard analysis (PSHA) is utilized to generate a stochastic set of seismic events with multiple levels of magnitudes and the ground motions at the bridge location of interest. Then, the time-dependent bridge deterioration model is developed by incorporating the interaction of the effects of corrosion and seismic event on structural behaviors, and subsequently used for the assessment of life-cycle resilience. Finally, a RC bridge in Seattle, WA is applied as the case study to illustrate this proposed framework. By doing so, the proposed framework can provide a more realistic resilience assessment for RC bridges under the combined effects of corrosion and seismic event, which can help bridge managers to determine effective resilience-enhancing strategies in long-term development planning.</p>
<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<p>This project contributes to filling the research gaps by providing a realistic estimation of life-cycle resilience for RC bridges with incorporating the interaction of the effects of corrosion and earthquake on structural behaviors as well as uncertainties. In addition to the large magnitude seismic events, this project considers the impacts of small magnitude earthquakes on the corrosion process of RC bridges, which is always ignored in existing studies. By doing so, this study can provide bridge managers with guidance on the change in the long-term performance of RC bridges due to corrosion and earthquake, which is important to determine the effective strategies to enhance structural resilience in risk management planning.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>Project is in progress.</p>
<p>Web links</p> <ul style="list-style-type: none"> <li>• Reports</li> <li>• Project website</li> </ul>	<p>Project is in progress.</p>