

<b>UTC Project Information</b>	
Project Title	Developing of Surface-Mounted Smart Piezoelectric Modules for Bridge Damage Identification and Safety Monitoring
University	Washington State University
Principal Investigator	Pizhong Qiao
PI Contact Information	qiao@wsu.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	University of Washington PacTrans \$40,000 Washington State University \$40,000
Total Project Cost	\$80,000
Agency ID or Contract Number	DTRT13-G-UTC40
Start and End Dates	December 16, 2016 – January 31, 2018
Brief Description of Research Project	The objective of the proposed study is to develop an effective non-destructive ultrasonic smart piezoelectric module (SPM) to be used for identifying the damage and condition (cracks, material degradation, etc.) in highway bridges. Such a smart sensing technology can be used to identify damage in bridge structures, monitor safety conditions, assist bridge maintenance decision-making, help state DOTs perform forensic studies on the bridge premature failure, and meet the PacTrans theme of “ <u>developing data driven solutions and decision-making for safe transport</u> ”.

<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<ul style="list-style-type: none"> <li>- An effort was made to implement the developed smart piezoelectric module (SPM) system in material property assessment and durability monitoring of concrete, including ultra high performance concrete (UHPC) (see Photos below of SPM and their embedment in UHPC) and shotcrete, in the projects funded by WSDOT and the Center for Environmentally Sustainable Transportation in Cold Climates (CESTICC).</li> </ul> <div data-bbox="716 474 1263 705" data-label="Image"> </div> <p>Fabrication process of smart piezoelectric module (SPM)</p> <div data-bbox="712 789 1287 968" data-label="Image"> </div> <p>UPHC specimen with embedded smart piezoelectric module (SPM)</p>
<p>Impacts/Benefits of Implementation (actual, or anticipated)</p>	<ul style="list-style-type: none"> <li>- UHPC has been applied in construction of bridge deck connections (as by WSDOT) to improve durability and fatigue resistance of connection. Monitoring durability and aging of UHPC connection is critical. The proposed SPM system has demonstrated its capability in monitoring material property change of UHPC over accelerated freeze-thaw process, and it benefits life cycle assessment of civil infrastructure.</li> <li>- The SPM system also has the potential to in situ and real time assess and monitor the condition of concrete structures, and it anticipate that it will be implemented in the ongoing shotcrete substrate interface study by WSDOT (2019-2021).</li> </ul>
<p>Web Links</p> <ul style="list-style-type: none"> <li>• Reports</li> <li>• Project Website</li> </ul>	<ul style="list-style-type: none"> <li>- Zhou ZD and Qiao PZ (2018). "Durability of ultra-high performance concrete in tension under cold weather conditions," Cement and Concrete Composites, 94: 94-106. <a href="http://dx.doi.org/10.1016/j.cemconcomp.2018.08.019">http://dx.doi.org/10.1016/j.cemconcomp.2018.08.019</a> (demonstrating implementation of SPM in durability assessment of UHPC).</li> </ul>