TriDurLE

National Center for Transportation Infrastructure Durability & Life-Extension

UTC Project Information – National UTC TriDurLE	
Project Title	Fiber Reinforced Polymer (FRP) Seismic Retrofit of Reinforced Concrete Bridge Columns Vulnerable to Long-Duration Subduction Zone Earthquakes
University	Washington State University
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Funding Source(s) and Amount Provided (by each agency or organization)	UTC: $75,000 Washington Department of Transportation (WSDOT): $75,000 Simpson Strong Tie (SST): $18,000
Total Project Cost	$168,000
Agency ID or Contract Number	
Start and End Dates	May 1, 2020 through August 30, 2021
Brief Description of Research Project	Many bridges in the western United States, including those built for the Interstate Highway System in the 1950s and 1960s, have seismically vulnerable reinforced concrete (RC) columns. The seismic performance of many of these bridges is essential to post-earthquake mobility, as bridges are relied upon as critical lifelines into urban centers after natural disasters. Some states, including California and Washington, have introduced retrofit programs to enhance the seismic ductility of vulnerable columns. The retrofit involves wrapping the column with either a structural steel or fiber reinforced polymer (FRP) jacket, which enhances the deformation capacity of the column to improve the seismic performance. Previous research on jacketed columns has focused on strike-slip earthquakes, rather than long-duration, subduction-type earthquakes. Long duration earthquakes are characteristic of the Cascadia Subduction Zone, which has the potential to generate a

	Magnitude-9.0 earthquake with strong shaking in Washington, Oregon, northern California, and Alaska. The objective of this research is to characterize the behavior of FRP jacketed bridge columns under long-duration earthquakes and formulate recommendations for column retrofit implementation. This research will build upon current research being conducted by the PIs on the behavior of steel jacket retrofitted columns under long-duration earthquakes. Although steel jackets have been used in locations in the northwest U.S. (e.g., Washington), it is anticipated that FRP jackets will provide better seismic performance than steel jackets under long-duration earthquakes. The improved seismic performance, characterized by enhanced ductility, is the result of the bi-directional properties of the FRP, which allow better spread of controlled plasticity in the jacketed region. The proposed research includes the formulation of a model to predict the deformation capacity of FRP jacketed columns, with validation/calibration of the model using large-scale testing to address the lack of test data for FRP-jacketed columns under long-duration earthquake demands.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The deformation capacity model that will be developed in this project is a useful tool that can be used to determine whether a FRP-jacketed bridge column is expected to fail under a given earthquake ground motion. The model can be used by national and state department of transportations to aid in the design of cost-efficient column retrofits. The availability of this tool is expected to promote implementation of column retrofits into practice, which can improve the service life of bridges by addressing seismic vulnerability.
Impacts/Benefits of Implementation (actual, not anticipated)	The implementation of bridge column retrofits into practice is expected to improve public safety by reducing the seismic vulnerability of bridges. Bridges are critical lifelines in and out of urban centers in the aftermath of an earthquake, and implementation of bridge column retrofits will improve post-earthquake response and recovery.
Web links • Reports • Project website	