UTC Project Information	
Project Title	New Seismic-Resisting Connections for Concrete-Filled Tube Components In High-Speed Rail Systems
University	UW
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Funding Source(s) and Amounts Provided (by each agency or organization)	ABC-UTC funding: $70,000 Match funded by PEER: $35,000
Total Project Cost	$105,000
Agency ID or Contract Number	Accelerated Bridge Construction University Transportation Center (ABC-UTC) 69A3551747121
Start and End Dates	(January 2018- January 2020)
Brief Description of Research Project	In seismic design of transportation structures there are several competing demands that must be met: high strength and stiffness, large ductility, damage resistance and efficient construction. Prior research at the University of Washington (UW) demonstrates that concrete-filled tubes (CFTs) can meet these competing demands. For a given diameter, CFTs have larger strength and stiffness than an RC component. Testing of CFT connections demonstrates their ductility, with drift capacities larger than 8%. When used with precast components, CFTs facilitates accelerated bridge construction (ABC). This research builds on the prior CFT research to develop connections specific for use in structural systems for high-speed rail (HSR). While the Florida International University (FIU) study focuses on the column-to-cap connection, this study will investigate a new, untested direct column-to-pile connection. This connection is critical to the structural performance and cost of the system, but few studies have focused on it, in particular for ABC. This study will advance design and construction of pile connections for HSR. The research will investigate the connection and HSR system response using advanced, nonlinear analysis methods. A thorough literature review will identify types of connections and document their structural response; the UW team will work with the HSR team to identify one or more connections for further study. Using high-resolution finite element modeling, salient parameters of selected connections, including materials, geometry, and soil-structure interaction, will be studied. Those results will be used to develop spring and line-element nonlinear models

	of the components and connections as a function of the important connection parameters. The final research task will investigate the seismic response of a prototype HSR CFT system using these nonlinear models. Connection design details, seismic performance objectives, seismic hazard levels, and soils will be varied to study their impact. The results will provide important initial guidelines for the connection design and seismic performance which will found a future experimental research study to validate the work. The overall goals of the proposed research are to investigate CFT connections and other column-to-pile connections including the seismic response and resilience, including damage, of selected CFT connections using high-resolution finite element analyses. Longer term work (beyond Cycle 1) will focus on investigation of a high-speed rail (HSR) system for study (to be selected in collaboration with the CA HSR technical team) through a limited structural analysis simulation using line-element nonlinear modeling methods to investigate the impact of salient parameters on the response including (1) connection type, (2) soil structure interaction and (3) seismic hazard level.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The outcomes will be tracked and reported once they are identified.
Impacts/Benefits of Implementation (actual, not anticipated)	The impacts will be tracked and reported once they are identified.
Web Links • Reports • Project website	https://abc-utc.fiu.edu/research-projects/uw-research-projects/new-sesimic-resisting-connections-or-concrete-filled-tube-components-in-high-speed-rail-systems/