Innovation in Seismic Evaluation and Design of Bridge Columns w/ Advanced Materials

M. Saiid Saiidi
Professor, Civil & Environmental Engineering
Director, Center for Advanced Technology in Bridges and Infrastructure
University of Nevada, Reno, USA

Standard reinforced concrete bridge columns are designed to dissipate earthquake energy through yielding of reinforcing steel and spalling of concrete that collectively cause large plastic deformations in columns. Even though bridge collapse is prevented using current design specifications, excessive plastic hinge damage and large post-earthquake permanent lateral deformations may cause decommissioning of bridges for repair or replacement. A new paradigm is emerging among bridge owners, requiring that bridges remain functional with minimal interruption of the traffic flow after earthquakes. To materialize this paradigm, advanced materials that make bridge columns resilient must be explored. Despite the superior performance of columns with advanced materials reported in the literature, design guidelines are not addressed in the current seismic bridge design specifications. A recent project funded by the US National Cooperative Highway Research Program directed by the author has addressed this important gap. The presentation will discuss shake table studies of innovative columns, the proposed AASHTO (American Association of State Highway and Transportation Officials) guidelines for the evaluation of innovative resilient bridge columns, and the design and construction concepts for innovative columns utilizing post-tensioning, shape memory alloy (SMA), engineered cementitious composite (ECC), elastomeric pads, and fiber-reinforced polymer (FRP) in addition to the associated analytical techniques.