M Shahria Alam, J Civil Environ Eng 2017, 7:5 (Suppl)
DOI: 10.4172/2165-784X-C1-010




# M Shahria Alam

*The University of British Columbia, Kelowna, Canada*


## Shape memory alloy (SMA) based smart bracing system for improving the seismic performance of steel structures

Buildings with traditional structural systems experience large residual deformation after a large magnitude earthquake, and often lose serviceability and need to be demolished incurring huge economic losses. In order to resolve this issue, various smart structural systems have been developed by researchers. One such system is the novel piston based self-centering bracing (PBSC) system. This study investigates the cyclic performance of this bracing system to determine its load-deformation response during seismic events. This newly developed bracing system utilizes Nickel Titanium (NiTinol) based shape memory alloy (SMA) bars inside a sleeve-piston assembly for its self-centering mechanism. During cyclic tension-compression loading, the bars are pulled from opposite directions in order to avoid compressive loading on the bars. The energy dissipation is achieved through nonlinear load deformation hysteresis. Furthermore, the PBSC bracing system is designed to be fully buckling restrained. The system exhibits flag shaped force deformation hysteresis. A novel hysteresis model is proposed from the simulated hysteresis response of the PBSC bracing system. This hysteresis model is implemented in a commercial structural analysis and design software called S-FRAME. Then the seismic performance of braced frames equipped with such PBSC bracing system has been evaluated. First, overstrength and force reduction factors are determined using FEMA P695 methodology. Using these factors, PBSC braced frames are designed and their seismic performance is evaluated in terms of inter-story drift responses and also compared against buckling restrained braced frames using fragility function. Finally, this research presents a step by step design methodology for the PBSC bracing system.

### Biography

M Shahria Alam is an Associate Professor in the School of Engineering at The University of British Columbia's Okanagan campus. He received his PhD in Civil Engineering from Western University in 2008. His research interests include smart materials and their structural applications in bridges and buildings; seismic isolation devices, seismic rehabilitation of structures; performance-based design; recycle/reuse of industrial wastes. He is the Vice-Chair of the Engineering Mechanics and Materials Division of Canadian Society for Civil Engineering (CSCE). He has published more than 150 peer reviewed articles. He is also the recipient of many national and international awards including CSCE Pratley Award 2015 and UBC Moldovan Memorial Award 2014.

alamgroup.research@gmail.com

**Notes:**