

# Seismic Protection of Highway Bridges Using Performance Based Design and Optimization

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Seismic protective devices, such as isolation and energy dissipation devices, have demonstrated great promise for seismic hazard mitigation of highway bridges. Their application has been slowed by two major challenges: (1) a comprehensive evaluation is required to assess the seismic performance of highway bridges that are equipped with protective devices, including consideration of the uncertainties inherent in ground motions and damage states of multiple critical components (e.g. columns and isolation bearings); (2) an effective design procedure that is able to consider nonlinearities in structures and protective devices, a wide choice of mechanical parameters for isolation devices, and conflicting responses of isolation bearings and piers is required to achieve the optimal design parameters of the protective devices. This presentation will summarize the research developments to facilitate the performance-based design and optimization of seismic protective devices. Through fragility functions, multi-objective optimization and the system-level performance index of repair cost ratio, a performance-based framework is developed to evaluate the effectiveness and optimal design of protective devices for seismic protection of bridges.

**Jian Zhang** is currently an associate professor in the department of Civil and Environmental Engineering at UCLA. She obtained her MSc and PhD degree from the University of California, Berkeley in 1997 and 2012 respectively. Her research interests include earthquake engineering, structure dynamics and mechanics, with an emphasis on the modeling, analysis and protection of structural systems under seismic excitations. She is the Chair of the ASCE/SEI committee on Structural Control and Sensing, Chair of the ASCE/SEI committee on Performance-Based Design of Structures, and an Associate Editor for the Journal of Bridge Engineering, ASCE. She was previously on the faculty at the University of Illinois, Urbana-Champaign.