Utilizing a novel steel rocking pier systemfor enhancing the seismic performance of bridges

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ABSTRACT: Past studies in the last few decades have shown that reinforced and precast concrete self-centering bridge piers can help achieve superior seismic response for bridge structures. Such self-centering systems have been adopted for the construction of new bridge structures in New Zealand and the US. A joint research project has been recently initiated at the University of British Columbia and École Polytechnique of Montreal to investigate the use ofan alternative rocking tubular steel bridge pier solution for the seismic protection of bridge structures. Details of the proposed system will be introduced and described in this keynote presentation. Results from detailed finite element analyses of the rocking response of the pier will be presented. The influence of the diameter-to-thickness ratio of the tube, end plate dimensions, and supplemental energy dissipating devices on the hysteretic response of the rocking column will be discussed. The lateral cyclic behaviorwill also be described by examining results from quasi-static tests performed on scaled specimens. Sources of degradation such astube local buckling and cyclic loss of prestressing forces will be investigated. The cyclicaxial response of buckling-restrained yielding energy dissipators used at the rocking interface will also be discussed. The presentation will also include results from nonlinear time history analyses conducted on bridge structures with steel rocking piers to examine their overall seismic response and possible effects of rocking induced impacts on the column axial loads and flexural demands on the bridge girders.Inthe end, the developed software to run seismic simulations of such rocking steel bridge piers will be presented.