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THE PERFORMANCE ASSESSMENT OF SEISMICALLY ISOLATED BRIDGES IN NEAR-FAULT REGIONS

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Bridges constitute one of the major components of transportation systems which serve as lifeline of cities. It is essential to maintain the functionality of critical bridges to form resilient societies after moderate-to-severe ground shaking. Seismic isolation of structures is proposed as a mature and innovative technique which can be incorporated for design of new bridges and retrofit of existing bridges. The most accurate estimate of seismic demands of isolated bridge can obtained through nonlinear response history analysis. In this sense, performance evaluation of seismically isolated bridges entails sophisticated analysis for the accurate estimation of seismic demands in near-fault regions. Near-fault ground motions have distinguishing characteristics that are attributed to the faulting mechanism, location of the hypocenter, direction of rupture propagation relative to the location of site. Post-earthquake surveys indicate that observed structural damages within 0-15km from fault rupture are associated with forward-directivity, fling-step effects and severe vertical ground motions. This study investigates the influence of near-fault ground motions on seismically isolated bridges by considering their well-known characteristics. Long period ground motion characterization is assessed for the proper seismic isolation applications for multi-span continuous bridges. Isolation units with a large displacement capacity and sufficient restoring force capacity are elaborately selected to accommodate large displacement demands of selected bridge examples. The critical appraisal is given to the sliding type of isolation systems among the most commonly used isolation devices in bridges. The selected bridge examples are exposed to multi-component earthquake ground motions with pulse content in near-fault regions to address particular problems that might be associated in close proximity to active faults.

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