EFFECTS OF VERTICAL GROUND MOTIONS ON SEISMIC RESPONSE OF HIGHWAY BRIDGES

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ABSTRACT

This paper will present preliminary findings from an ongoing research study that systematically characterizes ground motion parameters and investigates the effects of vertical acceleration on the overall response of typical highway bridges. Nonlinear simulation models of two existing bridges designed to Caltrans specifications is considered in the analytical study. Sixty ground motions with horizontal PGA in excess of 0.5g were selected from the PEER NGA (Next Generation Attenuation) project. The selected ground motions are classified by source mechanism, fault distance, vertical to horizontal acceleration ratios, and other relevant ground motion measures. The simulation models will be subjected to the selected ground motion set in two stages: in the first phase, only horizontal components of the motion will be applied; while in the second phase both horizontal and vertical components will be applied simultaneously. Important response measures will be monitored to gain an insight into the effects of vertical acceleration on the inelastic response of the bridge structures. Concurrent studies are also underway examining spectral characteristics of ground motions before and after the arrival of the S-waves. The Arias Intensity is used as a measure for estimating the arrival time of S-waves. Findings from the study will provide the basis for developing revised guidelines to address vertical ground motion effects in the seismic design of highway bridges.

Key Words
Bridges; near-fault effects; nonlinear analysis; vertical ground motion