The ability to predict the reduction in capacity of a structure after an earthquake is vital in the process of assessing a structure after a main-shock or an after-shock. Main-shocks are normally followed by a few aftershocks in a short period of time. Researchers in the past have focused for the most part on the effects of main-shocks on buildings. Very little research has been performed in the past on the ability to predict the reduction in capacity on bridges for aftershocks. This thesis focuses on providing a way of comparing the reduction in capacity for main-shocks as compared to aftershocks and the effects and importance of both in a bridge.

The reduction in capacity was defined using three different ratios: ultimate force, stiffness, and strain energy. The ratios were computed relative to an undamaged state following both the main-shock scenario and the main-shock combined with aftershock scenario. The probabilistic demand model describing the loss in capacity was formulated by pairing intensity measures, based on real ground motions obtained from previous earthquakes, for the main-shock and aftershock with the capacity ratios, obtained from nonlinear dynamic time history analysis.

The reduction in capacity ratios demonstrates that degradation of the bridges following aftershocks can be mainly attributed to the material and geometric nonlinearities. This paper demonstrates that the usage of strain energy provides a better engineering demand parameter that ultimately improves previous probabilistic demand models from previous studies.

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The public is welcome to attend.