



## Study on the Seismic Design Load Considering Residual Risk

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### Introduction

Recently the concept of performance design has made it common to introduce multi-level seismic design loads so that the given performances with proper reliability are assured. On the contrary, the social requirement to secure safety against ground motions given for specified recurrence periods. However, the current seismic design using the ground motion unfortunately cannot secure the safety against the ground motions greater than specified level, since no consideration is given to these level of ground motions which certainly occur. Authors insist the necessity of introducing the concept of residual risks into seismic design so that this paper examines the seismic design loads considering the residual risks.

### Estimation Residual Risk

Two types of seismic design loads are considered based on the seismic hazard curve; the one called VaR (Value at Risk) is corresponding to the given exceedance probability, and the other called CVaR (Conditional VaR) is corresponding to the centroid of probability distribution greater than VaR. VaRs and CVaRs are calculated for 47 sites in Japan to examine the features of ground motions followed by figures to characterize the seismic hazard of each site.

The risks of buildings using VaRs and CVaRs as design seismic loads are evaluated from the risk curves. In case that uses VaR as design seismic load, the risks scatter largely around the mean value. On the contrary, the scattering of risks remains small when using CVaR. This tendency can lead to the setting procedure of design seismic loads that gives that realize uniform risk.