PRACTICAL APPLICATION OF SEISMIC RISK EVALUATION FOR BUILDINGS

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After the Great Tohoku Earthquake happened on 11 March 2011, there are growing concerns to know seismic risks of buildings whether it is structurally healthy or needed some kind of seismic enhancements for building owners and tenants whose building is located out of the devastated area, such as the Tokyo metropolitan area in Japan. If it is found that the structural capacity of a building is not sufficient structurally, there are usually some options available in order to reduce seismic risks, i.e., seismic retrofitting, reducing some stories of an existing building, or rebuilding. Relocation to the other quake-resistant building can be also an alternative for tenants. However, project costs for those options are generally very expensive in comparison to staying current building. Thus owners/tenants of buildings are reluctant to consider this issue before the Great Tohoku Earthquake in 2011. Because it can be said that seismic risk management issues are not able to solve only by natural sciences, risk evaluations for individual buildings are necessary to understand potential risks and select the best alternative.

In order to evaluate the seismic risk of individual buildings, it is important to evaluate the entire damage process of buildings beginning with the rupture of seismic sources through soil and building response analysis consistently, as well as integrating the up-to-date information for uncertainties of each event. The time-domain response analysis is one of the seamless methods to evaluate the entire damage process of buildings, but it is not a practically adopted method for seismic risk assessment. Because it is required to take into account the staggering amount of possible scenario earthquakes. For the sake of practical and rational use of risk assessment, the author proposed a seamless seismic risk assessment methodology utilizing the capacity spectrum method.

In this session, application of proposed methodology to the existing governmental buildings is introduced as an example. In this study, firstly expected damage states of buildings under the selected scenario earthquakes are evaluated in order to limit to feasible alternatives from the list of every possible alternative. In this process, although no definite values regarding future building damage are shown here, expected damage states and its occurrence probabilities can be help to classify into two groups which is acceptable or not from the point of a local government and citizens. Finally, expected life-cycle costs are compared between feasible alternatives, and those risk assessment results are utilized in the decision-making process, i.e., what is the best option for them and what kind of risks they need to accept at the congressional discussion.