

ABSTRACT

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Title: Effects of aging on seismic performance of Japanese traditional wooden temples

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Abstract

This paper examined seismic performance of Japanese traditional wooden temples in consideration of aging of their members.

First, the strength tests were conducted in order to evaluate strength and embedment properties of old wooden members used in Japanese traditional wooden buildings. As a result, most of old members had similar or larger Young's moduli and strengths comparing to new ones. However, old zelkova and Japanese red pine specimens tended to show brittle failure in the tests. Furthermore, the embedment properties of old Japanese cypress were not changed by aging.

Second, the numerical analyses were conducted to evaluate the effect of aging on the seismic performance of Japanese traditional wooden temples. Push-over analysis of Kiyomizu temple building showed that deterioration of the beam-column joints decreased the load bearing capacity, especially in the E-W direction. The earthquake response analysis was conducted for a numerical model which was assumed internal loss or stiffness and strength change of old structural members due to aging. The results showed that the internal loss which exist column bottoms had minor influence on the seismic performance of Kiyomizu temple building. This paper also showed the method to propose the strengthening parts and time suitable for each building.

Finally, the methods of evaluating internal loss or Young's modulus and yield stress of an actual member of old buildings were established. As a result, electromagnetic radiation test was able to detect 10cm over internal loss. And the result showed that it is possible to evaluate seismic capacity of existing old temples by using embedment tests.