Study on Seismic Performance of Historical Buildings

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1. Outline

In Japan, it is important to protect historical wooden buildings (Fig. 1) from natural disasters such as earthquakes, as well as to repair them periodically for their preservation. In developing countries, historical masonry buildings made of stone or soil are vulnerable to earthquakes, and hence, ensuring their seismic resilience is very important on a global scale. The objective of our research is to develop a method for seismic performance evaluation and seismic reinforcement of historical buildings; this study covers the historical masonry buildings in Bhutan and Nepal (Figs. 2 and 3), where many historical buildings have been severely damaged by a large earthquake recently, and also the historical wooden buildings in Japan.

Fig. 1. Historic Townscape

Fig. 2. Rammed Earth in Bhutan

Fig. 3. Brick Masonry in Nepal

2. Seismic Performance Evaluation of Mud Walls

Mud walls are used as seismic walls in historical wooden buildings in Japan. They consist of wooden frames, lattice substrata made of bamboo, and viscous soil mixed with straw (Fig. 4). Their seismic performance depends on the mechanical characteristics of wall clay, which in turn are considerably influenced by the location or region in Japan or the amount of straw that is mixed in the wall clay. However, the mix proportion of the wall clay or straw is determined based on the plasterer's experience and intuition, and hence it is important to obtain the mechanical characteristics of the wall clay by material tests. In this study, the seismic performance of mud walls is evaluated considering the regional characteristics of the wall clay (Fig. 5).

3. Monitoring System for Historical Buildings

In the seismic diagnosis of historical buildings, it is important to understand the characteristics of building vibrations using seismic measurements. However, such measurements must be conducted nondestructively to prevent damage to the structure, using a wireless acceleration measurement system that can be easily installed (Fig. 6). One of the objectives of this study is to develop a wireless acceleration measurement system that can be easily installed and used in buildings.

Fig. 4. Plaster of Wall Clay

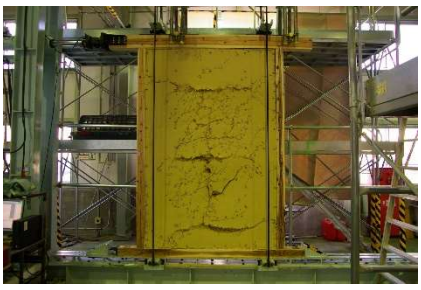

Fig. 5. Static Test for Mud Wall

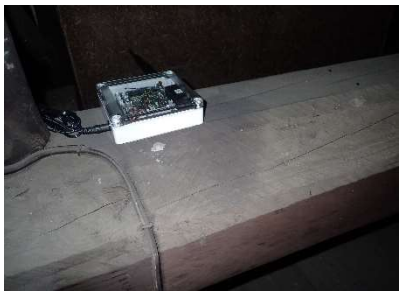

Fig. 6. Installation of Sensor