SHAKING TABLE TEST OF TIMBER MASONRY HOUSE MODELS RETROFITTED BY PP-BAND MESHES

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ABSTRACT

Unreinforced masonry is one of the most popular construction materials in the world. It is also unfortunately, the most vulnerable against earthquakes. Damage to unreinforced masonry buildings has caused huge number of human casualties historically and during recent earthquakes in developing countries. Therefore, retrofitting of low earthquake-resistant masonry structures is the key issue for earthquake disaster mitigation in developing countries to reduce the casualties significantly. When we propose the retrofitting in developing countries, retrofitting method should respond to the structural demand on strength and/or deformability as well as to availability of material with low cost including manufacturing and delivery, practicability of construction method and durability in each region. Considering these issues of developing appropriate seismic retrofitting techniques for masonry buildings to reduce the possible number of casualties due to future earthquakes in developing countries, a technically feasible and economically affordable PP-band (polypropylene bands) retrofitting technique has been developed and many different aspects have been studied by Meguro Laboratory, Institute of Industrial Science, The University of Tokyo. PP-band is commonly used for packing.

In order to understand the dynamic response of masonry houses with and without PP-band mesh retrofitting, crack patterns, failure behavior, and overall effectiveness of the retrofitting technique, shaking table tests were carried out. In this experimental program, ¼ scale single box shape room structure with wooden roof models were used. Addition to that, effect of surface plaster on PP-band retrofitted house model also studied.

From the experimental results, it was found that a scaled dwelling model with PP-band mesh retrofitting was able to withstand larger and more repeatable shaking than that without PP band retrofitting, which all verified to reconfirm high earthquake resistant performance. When surface

finishing applied above house model, due to improve bond connection between PP-band and brick wall, surface plaster kept well with wall.

1. INTRODUCTION

A real scale model test makes possible to obtain data similar to real structures. However, it requires large size testing facilities and large amount research funds, so it is difficult to execute parametric tests by using full scaled models. Recently, structural tests of scaled models become larger and larger as the overall behavior of the system can be understood from scaled model also. In this experimental program ¼ scale models were used to investigate the seismic behavior of masonry houses and effectiveness of PP-band retrofitting technique.

2. EXPERIMENTAL PROGRAM

2.1 Description of the specimens

For shaking table experiment, four models were built in the reduced scale of 1:4 using the unburnt bricks as masonry units and cement, lime and sand (1:2.8:8.5) mixture as mortar with cement/water ratio of 33%. Attention was paid to make the models as true replica of adobe masonry buildings in developing countries in terms of masonry strength even though the construction materials used were those available in Japan.

All the building models dimensions were 933mmx933mmx720mm with 50mm thick walls. The sizes of door and window in opposite walls were 243x485mm^2 and 325x245mm^2 respectively.

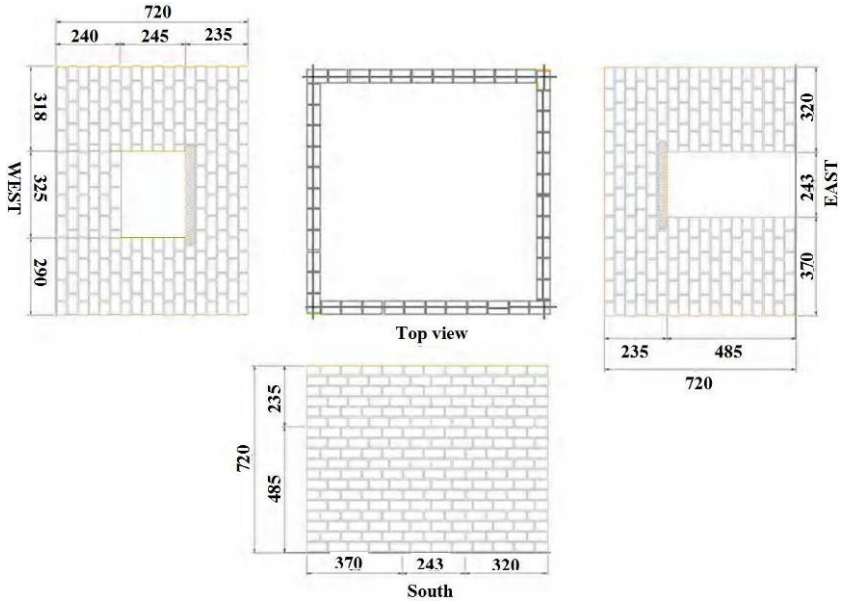

Figure 1: Model dimension (mm)