Shaking Table Test of Two-Story Masonry House Model Retrofitted by PP-band Mesh

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SUMMARY
This paper introduces the results of shaking table tests using 1/4-scale two-story masonry house models with and without retrofitting by PP-band method. The two-story masonry house model used in the study is an ordinary dwelling house in south Asia. Shaking table test was carried out using the sinusoidal input wave of the horizontal one direction. Acceleration and displacement of shaking table and some parts of models were measured. Based on the comparison of dynamic response properties and seismic performance of unreinforced and retrofitted two-story models by PP-band method, it can be concluded that PP-band method can increase a lot seismic capacity of two-story masonry house and retrofitted two-story masonry houses could withstand much stronger ground motions that unreinforced two-story masonry house easily collapsed. From these results, PP-band retrofitting technique proposed can enhance safety of both existing and new two-story masonry buildings and can contribute earthquake disaster in the future.

Keywords: two-story masonry, polypropylene band, shaking table test, arias intensity

1. INTRODUCTION

Unreinforced masonry structure is one of the most popularly used constructions. It is also unfortunately the most vulnerable to the earthquakes. It would collapse within a few seconds during earthquake movement, and does become a major cause of human fatalities. Therefore, retrofitting of low earthquake-resistant masonry structures is the key issue for earthquake disaster mitigation to reduce the casualties significantly. When we propose the retrofitting method in developing countries, retrofitting method should respond to the structural demand on strength and 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, a technically feasible and economically affordable polypropylene band (PP-band which is commonly utilized for packing) retrofitting technique has been developed (Mayorca and Meguro, 2004), and many different aspects have been studied by Meguro Laboratory, Institute of Industrial Science, The University of Tokyo (Sathiparan, 2008).
Single-story masonry house made of a regular shape brick units have been widely studied both from experimental and numerical points of view, and based on previous research results, it was concluded that in single-story houses with timber roofs, PP-band meshes were not demanded to their full capacity. This is because the band itself is very strong. Therefore, it is expected that PP-band meshes can also be efficient to retrofit two-story residential houses. Therefore, the present work aims at increasing the insight about the behavior of the two-story masonry house model under dynamic loading.
A full-scale model test makes possible to obtain data similar to real structures. However, it requires large size testing facilities and large amount of research funds, so it is difficult to execute parametric tests by using the full scaled models. Recently, structural tests of scaled models become well-known as the overall behavior of the system can also be understood from the scaled model. In the experimental program of the study, 1/4-scale models were used to investigate the static and dynamic