Shaking Table Tests on 1/4 Scaled Shapeless Stone Masonry Houses with and without Retrofit by Polypropylene Band Meshes

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SUMMARY
We have developed a technically feasible and economically affordable retrofitting method using Polypropylene band (PP-band) for low earthquake resistant masonry structures in developing countries (Mayorca and Meguro, 2004). And we have done many experimental and numerical researches on the effects of the PP-band method on the dynamic behavior of brick and adobe, unburned clay brick, masonry houses. Results of the material tests and shaking table tests using building models show that the PP-band retrofitting method can enhance safety of both existing and new brick and adobe masonry buildings even in worst case scenario of earthquake ground motion. However, the effects of the method on stone masonry houses, especially made of shapeless stones were not checked well yet.
Therefore, in this study, as an extension of application of PP-band retrofitting method, we have carried out diagonal shear tests and shaking table tests using PP-band retrofitted and non-retrofitted stone masonry models made of shapeless stones. From the results obtained, it can be concluded that stone masonry made of shapeless stones can be retrofitted well with PP-band method and the method can be one of the optimum solutions for promoting safer building construction in developing countries and contribute earthquake disaster mitigation in the future.

Keywords: Stone masonry, masonry structure, polypropylene band, PP-band retrofit, shaking table test, arias intensity

1. INTRODUCTION

Masonry is one of the oldest building materials. In spite of this, the technological development of masonry in earthquake engineering has lagged behind compared to other structural materials like concrete and steel. Therefore, in earthquake prone regions of the world have resulted in a large number of casualties due to the collapse of this type of structures. This is a serious problem for the societies. Apparently, its solution is straight forward: retrofitting the existing structures. When we propose the retrofitting method in developing countries, method should respond to the structural demand on the 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, 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 Polypropylene band (PP-band, commonly used for packing.) retrofitting technique has been developed and many different aspects have been studied by Meguro Laboratory, Institute of Industrial Science, The University of Tokyo.
Masonry walls made of regular shape brick units have been widely studied both from experimental and numerical points of view, but scarce experimental information is available for shapeless stone masonry walls that constitute the material still used in the construction of non-engineering structures. Therefore, the present work aims at increasing the insight about the behavior of typical shapeless