JOINT CONFERENCE PROCEEDINGS
7th International Conference on Urban Earthquake Engineering (7CUEE) &
5th International Conference on Earthquake Engineering (5ICEE)
March 3-5, 2010, Tokyo Institute of Technology, Tokyo, Japan

# EXPERIMENTAL STUDY ON STATIC AND DYNAMIC BEHAVIOR OF PP-BAND MESH RETROFITTED ADOBE MASONRY STRUCTURE

**Navaratnarajah Sathiparan[1)], Paola Mayroca[2)], and Kimiro Meguro[3)]**

*1) Post Doctoral Fellow, Institute of Industrial Science, The University of Tokyo, Japan*
*2) Senior Engineer, Det Norske Veritas AS, Norway*
*3) Director/Professor, ICUS, Institute of Industrial Science, The University of Tokyo, Japan*
*sakthi@risk-mg.iis.u-tokyo.ac.jp, Paola.Mayorca@dnv.com, meguro@iis.u-tokyo.ac.jp*

**Abstract:** This paper introduces a technically feasible and economically affordable PP-band (polypropylene bands) retrofitting for low earthquake resistant masonry structures in developing countries. Results of the material tests and shaking table tests on building models show that the PP-band retrofitting technique can enhance safety of both existing and new masonry buildings even in worst case scenario of earthquake ground motion like JMA7 seismic intensity. Therefore proposed method can be one of the optimum solutions for promoting safer building construction in developing countries and contribute earthquake disaster mitigation in future.

## 1. INTRODUCTION

Masonry is the most universally available and economical construction material. Individual owner used it widely around the regions and it is a highly durable form of construction because the materials used are not much affected by the elements, but the quality of the mortar and the pattern of the brick units can strongly affect the quality of the overall masonry construction. The common materials of masonry construction are burned and unburned bricks called adobe, stones and concrete blocks. Adobe masonry made of unburned bricks is the most common type of masonry. Masonry structures are generally self-made because the construction practice is simple and does not require additional energy consumption. In addition to its low cost and simple construction technology, masonry has other advantages, such as excellent thermal and acoustic properties. In spite of this, the technological development of masonry in earthquake engineering has lagged behind compared to the other structural materials like concrete and steel. Therefore, earthquake prone regions in the world have suffered 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, that 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 on 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; PP-band is 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 (Mayorca P. and Meguro K., 2004).

A real scaled 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. Therefore, in this study we performed scale model tests to understand the overall behavior of the system.

In this research, to evaluate the beneficial effects of the proposed PP-band mesh retrofitting method, diagonal shear tests and out-of-plane tests were carried out on masonry wallettes with and without retrofitting. Also, 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.

## 2. AXIAL TENSILE TEST ON PP-BAND

Preliminary testing of the PP-band was carried out to check its deformational properties and strength. To determine the modulus of elasticity and ultimate strain, 3 bands were tested under uni-axial tensile test as shown in