EXPERIMENTAL STUDY ON DIAGONAL COMPRESSIVE BEHAVIOR OF MASONRY WALL RETROFITTED BY POLYPROPYLENE BAND MESHES

Navaratnarajah Sathiparan[1)], Paola Mayorca[2)], Kourosh Nasrollahzadeh Nesheli[3)], Ramesh Guragain[4)] and Kimiro Meguro[5)]

1) Student Member, Institute of Industrial Science, The University of Tokyo
4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan
e-mail: sakthi@risk-mg.iis.u-tokyo.ac.jp
2) Post Doctoral Fellow, Institute of Industrial Science, The University of Tokyo
e-mail: paola@iis.u-tokyo.ac.jp
3) Post Doctoral Fellow, Institute of Industrial Science, The University of Tokyo
e-mail: nesheli@iis.u-tokyo.ac.jp
4) Student Member, Institute of Industrial Science, The University of Tokyo
e-mail: ramesh@risk-mg.iis.u-tokyo.ac.jp
5) Professor, Institute of Industrial Science, University of Tokyo
e-mail: meguro@iis.u-tokyo.ac.jp

INTRODUCTION

Unreinforced masonry is one of the most used construction materials in the world. It is also unfortunately, the most vulnerable during earthquakes. This combined with the widespread use of masonry in earthquake prone regions of the world has 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. Several methods have been proposed to improve strength, ductility and energy dissipation capability of masonry structures. However, in developing countries, retrofitting masonry structures should be economic, the retrofitting material accessible and the local available workmanship used. Also simple construction procedure is needed. Considering these points, a new retrofitting technique has been proposed based on the use of polypropylene bands (PP-bands), which are commonly utilized for packing [1)]. This material is available at a very low price even in remote areas of the world.

Diagonal compression tests[2)] were carried out on masonry wallettes with and without retrofitting for both burned and unburned bricks to evaluate the beneficial effects of the proposed PP-band mesh retrofitting method. The mesh edges were fully and partially connected to evaluate whether the connection type influences the retrofitting performance. The test results are reported in this paper.

AXIAL TENSILE TEST OF POLYPROPYLENE BANDS

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 uniaxial tensile test as shown in Fig.2. The test was carried out under displacement control method. The results are shown in Fig.3. To calculate the stress in the band, its nominal cross section $15.5\times0.6mm^2$ was used. As the matter of fact, the band has a corrugated surface and therefore its thickness is not uniform.

All of the bands exhibited a large deformation capacity, with more than 13% axial strain. The stress-strain curve is fairly bilinear with an initial and residual modulus of elasticity of 3.2 GPa and 1.0 GPa, respectively. Given its large deformation capacity, it is expected that it will contribute to improve the structure ductility.

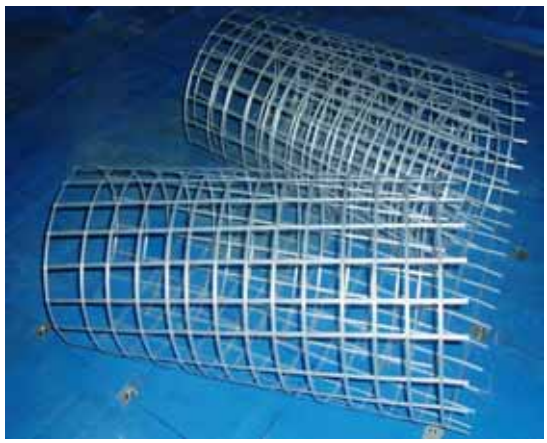

Figure 1 Polypropylene band mesh used for retrofitting