Evaluation of retrofitting masonry structures with polypropylene band meshes by means of diagonal compression tests

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1. Introduction

Unreinforced masonry is one of the most used construction materials in the world. It is also unfortunately, the most vulnerable during earthquakes. In seismic prone regions of the world, large number of casualties resulted due to the collapse of this type of structures.

Several retrofitting methods for masonry structure have been proposed to improve strength, ductility and energy dissipation capability. However, in developing countries, strengthening masonry structures should be economic, the retrofitting material accessible and the local available workmanship used. 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]. In order to evaluate the effect of retrofitting masonry walls by PP-bands, a series of diagonal compression tests were carried out on masonry wallettes with and without retrofitting as a means to assess its seismic strength. The initial results of these are reported in this paper.

2. Experiment program

The wallette dimensions were 292.5×290×50 mm^3 and consisted of 7 brick rows of 3.5 bricks each. The mortar joint thickness was 5mm. A mortar mix of Cement: Lime: Sand=1:7.9:20 and Cement/Water ratio = 0.14 was used. To observe the efficiency of different mesh orientations, two types of PP-band mesh arrangement shown in Fig.2 were used.

Type-1: PP-band mesh oriented parallel to the masonry joints.

Type-2: PP-band mesh oriented 45° from the masonry joints.

Both had mesh pitch equal to 40mm. A total of 4 wire connectors were used to attach the mesh with the masonry. In the retrofitted case epoxy was used for connecting PP-meshes from both sides.

In this study five brick walls were constructed. In order to identify the effect of the external overlay on the efficiency of the mesh retrofitting and strength, some wallettes were applied an 8-mm thick lime surface paste with a mix proportion lime: sand = 2:5. The specimens were named according to the following convention: **A-B-N** in which **A** is **U**: Unreinforced or **R**: Reinforced; **B** is **P**: With external paste or **X**: without external paste; and **N** is 1 or 2 according to the mesh type.

Specimens were tested 28 days after construction under displacement control. The loading rate was 0.3mm/min and 2mm/min for the unreinforced and retrofitted cases respectively. The retrofitted wallettes were applied 50mm vertical displacement. In order to determine the masonry mechanical properties, direct shear and bond strength of the masonry assembly were also evaluated.

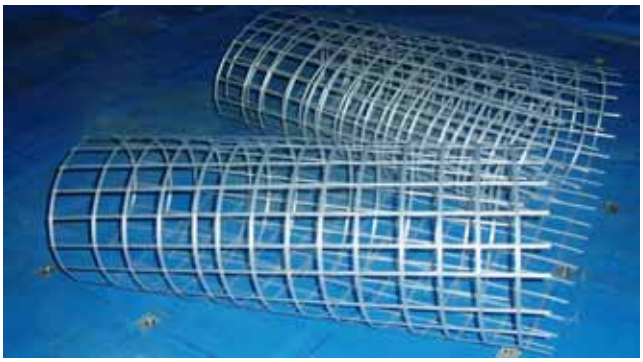
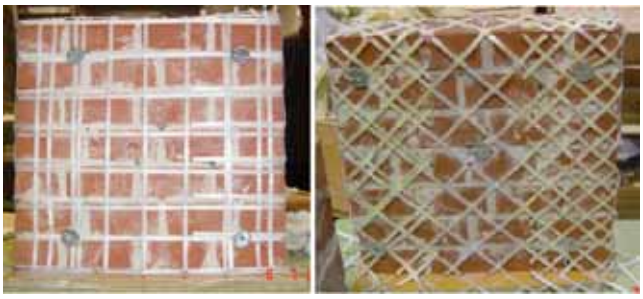


Figure 1 Polypropylene band mesh used for retrofitting



(a) Type-1 **(b) Type-2**

Figure 2 Masonry wall specimen retrofitted by PP-band mesh

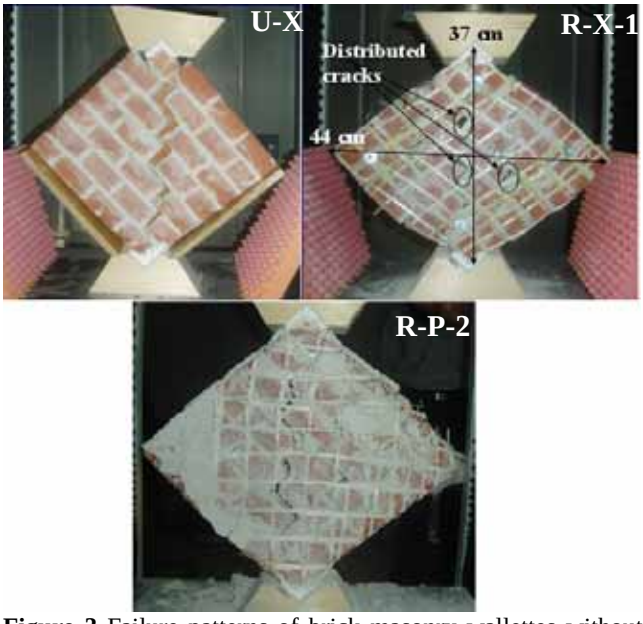


Figure 3 Failure patterns of brick masonry wallettes without and with retrofitting by PP-band mesh.

Key Word: unreinforced masonry, polypropylene band, diagonal compression test, residual strength, wire connectors, wallettes

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