NUMERICAL AND EXPERIMENTAL SEISMIC EVALUATION OF CONFINED MASONRY WALL RETROFITTED BY POLYPROPYLENE FIBER, STEEL FIBER AND WIRE MESH REINFORCED SHOTCRETE

Mohammad KHALAF REZAE
M.Sc. Student, Department of Civil and Environmental Engineering of Tarbiat Modares University, Tehran, Iran
mohammadkhalaf65@gmail.com

Mehran MOUSAVI
M.Sc. Student, Department of Civil and Environmental Engineering of Tarbiat Modares University, Tehran, Iran
m_mousavi@yahoo.com

Hamzeh SHAKIB
Professor, Department of Civil and Environmental Engineering of Tarbiat Modares University, Tehran, Iran
shakib@modares.ac.ir

Sadegh DARDAEI
Assistant Professor, Faculty of High Technologies of Tarbiat Modares University, Tehran, Iran
dardaei@modares.ac.ir

Masoud SAMADIAN
Director of the Research Bureau, Tehran Province Gas Company, Tehran, Iran

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Masonry structures are widely used due to its available materials, low cost and construction easiness. Generally, large casualties due to collapse of masonry buildings during earthquakes are reported. Many of the existing unreinforced masonry (URM) buildings are seismically vulnerable and need to be retrofitted. Mesh-reinforced shotcrete has the wide application method on seismic retrofitting of confine URM walls. Using fiber, specialy steel fiber and polypropylene-fiber in concrete may improve strength and ductility of concrete compare to ordinary concrete (Ezeldin and Balaguru, 1992), Bencardino, Rizzuti and Swamy (2008). This paper presents experimental and analytical results of the in-plane behaviour of URM walls retrofitted using mesh-reinforced fibre shotcrete. Three full-scale clay brick wall specimens under cyclic lateral loading combination with vertical constant load were experimentally tested. The first confined masonry wall specimen was built without any retrofitting as a reference wall (URM wall). The second specimen was retrofitted with mesh-reinforced steel-fiber shotcrete (MRSFS wall) and the third one was retrofitted with mesh-reinforced polypropylene-fiber shotcrete (MRPFS wall). The walls were retrofitted by using a 60 mm thick layer of fiber shotcrete on one side. The walls consist of a single-story clay brick panel confined by RC bond-beams and tie-columns. The RC members are assumed to be of the concrete with a compressive strength equal to 12 MPa. The lower RC bond–beam is restrained against horizontal and vertical displacements. However, the upper one transfers static cyclic lateral displacement load. The stiffness, strength, ductility, and failure mode of the wall specimens were determined and compared. The experimental results showed that, the strength of the retrofitted walls with steel-fiber shotcrete and polypropylene-fiber shotcrete was increased about %57 and %55 compared to the reference wall, respectively. Therefore, using steel-fiber has more effect on the strength as well as the ductility of the wall compare to the polypropylene-fiber shotcrete. Figure 1 shows the comparison of shear capacity of the non-retrofitted and retrofitted tested walls.

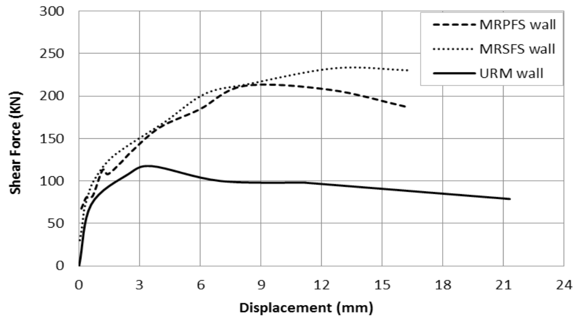
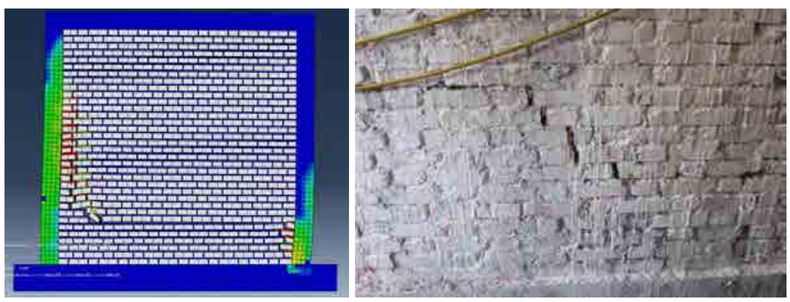


Figure 1. Comparison of shear capacity curves of the experiment tested walls

In this study a numerical modelling base on the micro modelling was also, carry out in order to calibrate behavior of the tested specimens in terms of shear/displacement, shear capacity, and cracking pattern of the walls. In this approach both brick and mortar materials were modelled separately by means of nonlinear continuous elements (Lourenco, 1996). Dynamic explicit method carried out in the numerical analysis. The analytical outcome agreed reasonably well with the experimental results. Figure 2 shows the crack pattern and damage of the numerical models and experiment models.

(a) 

(b) 

Figure 2. Crack pattern of analytical and experimental models; a) URM wall; b) MRSFS wall and MRPFS wall

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