COMPARATIVE STUDY ON SEISMIC PERFORMANCE OF CONFINED UNREINFORCED MASONRY WALLS CONSTRUCTED BY SOLID AND HOLLOW BRICKS

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

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

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

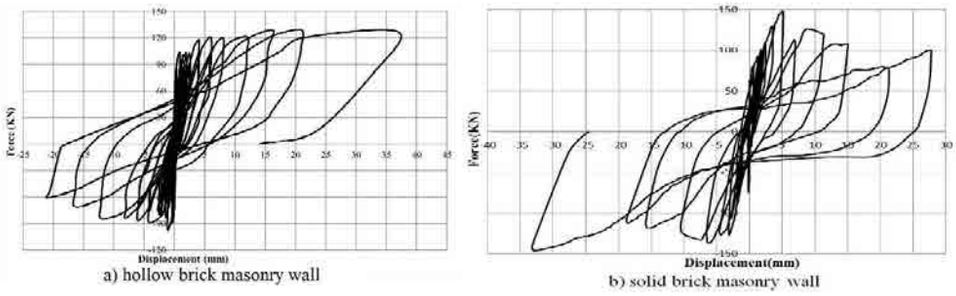
Sadegh DARDAEI
Assistant Professor, Faculty of High Technologies of Tarbiat Modares University, Tehran, Iran
dardaei@modares.ac.ir

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

Keywords: Unreinforced Confined Masonry Wall, Solid Clay Brick, Hollow Brick, Seismic Behavior, Numerical Analysis

Masonry is one of the oldest and most widely used construction methods in the world due to low cost, wide access to materials, low demand to maintenance, experience and technology, isolation against temperature changes, fire resistance and construction easiness. Masonry structures are consisted commonly from units and mortar. Various types of materials were used for units and mortars that can be affected on the seismic performance of masonry walls.

In this paper, the effects of brick types on the in-plane seismic behaviour of unreinforced confined masonry walls were numerically and experimentally evaluated. Two full scale confined masonry walls were tested under in-plane lateral cyclic loading. The first wall was constructed by solid clay bricks and the other one was constructed by hollow bricks. The material properties of surrounded ties and mortar element were considered equally in both experimental models. The stiffness, ductility, strength and mode of failure of the experimental models were determined and compared together. The experimental results showed that the failure mode of both walls was similar whereas the maximum strength of solid clay brick wall was greater than the hollow brick masonry wall. In the other hand, the strength parameter was dropped at lower displacement in solid brick masonry wall and ductility of this wall was so lower than the hollow brick masonry wall. The hysteresis response and the mode of failure of the hollow and solid brick masonry walls are shown in Figure 1 and Figure 2, respectively.



a) hollow brick masonry wall b) solid brick masonry wall

Figure 1. Hysteresis curve of the solid brick and hollow brick masonry wall

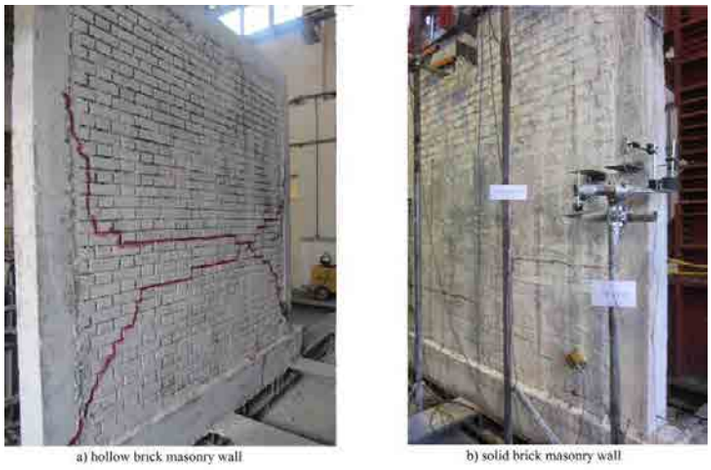


Figure 2. Hollow brick and solid brick masonry walls with bed-joint sliding failure

The seismic performance of both experimented walls was calibrated by finite element analysis. Modelling of masonry is performed by two main approaches consist of micro-modelling and macro modelling. In this paper, the macro-modelling approach was used where all components are smeared into a homogeneous continuum. Macro-modelling created proper approximation of general behaviour of both experimental models in case of failure mode and maximum strength.

ACKNOWLEDGES

The authors wish to acknowledge the financial support of Tehran Province Gas Company.

REFERENCES

Grande E, Milani G and Sacco E (2008) Modelling and analysis of FRP-strengthened masonry panels, Eng. Struct., 30, 1842–1860

Haroun MA and Ghoneam EH (1997) Seismic performance testing of masonry-infilled frames retrofitted by fiber composite, Society of Photo-Optical Instrumentation Engineers (SPIE) Conf. Series, Vol. 3089, SPIE, Bellingham, Wash., 1650–1656

Prakash SS and Alagusundaramoorthy P (2006) Numerical study on masonry load bearing walls retrofitted with GFRP composites, Proc., 3rd Int. Conf. on FRP Composites in Civil Engineering (CICE 2006), Int. Institute for FRPs in Construction (IIFC), Winnipeg, Canada

Verhoef LGW and Van Zijl GPAG (2002) Re-strengthening of brickwork to reduce crack width, Adv. Eng. Software, 33: 49–57

Van Zijl GPAG and de Vries PA (2005) Masonry wall crack control with carbon fiber reinforced polymer, *J. Compos. Constr*., 9(1): 84–89