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CODE 729 THE FIRST IRANIAN GUIDELINE FOR STRENGTH-BASED DESIGN OF NON-STRUCTURAL MASONRY WALLS: A VERIFICATION REPORT

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It is well recognized that non-structural elements and contents represent most of the monetary investments in almost all buildings. Moreover, during a seismic or windstorm event, failure of heavy non-structural elements can impose significant life threat. Surprisingly, current national and international codes of practice do not provide a straightforward design procedure for non-structural elements. In 2017, the first Iranian guideline for strength-based seismic design of non-structural masonry walls, Code 729 (2017), published by The Plan and Budget Organization of Iran. Code 729 uses strength-based procedure and the well-known yield-line theory to design unreinforced and reinforced non-structural masonry walls. These walls are acceleration-sensitive elements which would be subjected to out-of-plane bending. Note that non-structural masonry walls are anisotropic and most of them are constrained along three or four edges. Subsequently, the wall would experience a two-way bending which further complicates the problem. A strength-based guideline, such as Code 729, should be able to reliably estimate ultimate out-of-plane capacity of the wall considering its anisotropic nature and two-way bending.

In this paper, using a comprehensive experimental database of 72 full-scale masonry walls, accuracy of Code 729 is demonstrated. Using quasi-static air-bag cyclic tests, Griffith et al. (2007) have reported out-of-plane behavior of unreinforcemed masonry walls with and without openings. Experiemntal results with those estimated by Code 729 are compared in Figure 1. To acheive a better understaning, Finite Element (FE) simulations are also carried out in this study, as illustrated in Figure 1.

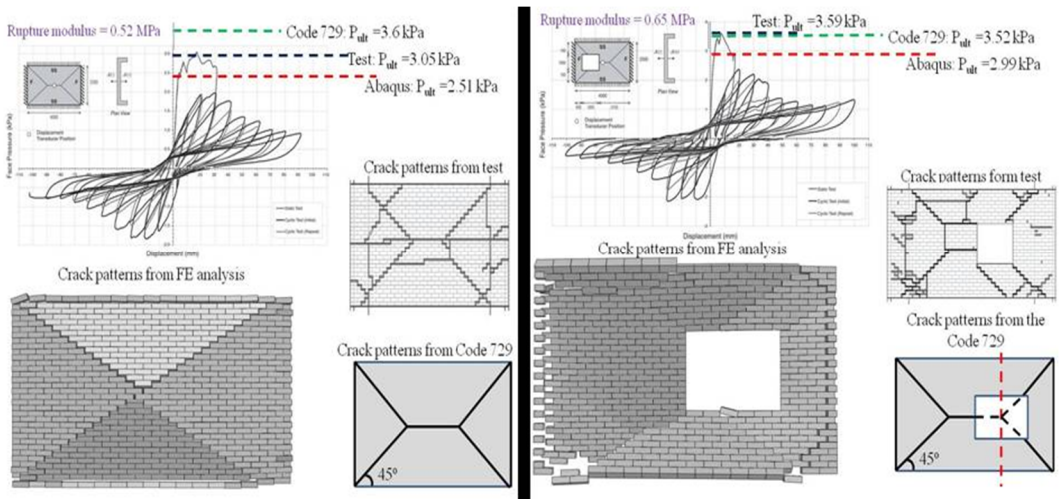

Figure 1. Verification of Code 729 with experimental results by Griffith et al. (2007).

Out-of-plane capacities of concrete block walls with bed joint reinforcements have been experimentally investigated by Drysdale and Essawy (1988). Figure 2 compares tests results with those estimated by Code 729 in terms of out-of-plane capacity and crack patterns. It turned out that Code 729 can estimate out-of-plane capacity of the walls with good accuracy.

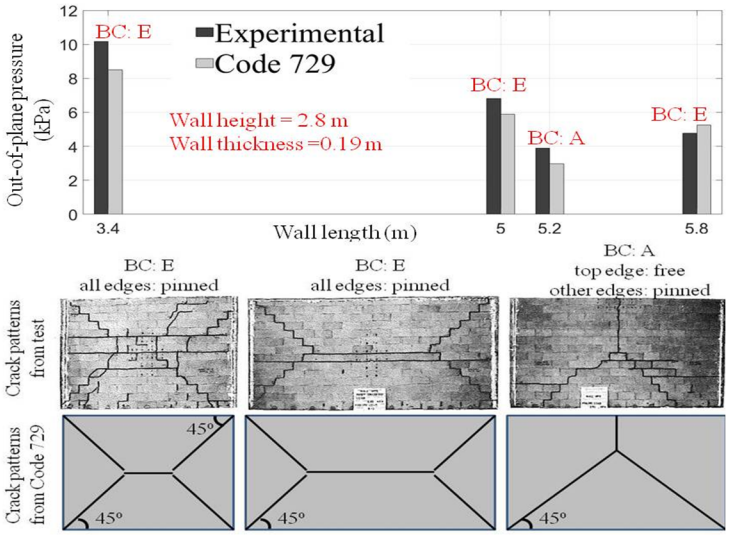

Figure 2. Verification of Code 729 with experimental results by Drysdale and Essawy (1988).

In addition to experimental results, FE simulations are also carried out in this study to shed light on out-of-plane behaviour of walls with different opening details. According to Code 729, unreinforced non-structural masonry walls are not allowed in seismic prone regions. Figure 3 illustrates contribution of bed joint reinforcements to out-of-plane behaviour of a non-structural masonry wall with openings. Ultimate capacities of the walls per Code 729 are also presented in Figure 3. Obtained results of this study indicated that Code 729 is a reliable guideline to design non-structural masonry walls with different boundary conditions, different masonry units and different types of opening.

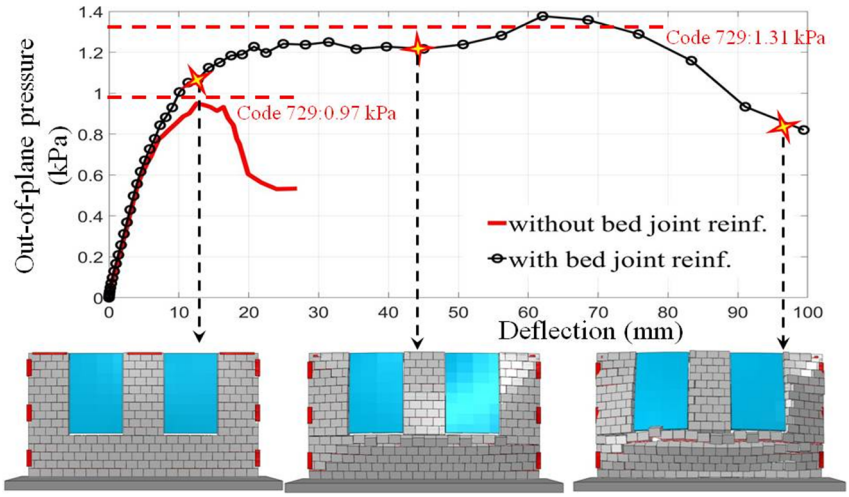

Figure 3. Verification of Code 729 with FE simulations.

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