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Experimental Study of Infill Walls with Joint Reinforcement Subjected to In-Plane Lateral Load

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Abstract : The experimental results about the global behavior of twelve 1:2 scaled reinforced concrete frames subject to in-plane lateral load are presented. The main objective was to generate experimental evidence about the use of steel bars within mortar bed joints as shear reinforcement in infill walls. Similar to the Canadian and New Zealand standards, the Mexican code includes specifications for this type of reinforcement. However, these specifications were obtained through experimental studies of load-bearing walls, mainly confined walls. Little information is found in the existing literature about the effects of joint reinforcement on the seismic behavior of infill masonry walls. Consequently, the Mexican code establishes the same equations to estimate the contribution of joint reinforcement for both confined walls and infill walls. Confined masonry construction and a reinforced concrete frame infilled with masonry walls have similar appearances. However, substantial differences exist between these two construction systems, which are mainly related to the sequence of construction and to how these structures support vertical and lateral loads. To achieve the objective established, ten reinforced concrete frames with masonry infill walls were built and tested in pairs, having both specimens in the pair identical characteristics except that one of them included joint reinforcement. The variables between pairs were the type of units, the size of the columns of the frame, and the aspect ratio of the wall. All cases included tie columns and tie beams on the perimeter of the wall to anchor the joint reinforcement. Also, two bare frames with identical characteristics to the infilled frames were tested. The purpose was to investigate the effects of the infill wall on the behavior of the system to in-plane lateral load. In addition, the experimental results were compared with the prediction of the Mexican code. All the specimens were tested in a cantilever under reversible cyclic lateral load. To simulate gravity load, constant vertical load was applied on the top of the columns. The results indicate that the contribution of the joint reinforcement to lateral strength depends on the size of the columns of the frame. Larger size columns produce a failure mode that is predominantly a sliding mode. Sliding inhibits the production of new inclined cracks, which are necessary to activate (deform) the joint reinforcement. Regarding the effects of joint reinforcement in the performance of confined masonry walls, many facts were confirmed for infill walls. This type of reinforcement increases the lateral strength of the wall, produces a more distributed cracking, and reduces the width of the cracks. Moreover, it reduces the ductility demand of the system at maximum strength. The prediction of the lateral strength provided by the Mexican code is a property in some cases; however, the effect of the size of the columns on the contribution of joint reinforcement needs to be better understood.

Keywords : experimental study, infill wall, infilled frame, masonry wall
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