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A Dissertation Report on

"STIFFNESS OF BRICK MASONRY WALLS WITH OPENINGS"

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By

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ABSTRACT

Masonry walls are subjected to shear force during earthquake. Both gravity loads and horizontal seismic loads are resisted by these walls. Seismic performance of unreinforced masonry buildings is governed by structural behavior of in plane shear walls. Lateral stiffness of structural walls is an important parameter for the estimation of the design force on brick masonry buildings. Period of vibration of building depends on the stiffness of walls. Seismic shear is distributed among the walls according to their individual stiffness. Thus, the estimation of stiffness of brick masonry shear walls is of practical importance. When failing in shear, plain masonry walls behave as brittle structural elements with limited dissipation capacity. In order to improve lateral resistance and ductility, masonry walls are reinforced with steel reinforcement. It is the ductility of structural walls and their sections which makes it possible for the structural system to resist earthquakes

The stiffness of brick masonry wall was evaluated by conducting experiments on brick masonry wall panels with openings. The experimental investigation involved casting a one-third scaled down masonry wall with a window opening and the same is tested under lateral load. To determine the influence of reinforcement on lateral stiffness of masonry, Reinforced masonry walls with opening were casted and tested. The horizontal deflection of wall was measured at top. Load v/s deflection plot was plotted to obtain the stiffness of masonry wall. The experimental results were compared with analytical results using the finite element software ANSYS version 14.5. The material properties for the analysis were obtained experimentally by testing in the laboratory.

From the results, the lateral resistance and ductility of reinforced wall was found to be more than unreinforced wall. The error in the lateral stiffness was 5% between experimental and analytical values for unreinforced masonry (URM). Experimental study revealed that providing steel bars on either side of opening improved lateral stiffness of masonry by 54%. Stiffness of URM calculated from hand methods available in the literature and linear finite element analysis was found to be 37.9 kN/mm and 28.17 kN/mm respectively. From the parametric study, it is found that hand method is overestimating lateral stiffness of masonry at low aspect ratios compared to linear finite element analysis.