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Effectiveness of FRCM System in Strengthening Reinforced Masonry Walls Subjected to Cyclic Loading

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Abstract

Much of the research on the strengthening of masonry structures has focused on strengthening of *unreinforced* masonry structures; as a result, most strengthening design guidelines are limited to this type of structural strengthening. In addition, only a limited experimental database of reinforced masonry structures with strengthening is available. The main purpose of this research is to study the behavior of fully grouted reinforced masonry walls strengthened with Fiber Reinforced Cementitious Matrix (FRCM) system under out-of-plane action. Seven reinforced masonry walls strengthened in flexure using (FRCM) were built as a part of this study. Two reinforced walls constructed in running and stack bond pattern were investigated as control specimens and the other specimens were strengthened using different types of fibers. FRCM strengthening composite materials consisted of one or two plies of fabric embedded in cementitious mortar. The test results indicated that the FRCM system is a very effective technique for upgrading flexural capacity of masonry walls and improve the behavior of stack wall.

Keywords: Strengthening, FRCM, reinforced masonry, cyclic load.

1 Introduction

Most of the existing research literature has focused on strengthening of unreinforced masonry (URM) walls due to its insufficient strength to withstand out-of-plane loads. Previous studies have addressed the effectiveness of fiber reinforced polymer (FRP) composite to increase out-of-plane capacity of masonry walls (1-5). Experimental results of these researches showed remarkable enhancement in out-of-plane capacity and stiffness for strengthened walls.

Strengthening with FRP has some drawbacks including poor behavior of epoxy at and above the glass transition temperature, inability to be applied on wet surface, emission of toxic fumes, and moisture impermeability (6-9). All these drawbacks related to the organic adhesive, so fiber reinforced cementitious matrix (FRCM) has emerged as a solution and alternative to FRP systems.

The use of FRCM as strengthening material for substandard unreinforced masonry structures has been experimentally investigated and reported to be effective strengthening system. The feasibility of FRCM as external strengthening technology was evaluated (10). This study focused on out-of-plane capacity of URM strengthened with two different amounts of FRCM, namely one and four reinforcement fabrics. Experimental evidence shows significant improvements in the structural performance in terms of flexural capacity and stiffness of the strengthened walls. The effectiveness of FRCM system in comparison to one provided by FRPs was evaluated (11). Comparing with FRP system, FRCM system may

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