

FRCM-Strengthened CMU Masonry Walls Subjected to Out-of-Plane Load

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Abstract:

Unreinforced masonry (URM) walls do not have sufficient flexural capacity and are prone to brittle failure when subjected to out-of-plane loads caused by earthquakes or high wind pressure. Composite materials such as fiber-reinforced polymers (FRP) in the form of pre-cured laminates and near surface mounted (NSM) bars have been used successfully as a retrofitting technique. Recently, fabric-reinforced cementitious matrix (FRCM) materials have emerged as an innovative strengthening composite system to improve out-of-plane behavior of URM structures. In the present paper, an experimental program carried out on nine CMU walls of which six were strengthened with 1-ply and 4-ply carbon-FRCM (C-FRCM) is presented. The test results demonstrated the high efficiency of FRCM rehabilitation technique under out-of-plane loading. Significant increases in ultimate flexural capacity, stiffness, and pseudo-ductility were achieved compared to the control walls. The analytical method according to ACI 549.4R-13 was used to predict flexural capacity. The comparison between experimental and design values shows that ACI 549.4R-13 provisions can be safely used for the design of CFRCM rehabilitation of CMU walls. Finally, the findings of this research program are compared to the experimental results from other research programs using FRP strengthening after normalizing flexural capacity and calibrating the reinforcement ratio. The comparison shows that the two technologies provide the same flexural capacity enhancement for the same calibrated reinforcement ratio.

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