INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

This study consists of experimental, numerical, and analytical evaluation of URM walls and buildings with and without strengthening. Initially, a preliminary numerical study was carried out over a tested URM building using three popular FE software considering three different material constitutive models under continuum modeling approach (Equivalent Frame Method, Mohr-Coulomb failure criteria, and Concrete Damage Plasticity model). To get more insight into the lateral load behaviour of URM walls and building and to generate the input data required for numerical simulations, pseudo-static in-plane cyclic tests were carried out on three full-scale URM walls with different opening configurations and three single room URM buildings, constituting the walls, which were already tested. The tests were carried out over unstrengthened (1 specimen) as well as strengthened URM buildings (2 specimens) in order to evaluate the effectiveness and suitability of using the surface-mounted steel bands as a strengthening scheme. One specimen was strengthened using surface-mounted steel bands on both faces (external as well as internal) of all the walls horizontally at lintel level (Model 1), and the other was strengthened using similar horizontal steel bands at sill and lintel levels and vertical bands around the openings (Model 2). Model 2 showed significant improvement in the lateral strength, deformability, and energy dissipation capacity of the URM building. The URM walls and buildings were then simulated in Abaqus and Strand7 to estimate the lateral strength and study the numerical damage output. The shortcomings of the existing numerical methods were addressed by introducing a new homogenized discretization method for numerical simulation of URM buildings. Finally, a systematic combination of in-plane and out-of-plane strengths of individual walls, estimated using available analytical methods, was suggested to estimate the lateral strength of URM buildings. Further, parametric numerical studies were carried out on unstrengthened as well as strengthened URM building models by varying some of the important parameters like wall thickness, aspect ratio (l/h) of walls, tensile strength of masonry, width and thickness of the steel bands, and cross-sectional area of the steel bands. Based on regression analysis of the obtianed data, empirical equations were developed for estimation of the lateral strength of the unstrengthened URM building as well as of the strengthened URM building.