Interaction of ln-Plane Shear and Flexure in Masonry Walls with Unbonded Longitudinal Reinforcement

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Abstract:

A rigorous micro-element-based analysis procedure is presented for evaluating the inelastic force-displacement behavior of masonry shear walls with ungrouted longitudinal reinforcement. In ungrouted reinforced masonry shear walls, the strains as well as forces in the longitudinal steel rebars are governed by the relative displacements of the end anchorages because the longitudinal steel reinforcement is not bonded to the surrounding masonry. As a result, the sectional response of such walls depends on the displacements of the wall boundary and cannot be determined by analyzing a single section. In addition, a shear wall with unbonded reinforcement may undergo uplift along with flexural and shear deformations when subjected to a lateral load. The present paper is part of a series based on research on the in-plane behavior of masonry shear walls with unbonded longitudinal reinforcement. An integrated analysis technique based on a fiber element (micro-element) model is proposed for predicting the nonlinear force-displacement envelope as well as complete stress and strain response of ungrouted reinforced masonry shear walls (with unbonded longitudinal reinforcement) considering the interaction of flexure, shear and uplift under in-plane lateral loading. The solution of the two-dimensional stress state in the masonry fiber elements was obtained using modified compression field theory. The model is verified using experimental data from cyclic loading tests. A simplified design methodology is also presented for assessing masonry shear walls with unbonded longitudinal reinforcement for safety against shear failure.

DOI: 10.70803/001c.140348

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