Hysteretic Behavior of Concrete Masonry Shear Walls with Unbonded Reinforcement

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Abstract:

A micro element model is presented for predicting the hysteretic in-plane behavior of masonry shear walls with unbonded longitudinal reinforcement subjected to reversed cyclic loading in the inelastic range. Since the longitudinal steel reinforcement in ungrouted reinforced masonry shear walls is not bonded to the adjacent masonry, the steel strains as well as forces in the longitudinal rebars are governed by the relative displacements of the end anchorages. As a result, the in-plane response of such masonry shear walls with unbonded longitudinal reinforcement is dependent on the deformations of the wall boundary and cannot be determined by analyzing a single section. Further, the development of a flexural crack results in a partial loss of restraint at the base, thus, causing a part of the wall base to separate and uplift from the foundation. As the unbonded longitudinal reinforcement is unable to resist compression effectively due to lack of bracing along the wall height, the consecutive opening and closing of the separation under repeated load reversals imparts a 'rocking' motion to the wall under certain conditions and results in 'pinched' lateral force-displacement hysteresis loops that are peculiar to this class of shear walls. A rational analysis technique is developed based on a fiber element model for evaluating the nonlinear hysteretic force-displacement response of masonry shear walls with unbonded longitudinal reinforcement taking into account the interaction of flexure and uplift under lateral in-plane cyclic loading. The analysis technique is used to predict experimental results from cyclic loading tests. The formulation of the analysis procedure is based on cantilever walls under a concentrated lateral load at the free end. As a consequence, the procedure is applicable in the present form only to such walls. However, the formulation may be easily modified for applying the model to other boundary and loading conditions.

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