

Strength and Stiffness of Masonry Shear Walls and Openings

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Abstract:

Introducing openings in a masonry wall alters its behavior and adds complexity and difficulties in analysis and design. This paper presents a test program to study the lateral response of shear walls with openings through testing thirteen 1/3-scale reinforced concrete masonry shear walls. In this study, a simple analysis approach employing plastic hinge failure mechanisms was refined and used to predict failure mechanism, lateral load carrying capacity, and internal forces at ultimate load. The test specimens were designed to behave mainly in a flexural mode by forming plastic hinges at the member ends. The walls behaved mainly in a flexural mode as intended and failed by forming plastic hinges at the members ends. This study demonstrates that the plastic hinge model provides a simple and efficient analysis approach to predict the failure mechanism, ultimate strength and internal forces for flexural-dominated masonry shear walls with openings. The test results revealed that, for flexural-dominated reinforced masonry solid shear walls and shear walls with openings having the same overall dimensions and flexural reinforcement arrangement, the post-cracking stiffnesses and ultimate lateral load strengths are proportional (percent reduction in stiffness because of opening(s) is equal to the percent reduction in strength). Based on the results of this study, a simple model was proposed to predict the post-cracking stiffness of reinforced masonry shear walls with openings. This analysis model is able to give a good estimate for the post-cracking stiffnesses of the test specimens.

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