AN ABSTRACT OF A DISSERTATION

PREDICTING THE IN-PLANE CAPACITY OF MASONRY INFILLED FRAMES

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Buildings that consist of masonry infilled frames are common around the world. They are easy and economical to construct and provide a strong, ductile lateral force resisting system. Despite their efficiency and performance, the infill material has, historically, been ignored during design due to a lack of code guidance.

The research described herein is intended to: (1) translate existing experimental data into analytical methods for predicting the in-plane (IP) stiffness, capacity, and structural behavior of various types of infill materials and (2) formulate and verify (by comparing them with test data and finite element analyses) possible code approaches which may be used by practicing engineers for the design of new and the analysis of existing infilled frame structures.

These objectives have been accomplished through several steps. Experimental results were compiled from fifteen research programs and include almost sixty data points. These results focus on full-scale, unreinforced masonry infills without openings or gaps between the infill and the surrounding frame.

Stiffness methods from eighteen sources were investigated. Strength methods from thirteen sources were also investigated. The stiffness equations were compared to the experimental data at the first crack load. The strength equations were compared to the experimental results at the first crack load and the reported ultimate load. The results of these comparisons were used as a starting point for the development of better equations for determining the stiffness and strength of masonry infilled frames.

Linear and nonlinear finite element models were developed to analyze the behavior of masonry infilled frames. The linear model focused on the behavior of the infilled frame at the first crack load. The nonlinear model focused on the behavior of the infilled frame at the first crack load and then at the ultimate load.

A new equation has been presented for predicting the width of the equivalent diagonal strut and thus the stiffness of the masonry infilled frame system. Six new equations have been presented for determining the strength of the masonry infilled frame system. These strength equations are specific to the masonry infill material and represent the strength at first crack load and ultimate load.