Seismic Response of Unreinforced Masonry Buildings

by Daniel Abrams

Abstract and Background

Currently, there are two documents that provide guidance to the engineering profession on how to make a seismic evaluation of an unreinforced masonry building system. In Appendix Chapter C of the Federal Emergency Management Agency (FEMA) 178 report (1992) an evaluation procedure is described which is based on earlier National Science Foundation sponsored research with the ABK project. A similar evaluation procedure is given in Appendix Chapter 1 of the UCBC (1991) which is based on working stresses rather than strengths as is done with the FEMA 178 procedures. Each procedure is aimed at a single specific type of building configuration: low-rise buildings with unreinforced clay-unit masonry walls and flexible floors and roofs. A new document is presently being developed by FEMA and the Building Seismic Safety Council (BSSC) through contract to the Applied Technology Council (ATC) that will attempt to incorporate the UCBC and FEMA 178 methodologies for rehabilitated building systems containing unreinforced masonry with new elements of other construction materials such as steel, concrete or timber. Furthermore, the new guidelines will make a first attempt at a performance based design which will demand a more complete knowledge of the overall force-deflection characteristics of structural components.

Collaboration

John Mander
Sherwood Prawel
University at Buffalo

Daniel Abrams
Stephen Schneider
University of Illinois at Urbana-Champaign

Peter Gergely
Richard White
Cornell University

To provide the necessary theoretical information for the new guidelines, the NCEER Building Project is taking a close look at the basic response mechanisms for unreinforced masonry bearing wall buildings with flexible diaphragms. In addition, research on masonry infill-frame systems will furnish information needed for the development of provisions for modeling stiffness and strengths of infill panels.

This paper presents an overview of structural engineering research supported by NCEER on seismic response and behavior of unreinforced masonry buildings. Included are research projects related to improving engineering methods for seismic evaluation and rehabilitation of masonry bearing wall and infill-frame building systems.