A STUDY INTO THE EARTHQUAKE RESISTANCE OF CIRCULAR ADOBE BUILDINGS

by

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CERTIFICATE OF AUTHORSHIP/ ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Watcharin Jinwuth

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PUBLICATIONS

The following publications have been generated as part of this research project.

<u>Conference papers</u>

Jinwuth, W., Samali, B., Heathcote, K. & Wang, C. 2010, '*A Study into the earthquake resistance of circular adobe buildings using static tilt tests'*, paper presented to the 2010 AEES Conference, Perth, 26-28 November.

Samali, B., Jinwuth, W., Heathcote, K. & Wang, C. 2011, *'Seismic capacity comparison between square and circular plan adobe construction'*, paper presented to the Twelfth East Asia-Pacific Conference on Structural Engineering and Construction (EASEC-12), Hong Kong, 26-28 January.

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ABSTRACT

Unreinforced adobe or mud-brick structures have in the past suffered severe damage from seismic forces and have caused a vast number of deaths. However, a number of adobe buildings located in seismic regions have performed well under several seismic events. Most of these traditional buildings are symmetrical in shapes which have significant bearing on the performance of the buildings during strong earthquakes. Most existing circular adobe houses have performed well in withstanding earthquakes even though some did not have any additional ductile reinforcements.

This thesis presents a series of tilt table tests conducted to study the performance of unreinforced circular adobe buildings subjected to earthquake forces. Nine small-scale models (1:3 scale) of adobe structures were built with a variety of configurations and roof loads. The adobe house models were subjected to a constant acceleration when tilted on a tilt-up table. The lateral component of the models weight was used as a parameter to quantify the maximum seismic force for each model. The results then developed a methodology for designing circular adobe buildings to resist earthquakes in specific seismic zones and for specific site conditions.

A static pushover test and two shake table tests were also conducted in order to evaluate the reliability of the predictive model from the tilt table tests. The research outcomes give simple and effective solutions for construction of new adobe buildings located in seismic hazard areas. It can also be applied to evaluate existing circular adobe buildings for their seismic resistance which can assist in predicting the likely outcome in the event of an earthquake.

Keywords: Adobe construction, mud-brick, earthquake resistance, circular building, tilt table test, static pushover test, shake table test.