MODELLING THE STRUCTURAL BEHAVIOUR OF THE FOLD-AWAY SHELTER

A thesis submitted for the degree of Master in Engineering (Research)
University of Technology, Sydney

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March 2006

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.

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ABSTRACT

The F-shelter underwent non-destructive monotonic load tests and destructive shake table test. The timber-framed shear walls with different sheathings; namely wood wool cement boards (wwcb) and F11 structural plywood were tested under uniaxial loading. Furthermore, finite element models (FEM) supplemented the experimental work. An FEM of the corner metal bracket and a 2-dimensional FEM for the timber-framed shear wall were generated and verified from the experimental work.

Behavioural responses from unidirectional lateral loading of the wall were obtained. For the dynamic test, the Kobe earthquake and Zone IV earthquake were simulated to determine the dynamic response of the F-shelter. Excitation was limited to 70% full scale displacement record of Kobe and 80% of Zone IV, due to the 100mm limitation in the allowable displacement on both sides of the shaker table. The shake table test showed that the F-shelter can withstand the simulated earthquakes.

FEMs were developed using ANSYS 7.2, a general finite element software. A requisite input data for the timber-framed shear wall FEM in lieu of a hinge connection corner joint for the timber-framed shear wall were generated through experimental work on the corner metal brackets and verified with the generated FEM. The results of the FEM of the *Dipterocarpus grandiflorus Blanco* (Apitong) timber-framed sheathed with wwcb were 5% to 9% higher than the average values for maximum deflections and maximum load capacity. The FEM results of the Radiata pine sheathed with F11 plywood, however, were 25% to 14% lower than the average values for maximum deflections and maximum load capacity.

This thesis has demonstrated the process of generating FEMs that can be used as a tool to improve and modify the F-shelter. The structural reliability of design and construction of the first F-shelter prototype was verified from the whole house test and structural modeling of the wall using FEM.

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   b. Nodal stresses at x and y directions
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