# SEISMIC VULNERABILITY ASSESSMENT OF BUILDINGS IN AUSTRALIA

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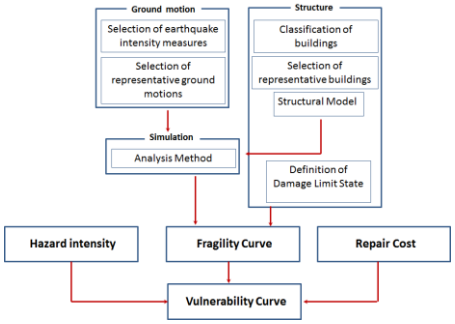
**THIS POSTER PRESENTS RESEARCH ACTIVITIES UNDERTAKEN IN THE UNIVERSITY OF MELBOURNE AND SWINBURNE UNIVERSITY OF TECHNOLOGY TOWARDS ASSESSMENT OF SEISMIC VULNERABILITY OF BUILDINGS IN AUSTRALIA. THE ACTIVITIES CONTRIBUTES TO BNHCRC PROJECT AIMED TO DEVELOP RISK MITIGATION AND RETROFITTING STRATEGIES FOR THE MOST VULNERABLE AUSTRALIAN BUILDINGS SUBJECT TO EARTHQUAKES.**

## INTRODUCTION

With earthquake action having only been reinforced in Australia since early 1990s, many Australian buildings are vulnerable to earthquakes. The vulnerability of buildings was evident in the Newcastle Earthquake of 1989 which has been reported to have caused an estimated total economic loss of AU$ 4 billion.

Models that are capable of predicting damage and potential economic loss in future earthquakes are fundamental in the formulation of risk mitigation and retrofitting strategies.

This poster presents research activities contributing to two major aspects of seismic vulnerability assessment, the definition of hazard intensity and the fragility modelling of vulnerable buildings.

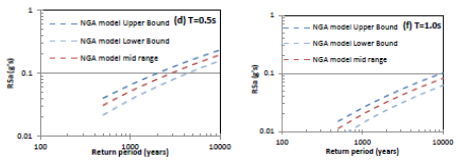



**Schematic process for derivation of vulnerability curves**

## HAZARD INTENSITY MODELLING

### Studies on rock hazard modelling

An analytical study has been undertaken to determine rock hazards and develop generalised response spectra on rock for varying return period.

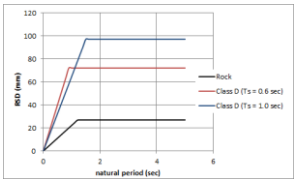



**Spectral acceleration on rock values for various return period at Left: 0.5 s; Right: 1 s**

## Hazard intensity modelling Cont'd

### Studies on soil spectra modelling

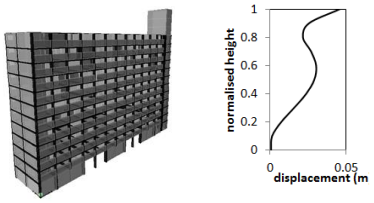
An analytical study has been conducted to develop soil response spectra for various site conditions




**Example of developed soil spectra (Class D)**

### Studies on systems effects

A simplified method to estimate drift demands of irregular buildings is currently being developed based on the developed rock and site response spectra.




**Left: 3-D finite element model of irregular building; Right: displacement profile of the building**

## FORCE-DEFORMATION MODELLING

### Studies on lightly reinforced concrete walls

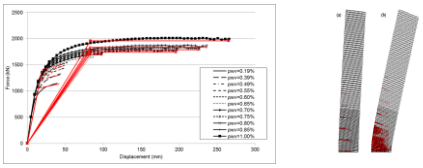
Experimental works have been undertaken to assess the global out-of-plane buckling and the local buckling of vertical reinforcement of RC walls.

**Testing of RC walls in in Swinburne's state-of-the-art Smart Structures Laboratory**

Analytical studies are being conducted to develop a force-displacement curve of the RC walls.

## Force-deformation modelling Cont'd

### Studies on lightly reinforced concrete walls cont'd



**Left: Force-deformation of RC walls showing very limited ductility for lightly reinforced walls; Right: Crack patterns showing discrete cracks**

### Studies on ordinary moment resisting RC frames

Experimental works have been undertaken to assess displacement capacity of RC columns

**Testing of RC columns in Swinburne's state-of-the-art Smart Structures Laboratory**

Analytical studies have been conducted to model force-displacement curve of the moment resisting frames, combining the component capacity of beams, columns, and beam-column joints.

### Vulnerability assessment

Studies are being conducted to construct fragility and vulnerability curves for a selected RC building type.

## END-USER STATEMENT

This project is focused on a key issue facing Australian cities associated with the presence of vulnerable reinforced concrete structures. The research is drawing upon a strong body of Australian experimental work by the research team to evaluate the deformation capacities of poorly detailed reinforced concrete wall and frame systems. I look forward to this work extending to the development of an improved understanding of the vulnerability these building types along with mitigation options to reduce it.

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