PROJECT SUMMARY

Managing earthquake risk: unreinforced masonry buildings

Natural Hazards Research Australia

RESEARCH TEAM

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SUPPORTING ORGANISATIONS

Queensland University of Technology
University of Newcastle

Project duration: Two years

Background

Legacy unreinforced masonry (URM) buildings in Australia were built before the introduction of seismic design codes. These buildings were typically designed to resist gravity loads, with only limited, anecdotal consideration given to lateral wind forces in tall structures such as stand-alone chimneys. Unlike gravity loading, earthquakes impose significant tensile demands on materials—a critical vulnerability in unreinforced masonry due to its low tensile strength. The 1989 Newcastle earthquake highlighted the risks associated with these buildings, resulting in substantial economic losses and tragic loss of life.

Australia experiences, on average, one to two M5 earthquakes per year and one M6 event approximately once per decade. Such events have the potential to cause severe damage to URM structures. To effectively mitigate these earthquake risks and support informed planning, preparedness, and disaster recovery, a comprehensive national dataset identifying the location and characteristics of URM buildings is urgently needed.

Project description

To support risk assessment, mitigation planning, and post-disaster recovery in Australia, several key stakeholders in the emergency management sector (Queensland Fire Department; South Australia Police; Department of Fire and Emergency Services Western Australia; and Fire and Rescue NSW) identified a critical need to identify and geo-tag a nationally consistent geospatial database of existing unreinforced masonry (URM) buildings.

This research, utilising Natural Hazards Research Australia funding, is centred on addressing that need by detecting and classifying URM buildings across Australia. The resulting database will enable evidence-based risk assessment and mitigation planning by the stakeholders. The core project will be accompanied by utilisation projects demonstrated to stakeholders as tools for developing targeted mitigation strategies and improving disaster response capabilities. Due to the large scope, achieving the inventory creation goal would require the application of Artificial Intelligence (AI) technologies.

Intended outcomes

A key outcome of this research is the development of a consistent, national database of classified unreinforced masonry (URM) buildings in Australia. This foundational data source will assist stakeholders to develop a better understanding of the impact of earthquakes on their jurisdiction, for example in conducting scenario-based seismic vulnerability assessments.

The proposed workflow is scalable and adaptable, allowing for extension to other infrastructure types and geographic regions, including international contexts. The project also fosters interdisciplinary collaboration among early- and mid-career researchers across computer vision, remote sensing, and structural engineering. Ultimately, this research lays the groundwork for future applications of AI in assessing community resilience to natural hazards.

Translation and implementation potential

The building inventory data will be delivered in geospatial formats specified by stakeholders, ensuring compatibility with existing risk mitigation and management platforms.

In addition, the GIS-based outputs are suitable for local governments that can conduct scenario-based risk assessments within their jurisdictions, supporting more informed decision-making for disaster preparedness, response planning, and long-term resilience strategies.

Further information

For full project details head to: https://www.naturalhazards.com.au/research/research-projects/managing-earthquake-risk-unreinforced-masonry-building-database

Or contact Nicola.Moore@naturalhazards.com.au