Data Article

Dataset from the detailed survey of vintage unreinforced masonry buildings in the State of Queensland, Australia

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**Abstract**

Due to an identified need to have realistic geometries and boundary conditions of vintage unreinforced masonry (URM) parapets and gable ends, this data collection study was conducted to document prevalent typologies of URM buildings in the Australian State of Queensland. Street surveys were completed in 7 towns and included measurement of the building geometry and the documentation of the other building construction details that were ascertainable using a brief external evaluation.

To collect the data, firstly the historical statistical records from Colonial Australia were interrogated to determine regions with the largest potential stocks of vintage URM buildings. It was found that, excluding the Queensland capital (Brisbane), seven other towns existed that had reported significant URM building construction during late 19th century and early 20th century census. These seven towns were selected for street surveys, and Brisbane was excluded due to the lack of sufficient resources. The street survey included take measurable photographs of building facades using a digital laser-based tool. These photographs were used in subsequent desktop study to calculate façade geometries. Additional relevant building information was extracted from

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Google Map and other sources, enabling an estimate of the roof shape and building plan dimension to be also obtained. This data report includes spreadsheets containing summary of the 363 surveyed building properties and the drawings that were created using the collected data.

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### Specifications Table

| Subject | Civil and Structural Engineering |
|---------|----------------------------------|
| Specific subject area | Unreinforced Masonry Buildings |
| Type of data | Table |
| How the data were acquired | Drawing |
| The data was collected by a team of 3 researchers on foot. The team was equipped with a laser-based measurement tool, called SpikeGPS. The device that is mounted on a mobile phone enables taking photographs with known dimension scale with 1% accuracy. Further desktop interpretation was conducted that included using SpikeGPS cloud services to extract drawings from photographs. Therefore, the raw form of information that were used to create most of the data in the spreadsheets are photographs that were tagged by SpikeGPS with geometrical properties within 1% accuracy. The CAD drawings are output from SpikeGPS cloud services | |
| Data format | Raw |
| Analyzed |
| Description of data collection | To collect data, the selected towns were surveyed on foot. Any building that was judged by the researchers to be a vintage URM building (with some exclusions explained herein) was selected for measurement and documentation. One criterion for a building to be regarded as vintage URM building was having visible construction material made of clay bricks and/or stone. Other criteria included having ornamental features such as pediments or elaborate parapets in the façade conforming to historical construction manuals noting that these features are rare in modern construction. However, irregular buildings such as churches and governmental structures that included features such as towers, colonnades, domes, aspires, etc. that are beyond those of a one-storey or multi-storey wall structure were excluded. A representative typology of the surveyed buildings is shown in Fig. 1 and also described in | [1]. |
| Data source location | Institution: Queensland University of Technology |
| City/Region: 7 towns within State of Queensland, including Bundaberg, Childers, Gympie, Ipswich, Maryborough, Toowoomba, and Warwick |
| Country: Australia |
| Data accessibility | Repository name: Mendeley Data |
| Direct URL to data: | https://doi.org/10.17632/wj7c5nts2r.1 [2] |
| Related research article | Khattak, N., Derakhshan, H., Thambiratnam, D.P., Perera, N.J. “Typological characterisation of vintage unreinforced masonry buildings of Queensland, Australia” Structures, (2022) 99-116. |
Value of the Data

• The data can be used as a sample for existing masonry building classification for different purposes
• The measurements are limited to the overall building dimensions, and therefore the data can be used to inform vulnerability studies of buildings with similar typologies. The information provided include the range of building dimensions and the presence of typically vulnerable elements such as parapets and chimneys. However, detailed structural assessment of any building would require further information on material and interior dimensions
• Elaborate facades have been identified that include parapets with different typology than that commonly assumed in seismic assessment studies. The dataset demonstrates the variety of the ornamental parapets that can be encountered in cities with vintage Victorian construction, highlighting the need to assess the seismic fragility of new URM parapet typologies.
• The relevant stakeholders include researchers with interest in URM building typologies including those involved in the development of assessment and rehabilitation guidelines such as American Society for Civil Engineering (ASCE/SEI 41-06 committee), the New Zealand Society for Earthquake Engineering (NZSEE) guideline committee. The stakeholders also include researchers collaborating with Emergency Management agencies such as Federal Emergency Management Agency (FEMA), in specific FEMA P-58 and Hazard US (HAZUS) committees which deal with seismic fragility assessments. Local stakeholders include Geoscience Australia (GA) and Queensland Fire and Emergency Services (QFES), who are involved in building-related seismic risk evaluation.

1. Data Description

The presented data includes two figures, two Excel spreadsheets and 7 AutoCAD drawings (2018 version).
- Fig. 1 shows a schematic of a representative building
- Fig. 2 shows important dimensions that have been reported in the dataset.
- The Excel file (Dimensions.xlsx) contains 23 columns, which list the general building properties such as a unique identifier, location city, coordinates, construction year (if known), and number of stories in addition to geometrical properties of the Plan and Elevation. The notations that have been used for geometrical properties are either self-explanatory or conforming to those shown in Fig. 2.
- The Excel file (OtherDetails.xlsx) list additional building details such as the roof type, the parapet shape, wall opening shapes, etc.
- The AutoCAD archive includes drawings of building facades labelled with the unique identifier that has been used on the Excel spreadsheets. These drawings have been extracted using tools available from SpikeGPS could services and considered to have the same accuracy (1% of the building dimensions) advertised by the device manufacturer [3].

2. Experimental Design, Materials and Methods

Past performance of URM buildings during the earthquakes has highlighted the vulnerability of these structures to seismic loading. In particular, out-of-plane failure of non-structural components has been reported as a recurring mode of failure [4,5]. Methods to assess the seismic fragility of out-of-plane loaded URM components are often based on simplistic geometries of components, for example parapets being represented by a vertical cantilever supported at base with either regular or irregular mass distribution [6]. However, field observations indicate that many existing buildings have pitched roofs with different configurations which dictate a parapet support condition that is fundamentally different from that assumed in the current assessment.
methods. Furthermore, there is a variety of parapet construction types that feature unique geometries and mass distributions. Finally, in the preliminary stages of the current research that has an objective to assess seismic fragility of URM buildings in Queensland, Australia, a research gap was identified in the definition of prevalent URM building typologies, specifically those located in regions with high seismic research priority [7].

For the above reasons, data collection surveys were conducted to establish prevalent vintage URM typologies in Queensland, Australia, with a specific focus on characterizing the building facades for assessment against seismic out-of-plane loads. To ensure effective surveys, firstly the historical statistical records from Colonial Australia were interrogated to determine regions with the largest potential stocks of vintage URM buildings. It was found that, excluding the Queensland capital (Brisbane), seven other towns existed that had reported significant URM building construction during late 19th century and early 20th century census. These seven towns were selected for street surveys, and Brisbane was excluded due to the lack of sufficient resources.

Two street surveys were completed, the first having an objective to create approximate location map of the buildings (e.g. streets where they are located). The second, detailed, survey was conducted to collect the quantitative data from the towns. The detailed survey included taking measurable photographs of building facades using a digital laser-based tool, called SpikeGPS [3]. The device that is mounted on a mobile phone enables taking photographs with known dimension scale for further desktop interpretation. The device contains a laser rangefinder, compass and Bluetooth. The device pairs with the phone or tablet via Bluetooth and is controlled through a mobile app to access the smartphone or tablet’s camera, accelerometer, and Global Positioning System (GPS) information. The manufacturer specifies that the accuracy of the rangefinder is ±5 cm for objects located between 2 and 200 m away, and the accuracy of the photo measurements is ±1% of the object being measured [3]. At the site of each building, other data such
as a hand-sketch of the facade, visible roof details, and the function/name of the building were also recorded.

The collected photographs were analyzed using SpikeGPS cloud services, and the CAD drawings that are attached to the presented dataset were directly extracted from the service provided by the device manufacturer. Additional relevant building information was also obtained from Google Map and Nearmap, enabling an evaluation of the roof shape and an estimation of the building plan dimensions to be made. This additional data was used to prepare the spreadsheets attached to this dataset.

The protocol for selection of buildings as part of the dataset included,

- The building be made of clay bricks or stone (although no stone building was actually found);  
- The building be regarded as ‘vintage’ by having parapets and other ornamental features such as pediments or window opening types that resemble those explained in historical construction manuals [8,9];  
- The building not having construction details typical of modern Australian construction, for example having concrete slab floors/roofs; and  
- The building be conforming to a one- or multi-storey wall structure; therefore, irregular buildings such as churches and governmental structures that included features such as towers, colonnades, domes, aspires, etc. were excluded.
CRediT Author Statement

Hossein Derakhshan: Funding acquisition, Conceptualization, Methodology, Supervision Data curation, Review, and Writing; Nouman Khattak: Conceptualization, Methodology, Data curation, Analysis, Review, and Writing; David Thambiratnam: Supervision; Nimal Perera: Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Data Availability

Dataset from the detailed survey of vintage unreinforced masonry buildings in the State of Queensland, Australia (Original data) (Mendeley Data).

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