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A procedure for prioritizing seismic risk reduction of load bearing masonry structures

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Abstract

Densely populated areas are subjected to significant risk if buildings are not designed for potential seismic events. This paper presents an approach for prioritizing the allocation of funds for seismic risk reduction of unreinforced masonry apartment facilities. The outcome would enable public authorities to decide where available funds should first be allocated for seismic risk reduction of such facilities.

The approach includes not only the structural capacity of the building, but the availability of emergency services, recovering potential of the community, and other factors. These were identified through discussions with local authority officials, through evaluation of previous studies on disaster risk management, and through examination of structural design code requirements.

The proposed model uses principle factors with weights identified from literature. Sub factors are defined and weighted with input from industry sources. Indicators identified from various sources are used as basis to score sub factors in an evaluation.

Keywords: seismic risk, buildings, infrastructure assets, unreinforced masonry

1 Introduction

The Western Cape Province is an area in South Africa of moderate seismic risk [1]. In 1969 a 6.3 Richter magnitude earthquake occurred in the small town of Tulbagh in the Western Cape. It was the most destructive earthquake to occur in South African history, causing an estimated $24 million (at 2002 currency rates) in property damage and 9 fatalities [1]. The damage would have been significantly more if the earthquake had occurred within the nearby city of Cape Town.

Sivaraja [2] reported that Unreinforced Masonry (URM) buildings are the most common type of structures used for housing purposes all around the world. It is also widely used in South Africa, including in seismically active regions in the Western Cape. Here, two to four storey URM buildings are a common sight in the city of Cape Town and the surrounding areas.

Many of these buildings were built prior to the introduction of the South African seismic loading code [3]. URM buildings are popular for a number of reasons, providing advantages such as low cost, good thermal insulation, durability and good compressive strength. Haas & Van der Kolf [4] however found that a three storey URM buildings showed a high probability of failure or damage under the local design seismic event.

Multi-storey URM buildings in the greater Cape Town region provide residence for over 11 000 individuals. The buildings are owned, serviced and maintained by the Department of Human

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