



Quantitative Study of Vulnerability / Damage Curves in South Africa

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Southern Africa is considered a stable continental region in spite of several cases of reported earthquakes, which caused considerable damage and casualties particularly in the mining industry. Most buildings and structures in South Africa are not designed to resist any intensity of earthquake and most architects, engineers and builders in the country do not consider seismic resistance as a design requirement. This is mainly because the region has not experienced any large and serious destructive earthquake in recent years. The most destructive earthquake recorded in South Africa is the Ceres earthquake of 1969. The earthquake with a magnitude of 6.3 occurred on September 29, 1969 in the Ceres-Tulbagh region of the Western Cape Province about 100 km northeast of Cape Town. Serious damage occurred to certain buildings in the area (amounting to a total of U.S. \$24 million). The structural damage varied from almost total destruction of old and poorly constructed buildings to large cracks in the better-built ones, twelve people were killed and many more were injured. Another event that caused severe damage to infrastructure occurred on March 9, 2005 at Stilfontein near Klerksdorp. It is known that up to 40 or more tremors are recorded monthly in Southern Africa, the locations are predominantly in the places surrounding the gold mining areas with many events around the Carletonville and Klerksdorp areas. Recent years have seen at least four mining induced tremors causing significant damage (Welkom 1976, Klerksdorp 1977, Welkom 1989 and Carletonville 1992). Such events show that it is very necessary to take seismic events into account in the design of any infrastructure. Assessing and understanding the risk facing the South African cities as a result of major seismic activity has been paid little attention. The main focus of this study is to use results of a deterministic hazard assessment to develop the most suitable damage curves for twelve of the most common building classes in four of the major cities in South Africa, namely, Johannesburg, Cape Town, Durban and Port Elizabeth.