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A REGIONAL EARTHQUAKE SCENARIO IN SOUTHERN PERU

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A well stablished earthquake scenario may be the best tool to prepare a city or a region to face a disaster. Realistic mitigation measures can be taken, emergency plans can be prepared and necessary drills can be performed.

According to various seismologist from Chile, USA and Peru, the subduction zone at the Peru-Chile border is a mature seismic gap. No earthquake of significant magnitude has occurred there since 1868. During that event a large area of the present southern Peru and northern Chile was subjected to an over VIII MM earthquake causing very severe damage, including the destruction of entire towns. A very destructive tsunami generated by the earthquake flooded the coastal low lands of the macroseismic area. In Arica the US Navy Wateree was deposited 300 m inland.

To investigate this problem a program was implemented by the UN Department of Humanitarian Affairs - DHA/ Geneva and Peru's Civil Defense -INDECI from 1992 to 1995 (Kuroiwa, 1995). It was assumed that an earthquake magnitude + 8 might occur in the subduction zone at the Peru - Chile border.

The microzonation of the studied region' main cities: Arequipa (Kuroiwa & Kosaka 1995), Moquegua and Tacna was carried out and the possible impact of the assumed earthquake on those cities was also investigated. Since the studied region covers an extense area of some 100,000 Km^2, the seismic risk of typical towns in the coastal strip and the highland was studied. According to the regional seismicity and the local site conditions the hazard of different sectors into which the population center was divided was estimated at intensities ranging from VI to IX MM. The most common types of construction existing in the region were established and grouped, and their respective vulnerability was found, based on the performance in past earthquakes. So the seismic risk of each sector of the studied urban center was estimated.

The possible effect of a tsunami on the main ports and towns located in low inundable zone was determined. The inundation zones and the arrival time of the first tsunami wave were estimated calculating the tsunami run-up and topographical data of the area.

In the investigation the National University of Engineering Lima, the University of San Agustin - Arequipa, and the University of Tacna participated. A total of six professional theses were developed: 4 civil engineering, 1 geology and 1 geophysics. The list is included in the first reference.

The microzonation studies made it clear to where Arequipa, Moquegua and Tacna may expand safely and with

less construction cost; and the most hazardous sectors were also established. It was found that the old sectors of those cities are very risky.

Typical towns in the highland region are more risky than those in the coastal strip in spite of their being more distant from the hypothetical earthquake epicenter. Most of the buildings are constructed with adobe, they have been weakened by past earthquakes and are built on humid soil. On the other hand, Peru's southern coastal region is one of the dryest regions of the world and most constructions are built on compact soil; and due to better socio-economic conditions there are a significant number of R.C. & reinforced masonry buildings.

Tsunami run-ups are from 7 to 10m high and the arrival times of the first wave range from 7 to 10 minutes, for different locations according to the drawn refraction curves. The border of the assumed generating ellipses with the epicentes located in the center, was located near to the coast, and included relatively shallow water. However a problem remains with no clear answer: What is the minimum ocean depth for the mass of water to absorb efficiently the elastic energy transmitted by the sea bottom during a tsunamigenic earthquake.

In spite of this uncertainty the results are very useful both for land use planning in low coastal areas, and for the preparation of emergency plans and the conduction of evacuation drills. In any case the uncertainty is on the safe side; -and according to the evacuation drill performed: since the inundation zones are relatively narrow, people there were able to evacuate the area in the available time.

According to Peru's Civil Defense Law, the mayors of the cities and towns are responsible for the safety of their communities. Their response so far has been uneven; some were excellent, such as the local authorities of the port of Ilo, who prepared an emergency plan and distributed it to the population, using the draft of the first results, and conducted drills. Others simply ignored the program and its results.

To cope with this problem, the Civil Defense authorities of the III Region, to which the studied region belongs, are doing their best to make the local authorities assume the leadership of their communities in taking mitigation measures and preparing the population to face the consequences of a destructive earthquake.

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