



Study of Site Effects in Lorca Town (Murcia, Spain) using Microtremors and Strong Motion Records

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The softness of the surface ground and the thickness of surface sediments have been observed as two important local geological factors that affect the level of earthquake shaking. Their local variations can lead to spatial seismic intensity differences and may have a remarkable influence in building damage level and significant earthquake damage distribution even in the cases of moderate earthquakes. So, it's very important to evaluate the site effects to understand the difference of the characteristics in the objective area before the occurrence of predictive earthquake. Recent moderate destructive earthquakes on the region (Adra 1993, Balerma, 1994, Mula 1999 and Alhoceima, 2004), with maximum intensity observed in the epicenter areas of VII or VIII on the EMS (1998), have shown that damage distribution is generally related to the typology of soil and the dynamic behavior of buildings, noticing large differences at the level of damages for relatively short distances. For this reason, in regions of moderate and small earthquakes, to analyse local site effects have an especial relevance.

In order to evaluate the site effects in Lorca town (southern Spain), geological and geomorphological survey, microtremor measurements and simultaneous strong motion records on different soil conditions were carried out. The geologic materials have been classified according to their seismic amplification capacity and basic geological and geotechnical characteristics have been determined (N-values for the SPT tests and density), identifying the nature of the material and obtaining the calculated values of the S-wave velocity (Vs). Measurements of short-period microtremors were performed during March of 2004 in and around the town, and Nakamura's method was applied to

determine a predominant period distribution map. The microtremors were recorded at 75 observation points and the distribution was arranged on the cross points of a grid of 200m x 200m dimensions. The observations were performed at daytime in non-noisy areas and far away to the traffic and artificial noise sources. The smallest values of predominant periods correspond to the north-west zone of the city (hard rock and hard soil), with values around 0.1 sec. The center zone and south of the town (medium soft and soft soil respectively) show a heterogeneous distribution of predominant periods with values from 0.2 to 0.8 sec. These values are strongly related with local ground conditions. The evaluation of ground shaking has been carried out by comparison of the results from simultaneous strong motion records on different soil conditions using strong motion record in hard rock as reference site. The results show an amplification factor 5 times in soft soil (uppermost quaternary formation with recent sedimentary materials, composed of sands and gravels) in relation to the reference site (Paleogene materials, mainly limestone and dolomite rocks).